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 styles, 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, like 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). 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 various researchers, educationists and psychologists.

**Justification of the study**

Research has shown that quality of learning material is enhanced if the material is designed to take into account the individual learning style (Woste 2007). 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. Identifying individual student’s learning characteristics may help the educator to improve the course design and choose helpful and appropriate learning outcomes, modes of delivery and assessment (Butler 1988, Sangster, 1996). Knowledge of students learning preferences can guide faculty to alter their preparation and instructional methods accordingly (Zhang, 2001). Several studies have emphasized the importance of learning style in teaching learning process (Bostrom and Hallin, 2013; Tulbure, 2012; Santo, 2008). Studies are available on relationship of learning styles and academic achievement ( Narayani, 2014; Mahshid et al, 2013; Breckler et al, 2011). A perusal of studies on styles of learning, as correlates of academic
achievement shows that although there has been a proliferation of research on achievement, yet there is growing need for further investigations as most of the research have been conducted in foreign countries.

Studies on importance of thinking styles are well documented in development literature. It is another area which has attracted attention of researchers into individual differences. 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. Studies are available on relationship between thinking styles and academic achievement (Zhang, 2001, 2002, 2004; Zhang and Sternberg, 1998; Sternberg and Grigorenko, 1997). Increasingly, research in the area of learning and thinking styles is being conducted in various domains which include medical and health care training, management, individual vocational training and a vast range of settings and levels in the field of education.

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 research has been conducted in foreign countries; however, 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 an expedient attempt to study learning and thinking styles as correlate of academic achievement. Without doubt, this void deserves the necessary attentions on behalf of researchers.

This scarcity of studies also manifests itself in the area of relationship between learning and thinking styles. An integration of studies on learning and thinking styles is required, including its influence on academic achievement. 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”.

Statement of the Problem

“Interrelationship and Influence of Learning and Thinking Styles on the Academic Achievement of High School Students”
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 and retrieving information for further processing, making sense of information to create new meanings, ideas, values, skills, strategies to solve problems and make decisions. One of the most developed approaches to learning styles, from both theoretical and empirical perspective is based on experiential learning theory of Kolb (1984). It conceptualised four different modes of student’s abilities needed to succeed which are concrete experience abilities, reflective observations ability, abstract conceptualization and active experimentation abilities.

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

- **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) 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 styles are assessed on the basis of dimensions given by Sternberg who suggested 13 kinds under five types namely function, form, level, scope and leaning.
• **Academic achievement**

Academic achievement means a successful accomplishment or performance in particular subject or course of study usually by reasons of skills, hard work and interest. 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.

**Objectives of the study**

The following objectives were formulated for the present 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 (eldest 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 and 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.

**Hypotheses**

Following hypotheses were formulated for the present study:

1. There exists significant and positive relationship between learning and thinking styles of students.

2. There exists significant and positive relationship of learning and thinking styles of low, average and high achieving students.

3. There exists significant difference in learning styles of male and female students.

4. There exists significant difference in learning styles of low, average and high achieving male and female students.

5. There exists significant difference in learning styles of first born and later born students.

6. There exists significant difference in thinking styles of male and female students.

7. There exists significant difference in thinking styles of low, average and high achiever male and female students.

8. There exists significant difference in thinking styles of first born and later born students.

9. There exists significant difference in learning styles of low, average and high achieving students.

10. There exists significant difference in thinking styles of low, average and high achieving students.
Delimitations

The study was delimited to:

1. The state of Haryana.
3. Public schools.
4. High school students.
5. First and later born students.

Methodology

The basic purpose of the study was to find out interrelationship and influence of learning and thinking styles on the academic achievement of high school students. Descriptive survey method of research was used in the execution of the present study.

Sample

The investigator employed the simple random sampling technique for selecting the sample. The investigator initially selected a sample of 359 students of 9th class from four D.A.V. public schools of Kurukshetra, Ambala, Panchkula and Rohtak districts of Haryana. Finally, 314 students were retained. While selecting the sample, it was ensured that all the students belonged to almost same socio-economic status, almost similar school environment conditions and from urban areas only. Care was taken to ensure that selected sample and gathered data would be free from all possible bias.

Tools Used

The investigator selected the following tools for collecting information from the respondents.

1. Learning style inventory developed and standardized by investigator.
2. Thinking style inventory developed by Sternberg and Wagner (1992), (Made reliable and valid according to Indian conditions by investigator).
3. Academic achievement on the basis of student’s record of previous two classes.
The high achiever students were having more than 85% score in their previous classes (taken average of previous two classes) (Grade A1, A2). Average achievers scores were between 60%-85% (Grade B1, B2); while low achievers were students who scored less than 60% (Grade C1, C2 and D).

Collection of Data

After getting permission, the investigator visited the classrooms and introduced her to the students. Firstly, the investigator established rapport with the students and then told them about the purpose of visit and gave orientation about the tools that were to be administered. Students were also assured that their responses would be kept confidential and used for research purpose only. The tools were administered one by one and all the instructions were explained to the students. The students were instructed that there were no right or wrong responses and they could take their own time in deciding any option by going through each and every item. They were instructed not to waste too much time on any one item. First of all, learning style inventory was distributed among students. Once the responses were filled by all the students, then thinking style inventory was given to the same students for assessing their respective styles. While administering the tools, the teachers helped the investigator in maintaining discipline in the class. After collecting the data, the investigator thanked the students as well as the staff for their co-operation. Same procedure was followed for every school.

In order to collect the data related to academic achievement, the investigator visited the school office and collected the grades as well as achievement scores obtained by the students in their annual examinations of previous two years. This was made available through the registers as well as computer records maintained by the schools.

Statistical Techniques Used

In the present study, the techniques used are given below:

1. In order to identify learning and thinking styles of students, *Percentage Method* was followed.
2. To find out the relationship of learning and thinking styles among high, average and low achievers, Pearson’s Product Moment Correlation was employed.

3. To find out the difference in learning and thinking styles of males and females and first born and later born students, t-test was employed.

4. To find out the difference in learning and thinking styles among low, average and high achievers, one way ANOVA was used.

Main findings

The study was conducted to analyse the interrelationship of learning and thinking styles with academic achievement. The findings have been drawn, on the basis of analyses and interpretations.

Findings on the basis of analyses

These findings have been given under different heads:

(I) Findings related to identification of learning and thinking styles

There were differences in learning and thinking styles of high school students.

1. Most preferred learning styles were visual, participative and auditory in which maximum percentage of students scored high. The least preferred learning styles were avoidant, competitive and independent in which less percentage of students scored high.

2. Low achieving students in the study preferred kinesthetic, visual, independent and auditory learning styles in which maximum percentage of students scored very high. Less percentage of students scored very high in collaborative, participative, competitive and avoidant learning styles indicating least preference for these styles.

3. Average achieving students in the study preferred visual, auditory and dependent learning styles in which maximum percentage of students scored very high. The least preferred learning styles were avoidant, independent and competitive in which less percentage of students scored very high.
4. High achieving students were having preference in visual, dependent and collaborative learning styles in which maximum percentage of students scored very high. The least preferred learning styles were independent, avoidant and kinesthetic in which less percentage of students scored high.

5. Most preferred thinking styles of students in the study were executive, liberal, legislative and hierarchical in which maximum percentage of students scored very high. The least preferred thinking styles were anarchic, oligarchic, local and internal in which less percentage of students scored very high.

6. Low achieving students in the study preferred executive, hierarchical, monarchic and global thinking styles in which maximum percentage of students scored very high. The least preferred thinking styles were judicial, legislative and conservative in which less percentage of students scored very high.

7. Average achieving students in the study preferred legislative, executive, oligarchic and hierarchical thinking styles in which maximum percentage of students scored very high. The least preferred thinking styles were external, internal and local in which less percentage of students scored very high.

8. High achieving students were having preference in liberal, judicial, legislative and conservative thinking styles in which maximum percentage of students scored very high. The least preferred thinking styles were oligarchic, anarchic, monarchic and hierarchical in which less percentage of students scored very high.

(II) Findings related to interrelationship of learning and thinking styles

Results found significant and positive relationship between learning and thinking styles of students.

1. Independent learning style had significant and positive relationship with legislative, judicial and monarchic thinking styles. With other thinking styles as executive, hierarchical, oligarchic, anarchic, global, local, internal, external, liberal and conservative; independent learning style had not significant correlation.
2. Dependent learning style had significant and positive relationship with executive, local and internal thinking styles; while with legislative, judicial thinking styles, it had significant negative correlation. With other thinking styles as hierarchical, monarchic, oligarchic, anarchic, global, external, liberal and conservative thinking styles; dependent learning style had not significant correlation.

3. Significant and positive relationship of competitive learning style was found with legislative, internal and liberal thinking styles, while with executive thinking styles, it had significant negative correlation. With other thinking styles as judicial, hierarchical, monarchic, anarchic, oligarchic, global, local, external and conservative; competitive learning style had not significant correlation.

4. Avoidant learning style had significant and positive relationship with hierarchical, local and internal thinking styles, while with legislative, monarchic, oligarchic and liberal thinking styles, it had significant negative correlation. With other thinking styles as executive, judicial, anarchic, global, external and conservative; avoidant style had not significant correlation.

5. Participative learning style had significant and positive relationship with executive, judicial and external thinking styles. With other thinking styles as legislative, hierarchical, monarchic, oligarchic, anarchic, global, local, internal, liberal and conservative; participative style had not significant correlation.

6. Significant and positive relation of collaborative learning style was found with judicial, external and liberal thinking styles, while with global thinking styles; it had significant negative correlation. With legislative, executive, hierarchical, monarchic, oligarchic, anarchic, local, internal and conservative thinking styles; collaborative learning style had not significant correlation.

7. Visual learning style had significant and positive relationship with legislative, judicial, oligarchic, global and external thinking styles. With other thinking styles as executive, hierarchical, monarchic, anarchic, local, internal, liberal and conservative; visual learning style had not significant correlation.
8. Auditory learning style had significant and positive relationship with anarchic, local and internal thinking styles, while with hierarchical, monarhich and oligarchic thinking styles, it had negative significant correlation. With other thinking styles as legislative, executive, judicial, global, external, liberal and conservative thinking styles; auditory learning style had not significant correlation.

9. Significant and positive relationship of kinesthetic learning style was found with legislative, judicial and external thinking styles, while with anarchic, liberal thinking styles, it had negative significant correlation. With other thinking styles as executive, hierarchical, monarhich, oligarchic, global, local, internal and conservative; kinesthetic learning style had not significant correlation.

(III) Findings related to relationship of learning, thinking styles and academic achievement

(a) Findings related to learning and thinking styles of low achiever students

The results found that learning and thinking styles of low achieving students were not significantly related

1. Independent learning style had significant positive correlation with monarchic thinking style and significant negative correlation with global and liberal thinking styles. With other thinking styles as legislative, executive, judicial, hierarchical, oligarchic, anarchic, local, internal, external and conservative style, it had not significant correlation.

2. Dependent learning style had significant positive correlation with internal thinking style while with legislative and anarchic thinking styles, it had significant negative correlation. With executive, judicial, hierarchical, monarhich, oligarchic, global, local, external, liberal and conservative; dependent learning style had not significant correlation.

3. Competitive learning style had significant negative correlation with executive and judicial thinking styles. With other thinking styles as legislative,
hierarchical, monarchic, oligarchic, anarchic, global, local, internal, external, liberal and conservative; competitive learning style had not significant correlation.

4. Avoidant learning style had negative correlation with legislative thinking style. With other thinking styles as executive, judicial, hierarchical, monarchic, oligarchic, anarchic, global, local, internal, external, liberal and conservative; avoidant learning style had not significant correlation.

5. Participative learning style had not significant correlation with thinking styles as legislative, executive, judicial, hierarchical, monarchic, oligarchic, anarchic, global, local, internal, external, liberal and conservative styles.

6. Collaborative learning style had significant positive correlation with anarchic and external thinking style. With judicial thinking style, this style had negative significant correlation. With legislative, executive, hierarchical, monarchic, oligarchic, global, local, internal, liberal and conservative thinking styles, this style had not significant correlation.

7. Visual learning style had negative significant correlation with hierarchical thinking style. With other thinking styles as legislative, executive, judicial, monarchic, oligarchic, anarchic, global, local, internal, external, liberal and conservative; visual learning style had not significant correlation.

8. Auditory learning style had not significant correlation with legislative, executive, judicial, hierarchical, monarchic, oligarchic, anarchic, global, local, internal, external, liberal and conservative thinking style.

9. Kinesthetic learning style had significant and positive relationship with oligarchic, anarchic and global thinking styles. With other thinking styles as legislative, executive, judicial, hierarchical, monarchic, local, internal, external, liberal and conservative; kinesthetic learning style had not significant correlation.
(b) Findings related to learning and thinking styles of average achiever students

Findings indicated positive and significant relationship between learning and thinking styles of average achiever students.

1. Independent learning style had significant and positive relationship with legislative, judicial, monarchic, internal and conservative thinking styles. With other thinking styles as executive, hierarchical, anarchic, oligarchic, external, global, local and liberal; this style had not significant correlation.

2. Dependent learning style had significant and positive relationship with executive, judicial, monarchic, local thinking styles. With legislative, hierarchical, anarchic, oligarchic, global, internal, external, liberal and conservative thinking styles; it had not significant correlation.

3. Significant and positive relationship of competitive learning style was found with legislative, judicial, hierarchical, global, internal and liberal thinking styles, while with oligarchic and external thinking styles it had significant negative correlation. With executive, monarchic, anarchic, local and conservative thinking styles; competitive learning style had not significant correlation.

4. Avoidant learning style had significant and positive relationship with internal and liberal thinking styles. With legislative, executive, judicial, hierarchical, monarchic, oligarchic, anarchic, global, local, external and conservative thinking styles; avoidant learning style had not significant correlation.

5. Participative learning style had significant and positive relationship with judicial, local and external thinking styles. While with oligarchic, anarchic and global thinking styles, it had significant negative correlation. With legislative, executive, hierarchical, monarchic, internal, liberal and conservative thinking styles, participative learning style had not significant correlation.

6. Significant and positive relationship of collaborative learning style was found with executive, hierarchical and external thinking styles. With other thinking styles as legislative, judicial, monarchic, oligarchic, anarchic, global, local,
internal, liberal and conservative; collaborative learning style had not significant correlation.

7. Visual learning style had significant and positive relationship with legislative, oligarchic, anarchic, global, external and liberal thinking styles. With executive, judicial, monarchic, hierarchical, local, internal and conservative thinking styles; it had not significant correlation.

8. Auditory learning style had significant and positive relationship with executive, judicial, monarchic, internal and liberal, while with anarchic thinking style auditory style had significant negative correlation. With legislative, hierarchical, oligarchic, global, local, external and conservative thinking style, auditory style had not significant correlation.

9. Significant and positive relationship of kinesthetic learning style was found with legislative, judicial, monarchic, global, external and liberal thinking styles. With executive and hierarchical thinking styles, it had significant negative correlation. With other thinking styles as oligarchic, anarchic, local, internal and conservative thinking styles; kinesthetic learning style had not significant correlation.

(c) Findings related to learning and thinking styles of high achiever students

Results pertaining to the same revealed that there exist positive and significant relationship between learning and thinking styles of high achiever students.

1. Independent learning style had significant and positive relationship with legislative, judicial, monarchic, internal and conservative thinking styles, while with hierarchical thinking style, it had significant negative correlation. With other thinking styles as executive, oligarchic, anarchic, global, local, external, liberal thinking styles; it had not significant correlation.

2. Dependent learning style had significant and positive relationship with executive, judicial, monarchic and internal thinking styles. With legislative, hierarchical, oligarchic, anarchic, global, local, external, liberal and conservative thinking styles; dependent learning style had not significant correlation.
3. Significant and positive relation of competitive learning style was found with legislative and internal thinking styles, while with executive and judicial thinking styles, it had significant negative correlation. With other thinking styles as hierarchical, monarchic, anarchic, oligarchic, global, local, external, liberal and conservative; competitive learning style had not significant correlation.

4. Avoidant learning style had significant and positive relationship with legislative, hierarchical, local and internal thinking styles, while with oligarchic, anarchic and liberal thinking styles, it had significant negative correlation. With executive, judicial, monarchic, global, external and conservative thinking style; this learning style had not significant correlation.

5. Participative learning style had significant and positive relationship with executive thinking styles; while with monarchic thinking styles, it had significant negative correlation. With legislative, judicial, hierarchical, oligarchic, anarchic, global, local, internal, external, liberal and conservative thinking styles; participative learning style had not significant correlation.

6. Significant and positive relationship of collaborative learning style was found with legislative, judicial and liberal thinking styles while with oligarchic, global and external thinking styles, it had negative correlation. With executive, hierarchical, monarchic, anarchic, local, internal and conservative thinking styles; collaborative learning style had not significant correlation.

7. Visual learning style had significant and positive relationship with legislative, judicial and liberal thinking styles. With executive, hierarchical, monarchic, oligarchic, anarchic, global, local, internal, external and conservative thinking styles; this style had not significant correlation.

8. Auditory style had significant and positive relationship with anarchic, local and internal thinking styles while with hierarchical, monarchic and oligarchic thinking styles, it had negative correlation. With other thinking styles as legislative, executive, judicial, global, liberal, external and conservative; auditory learning style had not significant correlation.
9. Significant and positive relation of kinesthetic learning style was found with judicial, hierarchical, local and external thinking styles, while with monarchic, oligarchic, anarchic and liberal thinking styles, it had significant negative correlation. With other thinking styles as legislative, executive, global, internal and conservative; kinesthetic learning style had not significant correlation.

(IV) Findings related to learning styles of male and female students

1. Significant difference was found between male and female students in dependent, collaborative, visual, auditory and kinesthetic learning styles. Female students preferred these styles than their male counterparts. However, there exists no significant difference between male and female students in independent, competitive, avoidant and participative styles of learning.

2. Low achiever male and female students were having significant differences in certain styles of learning. There were significant differences in dependent, avoidant, participative, collaborative, visual and kinesthetic styles of learning between male and female students. Female students were less avoidant, participative and kinesthetic in their style of learning than male. However, there exists no significant difference between low achiever male and female in independent, competitive and auditory styles of learning.

3. Average achiever male and female students were having significant differences in competitive, avoidant, participative and kinesthetic styles of learning. Females were less kinesthetic but more participative than male students. However, there exists no significant difference between average achiever male and female in independent, dependent, collaborative, visual and auditory styles of learning.

4. Significant differences in independent, dependent, competitive, avoidant and kinesthetic styles of learning were found between high achiever males and females students. Male students were having more preference in independent, avoidant and competitive styles of learning whereas, female were more dependent in their styles of learning. However, no significant differences were observed between high achiever male and female in participative, collaborative, visual and auditory styles of learning. Therefore, male and female students differ significantly in their styles of learning.
(V) Findings related to learning styles of first and later born students

Significant difference was found in independent, competitive, avoidant, participative, auditory and kinesthetic style of learning among first and later born high school students. Independent, competitive, avoidant, participative, auditory and kinesthetic styles of learning was most preferred by first born as compared to later born. No significant difference was found between first and later born in dependent, visual and collaborative styles of learning.

(VI) Findings related to thinking styles of male and female students

1. Significant difference was found between male and female students in legislative, executive, judicial, internal, external, liberal and conservative thinking styles. Female students preferred executive, judicial, external and conservative styles than their male counterparts. Male students were having more preference towards legislative, internal, and liberal styles. However, there exists no significant difference between male and female students in hierarchical, monarchic, oligarchic, anarchic, global and local styles of thinking.

2. Low achiever male and female students were having significant differences in certain styles of thinking. There were significant differences in legislative, executive, hierarchical, local, internal, external and conservative styles of thinking between males and females students. Female students were less legislative, internal and more executive, hierarchical, local, external and conservative in their style of thinking than male. However, there exists no significant difference between low achiever male and female students in judicial, monarchic, oligarchic, anarchic, global and liberal styles of thinking.

3. Average achiever male and female students were having significant differences in legislative, executive, hierarchical, global, monarchic, external and local styles of thinking. Females were less legislative, executive, hierarchical and monarchic than male students. However, there exists no significant difference between average achiever male and female students in judicial, oligarchic, anarchic, internal, liberal and conservative styles of thinking.
4. Significant differences in legislative, hierarchical, internal and conservative styles of thinking were found between high achiever male and female students. Male students were having more preference in legislative, hierarchical, internal and conservative styles of thinking than females. Whereas, there exist no significant difference between high achiever male and female in executive, judicial, monarchic, oligarchic, anarchic, global, local, external and liberal styles of thinking. Therefore, gender plays an imperative role in styles of thinking.

(VII) Findings related to thinking styles of first and later born students

Significant difference was found in legislative, judicial, hierarchical and monarchic style of thinking between first and later born students. Legislative, judicial and hierarchical style of thinking was most preferred by first born as compared to later born whereas later born preferred monarchic style. No significant difference was found between first and later born in executive, oligarchic, anarchic, global, local, internal, external, liberal and conservative thinking styles.

(VIII) Findings related to learning styles and academic achievement

There exists significant difference among different achieving groups in dependent, participative, collaborative, visual and kinesthetic styles of learning. High achieving students scored significantly higher in dependent, participative, visual and collaborative style. Low achieving students scored significantly lower than average and high achieving students in kinesthetic styles. However, no significant differences were observed among different achieving groups in independent, competitive, avoidant and auditory styles of learning.

(IX) Findings related to thinking styles and academic achievement

There exists significant difference in different achieving groups in legislative, executive, global, liberal, judicial and conservative styles of thinking. Results indicated that high achieving group of students scored significant higher in legislative, judicial and conservative style, while low achieving students scored significantly higher than average and high achieving students in executive, global, and liberal styles. Whereas, there exists no significant difference among different
achieving groups in hierarchical, monarchical, oligarchic, anarchic, local, internal and external styles of thinking. Also, no significant differences were observed between average and high achieving groups on any of the styles.

**Educational implications**

A perusal of the present study evident the attempt to add some novelty towards the research related to relationship of learning and thinking styles with academic achievement. This research contributes to broad understanding of the literature of learning and thinking styles. Knowledge of these variables should be considered paramount relevance as evidenced from results of the present investigation. Findings of this study reveal that recognizing student’s learning and thinking styles not only benefits the students, but also the teacher to act as an effective facilitator. It leads to enhanced learning and helps the learner to gain more in teaching-learning process. Results of the study clearly highlights that efficiency of a person depends not only on education and training received by him/her but also on personal learning and thinking styles.

Results of the study have implications for the learner. It is very important for the individual to be acquainted with his or her style of learning and thinking. Furthermore, the significant issue to become effective in the process of learning is an individual taking the responsibility for his or her learning. For this purpose, the individual should know what his own learning and thinking styles are and what characteristics these styles possess. Learner will integrate it in the process of learning to become successful and effective problem solver. Learner can gain confidence in their strengths and develop diverse strategies for coping with various challenging situations. The clarity of student’s learning preferences along with the appropriate classroom environment can potentially be a powerful contributor to enhance educational outcomes. Opportunities must be provided to the learners for expressing their learning and thinking approach in a variety of modes. Exploration of learning strategies implicate that students who are aware of their preferred learning styles are more likely to select the correct strategy for a particular task.
The study has its implications for the teachers also. It is necessary for the teacher to know that styles are not the labels for students of specific types. Indeed, these are the keys to open students as learners that have various types of learning behaviour and strategies. Teacher, by studying the results can apply these findings in the class environment which will surely create a harmonious class where both teachers as well as students can realize their potentials. Teacher should plan the lessons according to different learning styles and concentrate on students keeping in mind that even if learning levels differ, the preferences of students about learning style do not change. Teachers should also encourage students to utilize both hemispheric preferences so that they can access to the greatest possible range of mental abilities. 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. Different advanced teaching techniques and innovative methodologies must be used to activate and influence the hemispheric functions of the brain. Moreover, teacher can also share the performance of students with parents and inform them about how they can help their children to learn at home. For productive and effective teaching approach, teacher may consider to present concepts first for the theoretical foundation and then by giving examples for broader application which will encourage students to work on improving individual weaknesses. Knowledge of learning and thinking styles has enabled the teachers to meet the needs of the individual learner in the classroom. Students learn more efficiently and like the learning process better when they are taught through their identified learning styles. Therefore, it would be wise to understand what learning style preferences are and how to address them when preparing instructional materials for the entire lesson as well. Teacher should design lessons to clear the student’s doubts so that they can maximize the learning experiences. It is obvious that there are some factors such as class size which is beyond the control of a teacher. Therefore, a teacher can adjust his/her teaching methods to match the diversity of students. Teacher have to face the challenge of not only designing ways to motivate students while accommodating the learning preference of individual student, but also determining how to make the subject matter more exciting and interesting so that it actively engages the students and improve educational outcomes in the classroom. Teacher may help students in
recognizing the needs to enhance their learning capabilities as well by emphasizing the frequently used way of learning. Teachers, being self reflective and explicit about the role of learning styles can make teaching more rewarding and enhance student’s learning at the same time. Awareness of learning styles in teaching creates a harmonious class where both teachers and students can realize its immense potential. Conscious encouragement from teachers for student’s style stretch will make the students more competent in a variety of learning situations.

Different categories of learners are having varied preferences in several methods used by the teacher in a classroom. The study focuses that teaching methods should be according to learning and thinking styles of students. Present study also has its implications for teaching methods of teachers who deal with different types of learners.

> **For different learning styles:**

Independent learners prefer to work alone and require little directions. For these learners, a teacher can give independent study in their work assignment. Some kind of creativity should be rewarded for these types of learners. They can be made editor of the magazine of their schools. Also, they should be involved in the projects in which they are the leaders.

Dependent learners prefer the direction given by the teacher in facing any new challenge. A teacher while giving assignment to these learners should give clear instructions and no ambiguity should be there. Teacher can use the method of role modelling by illustration in which personal experiences can be shared. Demonstration method can also be used by which students can get clear instructions for doing a particular task.

Competitive learners learn in order to perform better than their peers do and to receive recognition for their academic accomplishment. For these types of learners, student centred class activities can be given. Teacher can use the skills of questioning to deal with these types of learners. Technology based presentations can also be given.
Avoidant learners are not enthused about attending class or acquiring class content. They are typically uninterested and sometimes overwhelmed by class activities. The best way to deal with these types of learners for teacher is to create congenial environment in the class and by making lectures interesting so that these learners are also involved and attend the classes regularly.

Participant learners are interested in class activities, discussions and they are eager to do as much class work as possible. They are eager to participate and can relate well to peers. For these types of learners, lecture with discussion is the best method for a teacher. Sharing thought process and sharing personal experiences with the students can relate well to peers and also assignment should be given.

Collaborative learners acquire information by sharing, co-operating with teachers and peers. Teacher can make small groups and give problem based learning related with group enquiry for these types of learners. Case studies are also good option to involve these types of learners.

Visual learners learn effectively through various activities or tasks that involve visual approaches such as reading notes, books, looking at wall displays, reading lists to organize thoughts etc. Teacher can make use of highlighters for highlighting the specific letters in spelling, words, formulas or equations. Teacher can also spend time on visualizing pictures, charts, graphs, printed information and provide time to practice recalling visual memories. Visual study tools such as visual mappings, hierarchies, comparison charts can also be used.

Auditory learners prefer that teacher should provide verbal instructions in order to gain information in the classrooms during the teaching and learning process. Teacher can read out loud to explain new information, express ideas, ask questions and express understanding of information orally. Lecture can also be given with a tape recorded version. To help remember specific facts, rhymes or songs can be used. Multimedia programs can also be used for these types of learners. Language laboratory should be available in the school and easily accessible.

Kinesthetic or experiential learners, learn best by doing or when learning involves their hands or other parts of body. Teacher need to create study tools that can move
around with hands. Flash cards can be shuffled, spread out, sorted or stacked as a way to categorize information. Teacher can use the activity of cut charts or diagrams apart and ask the learner to reassemble them in correct order. Teacher can use exaggerated movements and hand expressions, drama, dance, role playing to assist the development of long term memory, work at a chalk board with a flip card, or on a large poster paper to create study tools.

➢ For different thinking styles:

Students having legislative thinking styles prefer to work on tasks that require creative strategies. Thoughts based questioning and independent projects are best suited for students with this style. Projects encourage students for creative expressions. To assess these types of students, teacher can use essay test in which main skill of creativity is tapped.

Executive thinkers prefer to work on tasks with clear instructions and structures. Lecture method with clear instructions is best suited for students having this kind of thinking style. Teacher can make small group recitation in which student answer’s factual types of questions posed by the teacher. The students with executive style will feel comfortable answering these. Teacher can also use short answer and multiple choices, essay type tests to assess memory skill of these kinds of students.

Judicial students prefer to work on tasks that allow for evaluation. Teacher can use the method of thought based questioning, small group discussion for these students. Such discussions favours judicial students who like to analyze whatever issue is being discussed. Multiple choice items that require analysis as in the case of mathematical items, verbal analogy items, or item that measure reading for understanding tend to benefit people with judicial style.

Hierarchical students prefer to distribute attention to several tasks that are prioritized according to valuing of the tasks. The lecture style is compatible with the hierarchical style because students usually decide what are the most and the least important things that have been mentioned in certain lecture. Reading method also favours hierarchical students because there is usually more to absorb in the material than the student can possibly remember, so the student needs to decide selectively
what material is worth learning and what material is not. Short answer, multiple choice test and essay test in which certain time is allocated to finish them is given; hierarchical students will be benefited because they are the individuals best able to budget their time.

Monarchic prefers to work on tasks that allow complete focus on one thing at a time. Lecture method with clear instructions is best suited to this type of students. Project work with huge time allotted is benefited to assess the students of these styles.

Oligarchic prefers to work on multiple tasks in the service of multiple objectives, without setting priorities. Cooperative learning is likely to appeal to students of this thinking style where they learn best in groups. Short answer and multiple choice tests as method of assessment can be suited to learners of oligarchic thinking style.

Students with anarchic thinking styles prefer to work on tasks that allow flexibility as to what, where, when and how one works. Project work as a method of assessment in which huge time is given and good for these kinds of students.

Students having global thinking styles prefer to pay more attention to the overall picture of an issue and to abstract ideas. Lecture method is best suited for students with this kind of thinking style. Teacher can use short answer and multiple choices, essay type tests to assess memory skill of these kinds of students.

Local thinking styles students prefer to work on tasks that require working with concrete details. Independent projects are best suited for students having this style. To assess these types of students, teacher can use essay test in which memory skill is assessed.

Students having internal thinking styles prefer to work on tasks that allow them to work as an independent unit. Reading method favours internal students when the students are reading own their own. Multiple and short answer type, project methods of assessment favours internal students who like to work by themselves.

Students with external thinking styles prefer to work on tasks that allow for collaborative ventures with other people. Cooperative learning as a teaching method is suited to external thinkers because they enjoy working in a group. Small group
discussions can be used while teaching the external students who are willing to speak out in front of the group. Interview as a method of assessment can be used for these types of students.

Students with liberal styles prefer to work on tasks that involve novelty and ambiguity. Independent projects are best suited for students having this style. Project works encourage creativity among students. To assess these types of students, teacher can also use assignment or essay test in which main skill of creativity is tapped.

Students with conservative styles prefer to work on tasks that allow one to adhere the existing rules and procedures in performing the particular tasks. Lecture method with clear instruction, small group recitation in which students answer factual types of questions posed by the teacher is suited to these types of students. Teacher can use short answer and multiple choices, essay type tests to assess memory skill of these kinds of students.

Therefore, anything that encourages individual discovery and allows the learner to be active participant should be adopted by the teacher. Teacher should employ advanced exploration methods in their teaching to meet the requirements of various types of learners. Problem solving and brain storming techniques should also be used for developing divergent thinking, imagination and creative ability of students. Teacher should be familiar with differences in learning styles and follow suitable approach to teach various types of learner. When teacher and students understand how they learn and their preferred ways to learn, the efficiency of learning increases. Teacher should also understand the differences in brain functions which result in an individual difference in learning and thinking styles. The orientation towards specific learning and thinking style provides an excellent forum to build expertise and competency in an individual.

Study has also significant implications for classroom management. Knowing the learning style, educators can organize the classroom settings to responds learner's needs. For classroom management, recognition of the pattern which learners can concentrate best alone or with others is helpful in teaching the students with different learning styles.
These findings have significant implications in the process of curriculum development. A curriculum that utilizes various audio, visual, extra sensory and reflective techniques in evaluating student’s performance in courses would allow the students to excel academically in their preferred style. Results show that students prefer balanced approach. This implies that teachers should adopt a balanced teaching approach to meet all the learning objectives. There are different methods of teaching suitable for different learning and thinking styles. Teachers need to focus on whether the teaching methodology matches appropriately with the identified learning styles of students.

The study also has its implications for administrators and school principals. It is recommended that seminars and training programs should be conducted to acquaint teachers on various learning and thinking styles. School principals can create specific training programs based on individual teacher’s interpersonal behaviour profiles. They can provide various teaching aids, equipments, learning materials etc. so that teacher may create conducive environment with consideration of student’s learning preferences. This kind of awareness not only supports learning, but also improves the student’s self confidence.

Students counsellors in schools can use the knowledge of learning and thinking styles in informing students to think with more creativity and come up with more effective solutions to their learning problems.

Significant implications of the present study is that theorists, psychologists and researchers should give proper space to student’s learning and thinking styles while suggesting new methods, new techniques, new strategies and other related things to deal with the specific problem of individual variations. In addition to these, administrators should make efforts for establishment of various audio visual aids, extra sensory and reflective techniques in the schools which cater the needs of diverse learners. They should also arrange activities keeping in view the specific needs of various learners.

Besides these, the findings can be of great value, as they may help parents in creating favourable conditions for scholastic growth of their children.
Suggestions for further research

Every research study culminates in opening the newer avenues for further research. On the basis of findings of present study, it is suggested that further studies on related areas can be designed which are as follows:

1. The sample of present study was taken from four districts of Haryana state. The similar study can be undertaken for a larger population drawn from more districts of different states to provide comparatively and more comprehensive picture.

2. The present research work was restricted to sample from urban areas only. Envisaging wider perspectives of the work, a comparative and co-relational study can also be undertaken for sample from both urban and rural areas.

3. Further study can be conducted to compare students from government and public schools with different type of school environment.

4. Study can be conducted to explore learning and thinking styles in relation to some other different variables.

5. Present attempt was made on students of high school. Similar study can be designed for higher secondary and undergraduate students. Furthermore, comparative account can be drawn among these samples.

6. It is suggested that other psycho-social variables may be added for further investigation.

7. For further research, special exercises which will transform thinking styles in counselling process can be developed.

8. For gender differences, the other factors generating the differences between male and female can be explored and from the observed factors, counselling application programs and exercises should be developed.

9. Longitudinal study can be conducted to examine the development and change of thinking styles of individuals over time.

10. Further research can be carried out on matching teacher’s thinking style to student’s learning style.