CHAPTER - II

REVIEW OF RELATED STUDIES

Escalation of knowledge in modern times is an accepted fact. A review of related literature in the area of investigation is of prominent significance and its importance cannot be denied in any research. The review of related studies is an exacting piece of work calling for a deep insight to provide clear-cut perspective of the overall field. The term ‘Review’ means to organize, to envelope an edifice of knowledge, to show the present study would be an addition to a particular field. The term ‘Literature’ refers to the knowledge of a particular area of any discipline, which includes theoretical, practical and research studies. In tracing roots of problems, preparing outlines of the study, discussion and interpretation of the results and writing the research report, review of literature is of utmost importance. The study of related literature is useful to search the update and latest information already available and to define the limits of the specific problem.

Research takes advantage of the knowledge that has accumulated in the past as a result of constant human endeavours. Review is not only important from theoretical point of view but it also provides guidelines to decide procedure and tools to be used. The keys to the vast store house of published literature may open new doors to source of significant problems and explanatory hypothesis which provides helpful orientation for the definition of the problem and background for the selection of procedure.

Thus, the study of related literature helps investigator to acquire comprehensive information about what has already been done in a certain field. It helps in formulation of hypotheses and provides necessary knowledge regarding the methodology to be followed. For worthwhile study in any field of knowledge, the research worker needs an adequate familiarity with the work which has already been done in a particular area. The search for related material is a time consuming but fruitful phase of research programme.

With this background in view, the investigator tapped various sources of available literature like surveys of research, research journals, magazines, dissertations,
encyclopaedias available in the University libraries and educational research centres of the country as well as studies available on various websites and other sources of information related to the present study. A brief review of related studies is discussed under the following headings:

1. Studies related to learning styles
2. Studies related to learning styles and academic achievement
3. Studies related to thinking styles
4. Studies related to thinking styles and academic achievement
5. Studies related to learning styles, thinking styles and academic achievement.

2.1 Studies related to learning styles

Al-Qahtani and Al-Gahtani (2014) assessed learning styles of Saudi dental students using Kolb’s learning style inventory. Results indicated that diverging learning style was the dominant style among those in the sample. They also found that students preferred the assimilating style during their early preclinical years and preferred the diverging style during their later clinical years.

Mohammadi and Thaghinejad (2014) identified the most common learning styles of nursing students in Iran. Kolb’s learning style inventory was used to collect the data. Results concluded that in order to enhance students learning, more attention has been required to different learning styles. It was also recommended for teachers to pay more attention in student’s learning style and use appropriate teaching methods.

Sinnerton et al (2014) investigated awareness of educator about learning style preferences to enhance the education and training of allied health professionals. Results found that encouraging educators in allied health programmes had a positive impact on the teaching and learning process. It was also observed that by employing various strategies; educators can help the students to study according to their learning style preferences, engage more deeply with the course content and hence improve overall student outcome for training in allied health programmes.
Bostrom and Hallin (2013) performed comparative analysis of learning style differences between nursing and teaching students in Sweden. The study involved 78 teaching students and 78 nursing students. Twenty subscales of the productivity environmental preference survey (PEPS) were used to identify the participants learning style preferences. The results showed statistically significant difference between the two students groups. In comparison to teaching students, nursing students were highly kinesthetic.

Shukr et al (2013) studied learning styles of postgraduate and undergraduate medical students. A total of 170 students were taken. Learning style questionnaire was used to assess the learning styles of students. The results revealed an overall statistically significant difference in learning style preference between the two groups. Postgraduates commonly had reflector learning style while the undergraduates were predominantly activists and theorists.

Tulbure (2012) focussed on relationships between teaching strategies, learning style and student achievement in higher education. Sample of 269 pre-service teachers from three Universities were taken and data was collected through survey method. One way analysis of variance was used. Significant differences among three categories of students with different majors occurred in relation with the most effective teaching strategies corresponding to each learning style category.

Halstead et al (2010) conducted a study on learning styles as a tool for selecting students for group work. The sample included 24 second year and 9 third year undergraduate students. The learning style questionnaire was given to two separate groups of students and students were selected on the basis of their learning style and formed a group. The results revealed that students who joined groups allocated on the basis of their learning style performed better than the students who were self selected.

Khan (2009) observed differences between learning style of students in professional courses at University level. The sample consisted of 200 students studying in B.Tech. M.B.B.S., L.L.B. and M.B.A. courses selected from Aligarh University. Honey and Mumford learning style questionnaire was used. Students were compared
on four dimensions of learning style namely activist, reflector, theorist and pragmatist. The study revealed that students of different professional courses had different learning styles. It was found that B. Tech. and M.B.B.S. students differ significantly on reflector and theorist dimensions and those of M.B.A. and B.Tech also differed on the same dimensions. The students of L.L.B. and M.B.A. did not show significant differences in any aspect of learning style.

Paul et al (2009) conducted a study on learning preferences of medical students and explored differences in learning preferences from 1st to 4th year students. Total 95 students were administered the learning preferences inventory (LPI). Analysis of variance (ANOVA) was used to test the significance of the differences of the six LPI mean scores on abstract/concrete, teacher structured/student structured, and individual/interpersonal categories across the academic year. Results of this study showed that students preferred teacher structured learning experiences dealing with concrete and applied tasks, rather than abstract tasks.

Penger and Metka (2009) explored the learning styles of students enrolled in the economics of education course at the faculty of Economics, Ljubljana University. The study method included both a descriptive and an exploratory perspective. A qualitative method was used to overview the literature background and factor analysis was used to extract the learning styles. The findings outlined that difference in learning styles exists among students.

Bamidele et al (2008) analysed preferred learning style among residents and faculty members of an internal medicine residency program. The Kolb’s learning style inventory was used and given to 42 residents attending physicians. Assimilating style was the predominant learning style. There was no significant association found between age, gender or medical education status and learning styles.

Peker et al (2008) investigated the differences of pre-service elementary school teacher’s attitude towards Mathematics according to their learning styles. Total 281 pre-service elementary school teachers were involved in this study. The learning style inventory was designed to detect the participants learning style as diverger, assimilator, convergent, accommodator and the scale of mathematics attitude questionnaire was used to find the participant attitude towards mathematics. The
study concluded that there were statistically significant differences between the attitudes of learners, convergent and assimilator and that the convergent learners had more positive attitude towards mathematics than the assimilator learners.

Santo (2008) explored relationship between learning style and online learning. Sample taken were of adult learners. Nine different instruments were used to find this relation. Focus was on the extent to which learning styles were able to predict student’s success i.e. grades and attitudes. Results found that significant relationship exists between learning style and online courses.

Holt et al (2007) studied learning preferences of 5th and 6th grade students in northwest Arkansas. The learning style inventory was administered to the students enrolled at four elementary schools. The sample consisted of 160 students. Results showed that students preferred quiet noisy levels, dim light, high structured, informal design and authority figure around. Students also preferred variety of materials and learning methods especially tactile and kinesthetic.

Jedin et al (2006) conducted preliminary study on gender and learning style in Malaysian higher learning institutions. The target population for this study was undergraduate students of University. Results indicated that there were significant differences between male and female students in terms of individualistic and collective learning. Specifically, the female students characterized themselves as collective learners, but simultaneously they were also slightly inclined towards individualism, whereas male students partly viewed themselves as collective learners.

Verma (2006) analysed the variability in learning style of students enrolled in different courses. The sample consisted of University students in different courses i.e. private law, criminal law and administrative law. There learning styles were assessed with the help of learning style inventory. Results confirmed that there was variability in learning styles of University students.

Haley and Smith (2005) conducted a study to investigate relationship between learning style preference and entrance of medical students in the institution. The objective of the study was to identify learning style of new entrants to medical
school. A sample of 219 students was taken and the results indicated that reflector learning style was dominant. Over 50% of students changed their learning style over the year, with activists becoming the dominant group. Finally, theorists achieved higher results in the end of year examinations.

Yacizi (2005) studied collaborative learning style and learning performance. Sample included male and female students. Study found that participant or collective style was a significant predictor of female student’s performances, while the independent and competitive styles were significant in predicting the performance of male students. These findings explained that male students had more competitive qualities and they would prefer to study hard independently in order to win and stay competitive. In contrast, the female students were more dependent on their group members and also they would try to help and complement each other to perform well in academic performances.

Barnes et al (2004) identified differences in the learning styles of the online students. It was found that 64% of the population surveyed was divergers, 32% were assimilators and 2% were either accommodators or convergers and 2% had a combination of all styles. Results indicated that students had preferences in certain course delivery methods over others. It was found that there may be differences in learning outcomes for certain courses when courses were offered at different locations.

Rayneri and Gerber (2004) in their study on classroom performance of gifted middle school students and preference for learning style found that learning style plays an important role in classroom performances. Results showed that they had a high preference for tactile and kinesthetic learning style. Study also found that mismatch in the student’s learning style preference with learning environment would result in academic underachievement.

Werner (2003) studied the effect of self awareness about learning styles on the selection of learning strategies and the development of comprehension process. Kolb’s learning styles inventory was used to identify the learning styles of forty one adult learners and observed for six months. The subjects tackled strategies and
techniques on the basis of time, keeping in the memory, reading, note taking and decision making. The data concerning the learning preferences of subjects were collected through the compositions they wrote. The findings showed that learning types preferred according to the learning styles of the subjects were not the appropriate strategies.

Lovelace (2002) conducted meta-analysis of 76 experimental studies at multiple Universities. The total sample size was 7196. The overall data reported significantly higher test scores when Dunn’s learning style strategies were employed and compared with traditional teaching. Findings indicated that when academic underachievers were taught new and difficult content through instructional approaches that responded to their learning style strengths; they achieved statistically higher standardized achievement test scores than they did when the approach was dissonant from their style.

Paula (2002) did comparative analysis of the learning styles of Brazilian and German adolescents by age, gender and academic achievement levels. The purpose of this study was to identify and compare the preferred learning style characteristics of adolescents from the countries of Brazil and Germany and to analyze the similarities and differences by age, gender, and academic achievement with in these groups of students. Results concluded that overall, both Brazilian and German were more tactual and parent motivated. In general, Brazilian were more self and teacher motivated, prefer learning with peers and Germans were more authority oriented and persistent than Brazilian. These findings revealed that significant differences in learning style preference varied among students by age, gender and academic achievement.

Maubach and Morgan (2001) conducted a study on relationship between gender and learning styles amongst a level modern language student. Sample consisted of 72 language students comprised of male and female. Results found differences in gender with regard to male and female. Females were having advantage over males with regard to verbal ability.

Moss et al (2001) explored the relationship among learning style and selected
teaching strategies on student’s performance. The sample was of 186 students of undergraduate courses in agricultural economics. Results indicated that active learning and problem based learning techniques, as a supplement to the traditional lecture format could significantly affect their performance in an introductory course in agriculture resources and food.

Hong et al (2000) examined whether changes in children’s learning styles can occur from cultural, social and environmental changes within an ethnic group using LSI scores from a sample of 49 Korean-American students. Similarities and differences in learning styles were found between two nations as well as between boys and girls in both groups. Those learning styles, on which differences were significant, might be influenced by the social and environmental differences.

Diaz et al (1999) compared student learning style in an online distance learning class and an equivalent on campus class. The purpose of the study was to compare the student learning styles of two online health education classes (n=68) with an equivalent on campus class (n=40). The Grasha-Riechmann student learning style scales (GRSLS) was administered to determine student social learning preferences in six learning style categories. Study found that students who enrolled in the distance education class were significantly more independent learners than students in the equivalent on campus class students who were significantly more dependent learners than the distance group.

Vermetten et al (1999) conducted a study on consistency and variability of learning strategies in different University courses. Participants were 85 students attending the first year of law studies. An analysis of variance showed that students varied in their reported learning strategies as a function of different learning contexts. Evidence was found that learning strategies differ among each other in degree of variability.

Burns et al (1998) analysed differences between the learning style preferences of high academic achieving students and the preferences expressed by same age students with average or below average academic achievement obtained from 500 students in grades 4-5. The authors concluded that the differences within an achievement group existed and it was important to prescribe instructional methods
or categorize groups of learners by presuming that they had differences in style preferences.

Riding and Rayner (1998) studied cognitive style and learning strategies. Study found that given a choice of learning material, verbalizers will choose the text version, and imagers will choose the version with illustrations. Imagers almost double their learning performance if they were presented with information that include text and illustration compared to just text, while the performance of verbalizers remains the same.

Philbin et al (1995) investigated differences in learning styles between men and women. The study was collaboratively done by Belenky, Clinchy, Goldberger, and Tarule and David Kolb. A survey that included the Kolb’s learning style inventory, 12 educational dialectical questions and a subjective question was administered to 72 subjects of various ethnic groups. The results showed that men and women were having different learning styles and in general, men seemed to find congruence between traditional education and their learning style while women did not.

Wallace (1995) assessed how closely student learning style preferences matched those of their teachers. A total of 450 sixth and seventh graders completed the LSI and 128 teachers completed the productivity environmental preference survey, the adult version of LSI. Results found that auditory style was the teacher’s most preferred learning style, while students preferred the visual modality.

Hickson et al (1994) explored learning style differences in middle school pupil from four ethnic populations. Thirty six Asian, forty seven Hispanic, seventy eight African-American, fifty eight European American 4th-6th graders completed the learning style inventory. Results indicated that 12 variables on that instrument reliably discriminated among the four ethnic groups. These variables were design, requires intake, late morning, noise level, kinesthetic, responsible, parent’s figure motivated, authority figure present, temperature, afternoon, auditory, visual. Recommendations were made for adapting the environment to accommodate students according to their preferred learning styles.
Hayes and Allinson (1993) examined the interaction between individual learning style and instructional strategies. Results indicated that instructional strategies influence the achievement level of student’s with different learning styles.

Ewing et al. (1992) studied whether significant group gender and grade differences existed in the preferred learning styles of gifted minority 6th-8th graders. Fifty four African-American, sixty one Mexican-American and forty Chinese-American students completed LSI. Significant gender differences were found in preferences for tactile and intake modality. African-American preferred visual modality and studying in the afternoon. Mexican-American preferred a kinesthetic modality. Chinese-American reported the strongest preference for visual modality of the three groups.

Cook (1991) in an experimental study examined learning style awareness and academic achievement among community college students. The sample consisted of 78 second term anatomy students at Florida who were taught by two instructors using comparable content methods. The productivity environmental preference survey by Dunn was used. An Ancova was performed using the pretest scores as covariates. There was significant difference in academic achievement in favour of learning style awareness group.

Matthews (1991) conducted study on the effects of learning style on grades of first year college students. This study compared the grade point averages of 796 first year students in five institutions of higher education. Learning style inventory by Canfield was used. Results showed that there were no race differences in the proportion of students in various learning style, but gender differences existed. Female learned best with social and independent/applied styles. However, males learned best with social/applied and social conceptual styles.

Redding (1990) found that mismatch in student’s learning style preference with learning environment would result in academic underachievement. The results confirmed that those who are more participative tend to perform better academically. There was also an indication that highly independent learners were more likely to achieve better grades than those who are not.
Rollins (1990) analysed the theoretical relationship between learning styles of students and their preferences for learning activities. The population consisted of 10603 students enrolled in 262 secondary agriculture programs in public high schools. Myers Briggs Type Indicator (MBTI) form was administered to all respondents. Findings confirmed that 70% of secondary students preferred the sensing learning style and educators should make use of sequential exercises and experiments, group discussions, projects, team competition, demonstrations that provide new skills.

Cox et al (1988) examined learning style variation between rural and urban students by taking a sample of secondary school students. Learning Style Inventory (LSI) was administered to 9th to 12th grade students enrolled in different classes. Statistical significant differences were observed. Rural students were found to be significantly higher in the serious, analytical and active, practical learner characteristics, than their urban counterparts. Smaller but significant differences in preferred learning styles were found for other characteristics. Findings suggested that students in rural school appear to be more concerned and engaged in educational process than urban students.

Payton et al (1979) conducted a study on learning style preferences of physical therapy students in the United States. The purpose of this study was to find the learning style preferences of students enrolled in their first year of basic professional program. The testing instrument used was the learning styles inventory developed by Canfield and Lafferty. A sample of 1099 physical therapy students was collected. Results had important implications for physical therapy educators in terms of arranging their instructional activities to optimize learning.

2.2 Studies related to learning styles and academic achievement

Narayani (2014) studied the learning style of higher secondary students in relation to their academic achievement. The sample consisted of 300 students. Barbara and Soloman Learning style questionnaire (LSQ) was used. The results showed that there was no significant difference between active and reflective style learners in relation to their academic achievement.
Vania and Xin (2014) performed comparative analysis of the relationship between learning styles and mathematics performance. Sample included comparative analysis between middle school students of USA and three Asian countries namely Hong Kong, Japan and Korea. Findings indicated that competitive learning had a statistically significant positive though small relationship with mathematics performance in all four countries while cooperative learning had a statistically significant positive though small relationship with mathematics performance in three Asian countries, but not in the USA. It was recommended that teacher education may hold the key to improve the educational practice of different learning styles as a strategy to improve mathematics performance.

Mahshid et al (2013) observed the impact of learning styles and University type on the academic performance of the students. A sample of 339 students was taken and Kolb’s learning style questionnaire was used to determine the learning style and academic performance of the students. Results of Chi-square test found that there were differences in the learning styles of students. Also, results of Manova showed that University type and learning style both had a significant impact on the academic performance of students.

Pornsakulvanich et al (2012) examined the influence of big five personality traits and learning styles on cognitive and affective academic performance and gender differences in learning styles. Total 1529 students of business administration from University of Thailand were taken. Overall, results indicated that personality traits found to be better indicator of cognitive and affective academic performance than learning styles. The results also confirmed that no significant gender differences existed in learning styles of students.

Rahmani (2012) investigated the relationship between learning style of high school girl students and their academic achievement. The target population was 350 high school girls selected by multi-stage sampling method. Feldor and Soloman LSI were used and results showed that sensing intuitive learning style had significant correlation with academic achievement.

Breckler et al (2011) analysed academic performance and learning style self prediction by second language students in an introductory biology course. Sample
was undergraduate students of biology from University of California. Results showed significant relationship between academic performance and learning styles.

Haider et al (2010) conducted an investigation of relationship between learning styles and performance of learners. The experiment was conducted on 35 students. The results indicated that significant number of academic deficient learners were not inclined towards a specific learning style. However, learners belonging to verbal learning styles did well in introduction to ‘engineering profession’ subject. Learners who were neutral to visual verbal learning style group did well in ‘computer programming’ and those who belong to active learning group did well in ‘database management system’.

Elizabeth et al (2009) studied learning styles of high and low academic achieving teacher education students. Using the parameters set in the research, there were 19 students classified as low achievers and 29 students classified as high achievers. Results of the study revealed no significant difference in learning styles between low achieving and high achieving students. Teachers were recommended to incorporate specific methods reflective of visual, auditory, tactile and kinesthetic styles of learning in their teaching strategies.

Aripin et al (2008) conducted a study on student’s learning styles and academic performance. The objectives of the study were to ascertain the dominant learning styles and to discover the relationship between learning style and academic performance of the students. The Grasha Reichmann student’s learning style scales (GRSLSS) instrument was administered to determine student’s learning style preferences in six learning style categories. The subjects of the study were first year students from INTEC University. Results indicated academic performance based on learning style was found to be significant.

Gakhar (2007) conducted a study to find relation between achievement of students with regard to their learning and thinking styles. The sample taken was of students from bachelor of physiotherapy. The results found no significant relation exists between achievement, learning and thinking styles of students. There were no significant differences in the styles of thinking and learning of students.
Graf et al (2007) analysed the interaction between student’s learning styles, achievement and behaviour in mismatched courses. The impact of the strength of learning style preferences on achievement, correlation between particular learning styles and achievement were analysed and discussed. The study found that students with strong learning style preferences had more difficulties in learning in mismatched courses. It was also found that reflective learners could cope better with mismatched courses than active learners and significant differences were observed in learning styles of different achievers.

Malathi et al (2006) observed learning style of higher secondary students of Tamilnadu. The sample of the present study consisted of 160 higher secondary students from private and government schools. The objectives of the study were to find out learning style of higher secondary students and find out the significant difference in the learning style of students in terms of their sex, class and type of school exists. Significant difference in learning style between boys and girls was found.

Reyneri et al (2003) studied the impact of learning style preferences in the classroom. The study revealed some differences between achievers and underachievers in their preferences for quiet or sound, flexibility or structure in assignments, and level of need for mobility. Many low achievers showed a strong need for tactile and kinesthetic modalities. Persistence seemed to be a key to success for the achieving learners in this study since they were able to maintain high academic performance in all content areas.

Soylu et al (2002) found the effect of learning styles on achievement in different learning environments which were designed according to principles of Generative Theory of Multi Media Learning. Research was conducted in the framework of single group repeated measures experimental design model and three different learning environment were planned (text based, narration based, computer mediated) and group studied in these environments at different times. The two instruments were used to collect data for this study. The pre-post test were designed to identify student’s achievement’s score and Kolb’s learning style inventory to measure
student’s learning style. Results showed that the type of the learning style had significant correlation with student’s achievement in different learning environment.

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. Total 130 eighth grade students were taught to use either traditional study strategies or learning style responsive study strategies when completing mathematics homework. Analyses of data revealed that the students who applied learning style responsive strategies had significantly higher mathematics achievement and attitude scores than the students who applied traditional study strategies. No differences were found in either treatment group regarding the frequency of studying for tests.

Park (2000) studied subjects from Southeast Asian immigrants, Cambodians, Lao and Vietnamese and found that there was no statistically significant difference among high, middle, low achieving groups in their preferences for auditory, visual, kinesthetic or tactile learning styles. Southeast Asian students showed either major or minor preference for group learning compared with East Asian students who showed negative preference for group learning.

Matthews (1996) investigated relationship of learning styles and perceived academic achievement. Sample included high school students. Results showed that students with de-emphasis on human relationship and emphasis on deductive thinking rated themselves higher academically than their peers with other styles of learning and students who were people oriented had the lowest overall academic achievement.

Dunn et al (1995) studied a metaanalysis of 42 experimental studies across United States at 13 different Universities during 1980s. The analysis revealed that students learning style preferences were the strengths that enable them to master new and difficult information. Referring to the standard normal curve, this suggested that students, whose learning styles were accommodated, expected to achieve 75% of standard deviation higher than students who had not their learning styles accommodated. Study indicated that matching student’s learning style preferences with educational interventions compatible with those preferences were beneficial to their academic achievement.
Nunn (1995) examined the effects upon achievement and locus of control of at risk middle school students who were enrolled in a year long learning style/strategies intervention course. Students had their learning style assessed, profiled and interpreted. The intervention was of weekly basis. Discussions and exercises focussed upon which study and skill strategies would compliment the individual learning style. Results indicated significant improvement with in the at risk groups in terms of grade point average and locus of control when there learning styles were matched.

Jacobs (1987) determined whether a difference existed in the learning styles of Afro-American high, average and low achievers and compared the learning styles of Afro-American and Euro American high, average and low achievers. The sample included 300 students from three middle schools in the south. The LSI was administered to ascertain individual learning style characteristic. Chi square was used to analyze the data. Analysis of the data revealed that there were differences in learning styles according to achievement level, sex and race.

Cody (1983) examined the learning styles of highly gifted, average and underachieving students. The results confirmed that students with an IQ of 145 or higher, 9 of 10 were global, students with an IQ of 135 or higher, 8 of 10 were analytic and analytic performed better than global in school. Furthermore, Cody noted that the learning styles of gifted, average and underachievers were very different from each other.

2.3 Studies related to thinking styles

Fahmi Hasssan (2014) aimed at exploring the correlation between coping strategies and thinking styles. Sample consisted of 62 students from medical science college responded to the scale of coping styles and inventory of thinking styles questionnaire. Results found that active coping strategy was affected significantly by legislative, local and hierarchical thinking styles. Moreover, potential implications of the impact of thinking styles on coping strategies were also considered.

Thani et al (2014) investigated the relationship between students’ thinking styles, self-efficacy for learning and academic performance at Qatar University. A total of 289 college students from different majors participated in the study. Results
indicated that significant correlation was found between student thinking style and self efficacy for learning. Also, significant correlation between student’s academic performance and self efficacy for learning was observed.

Holmes et al (2013) explored relationships of children’s thinking styles, play preferences and school performance. For the study, 74 middle school children of mostly Filipino and part Hawaiian heritage were taken as sample. Using the group embedded figure test, written responses to three questionnaires, the authors found significant relationship between children’s thinking styles and academic performance.

Ozturk (2013) analysed thinking styles of students studying at physical education and sports academies of public and private Universities. 296 students consisted of 153 females and 143 males responded to thinking style scale. Results indicated that legislative, executive, judicial, monarchic, hierarchic styles were preferred by students. It was also found that females students used anarchic thinking styles as compared to male students.

Xie et al (2013) investigated whether individual differences in thinking styles influence explicit and implicit learning. A total of 87 University students in China participated in this study. Results indicated that performance in explicit learning condition was positively associated with legislative, liberal and internal style while negatively associated with conservative and external style.

Turki (2012) aimed to recognize the thinking styles in the light of Sternberg’s theory prevailing among the students of technical University and its relationship with some variables. The sample consisted of 800 students. Sternberg and Wagner (1991) inventory was used. The results indicated statistical difference in legislative and judicial styles where the differences came in favour of males and significant differences of executive style came in the favour of females.

Wang et al (2012) studied the relationship between the thinking styles and collaboration attitudes of college students in Taiwan. Sample was of 970 college students and four questionnaires were given to students. Findings showed a positive significant relationship between psychological well being and thinking styles of individuals.
Balgalmis et al (2010) investigated thinking styles of educational administrators in Turkey. Thinking styles were compared in relation to different variables such as age, gender, tenure and school type. The sample of the study was 241 voluntary school administrators who were selected conveniently. The thinking styles inventory and a personal data form were used to collect the data. Results showed that the most preferred thinking styles were hierarchical, legislative, and external; whereas the least preferred ones were conservative, oligarchic and local thinking styles. Significant differences across the independent variables of the study were found.

Bawaneh et al (2010) identified the thinking style of 10th grade students in Jordan and examined the relationship between these styles and their preferred educational track. Population consisted of 558 boys that include primary tenth grade level. Results revealed the dominance of externalized thinking style among scientific track students and dominance of the procedural thinking style among literary track students. It was also observed that nursing track students tend to prefer the interactive thinking pattern and sharia track students tend to have the internalized thinking style.

Herbst et al (2010) investigated the relationship between thinking style preference, emotional intelligence and leadership effectiveness in an institution of higher education. The sample comprised of 138 managers from higher education institution. The researchers found relationship between thinking style, emotional intelligence and leadership effectiveness and concluded that facets of brain dominance and emotional intelligence may be potentially useful predictors of transformational leadership behaviours.

Zhang (2010) observed effect of age and gender in the relationship between styles and abilities. The sample was of 42 students from one school. Two independent groups of secondary school students responded to the thinking style inventory. Results confirmed that age and gender made significant difference in the relationship of styles and abilities.

Palut (2008) conducted a study to find out the relationship between thinking styles and level of externality of female preschool teachers. The results revealed a close
correspondence between thinking styles and level of externality and a negative association between both in legislative, judicial, hierarchic, global and liberal thinking styles.

Zhang (2008) examined relationship between emotions and thinking styles of students. The results indicated thinking styles were associated with emotions and also thinking styles had predictive power for emotions beyond age. Type 1 styles were found to be positively associated with the ability to deal with emotions. The researchers concluded that depression was positively predicted by hierarchical style and negatively predicted by anarchic style.

Kao et al (2007) identified the effects of thinking levels on the internet search habits of users in order to improve search engine architecture. Findings showed that high global thinkers search for every possible issue while high local thinkers focus on a topic, look for explicit answers and explore that topic in detail.

Nawfal and Abu Awad (2007) studied the psychometric characteristics of Hermann’s brain dominance instrument in a sample of 500 Jordanian University students. Major findings included the brain dominance of the left lower area of the brain, followed by brain dominance of the left upper area of the brain. However, the brain dominance of the left hemisphere of the brain was extensively dominated by the brain dominance of the right hemisphere of the brain.

Zhang (2006) analysed relationship between thinking styles and personality. The thinking style inventory by Sternberg and Wagner were administered to 199 parents of secondary school students in mainland China. Findings showed significant relationship of individual style with personality. In addition, results supported Sternberg’s assertion regarding the validity of the theory of mental self government in both academic and non academic settings.

Balkis and Isiker (2005) studied sample of undergraduate students to investigate the relation between thinking styles and personality types and the effect of gender and major field of study on thinking styles. They concluded that thinking styles and personality type’s correlates and gender variations in thinking styles were also related.
Fjell et al (2004) investigated Sternberg Wagner thinking style inventory with regard to cross cultural replication and in relation to the five factor personality model. The inventory was administered to the 107 participants from USA and 114 participants from Norway. Inter correlations between the two were not very strong, few exceeding 0.40 and the correlations were in predicted directions.

Abdullah et al (2002) conducted study to determine which thinking modes were the most or least preferable among group of students. The sample consisted of business (n=154) and engineering students (n=90) in their first and second year. Hermann’s brain dominance instrument was used. Analysis of results indicated that their preferred thinking mode were analytical, rational and logical; whereas no preference of thinking mode was found among quadrant C learners.

Sternberg (2002) studied 124 students between the ages of 12 and 16 years distributed among four schools. Study found that socio-economic level was related negatively to judicial, local, conservative and oligarchic styles. It was also found that later born siblings tends to be more legislative than earlier born siblings which was consistent with the past findings that first born tends to be more accepting of societal dictate than later borns. By assessing student and teacher style, students performed better and were more positively evaluated by teachers, when their styles matched.

Zhang and Sternberg (2002) examined relationship on thinking styles and teacher characteristics. Research participants were 193 (65 males and 128 females) in service teachers studying in B.Ed. programme at the University of Hong Kong. The participants responded to the Chinese version of the thinking style questionnaire for teachers (TSQT) from Sternberg theory of mental self government. Findings showed that hierarchic and legislative thinking styles were more preferred than others whereas conservative style was the least preferred. Gender was also taken into consideration as a variable and legislative, monarchic and conservative styles showed significant variations. It was further found that legislative thinking was positively related to kinesthetic learning while monarchic, local and internal thinking styles were negatively related with visual learning, which was most preferred learning.
De Boer and Berg (2001) examined learning styles and distributions for the four quadrants of brain based on Hermann’s model. The sample included 68 students enrolled in a bacteriology course in the first semester at the University of Pretoria. Hermann’s brain dominance instrument was used to identify their styles. Results from the data analysis indicated that the students were equally assigned to the four (A, B, C, D) learning styles.

Kaufman (2001) correlated study on thinking style and vocational subjects. Sample comprised of student journalists and student creative writers and results found that journalists scored higher on executive thinking than creative writers, whereas creative writers preferred legislative thinking than journalist.

Zhang (2001) studied the relationship between teaching approaches and thinking styles in teaching. A total of 76 in-service teachers from Hong Kong responded to the approaches to teaching inventory. Results from both the zero order correlation analysis and the factorial structural analysis fully supported the relationship between the two. It was concluded that approach and style were two overlapping constructs with different labels. The difference between approach and style were in degree, but not in kind.

Zhang and Huang (2001) correlated thinking style inventory with personality type. Results indicated that thinking styles and personality dimensions to a degree overlap. More creativity generating and complex thinking styles were related to extraversion and openness to experience dimension of personality while more norm favouring and simplistic thinking styles were related with neuroticism dimension of personality.

Zhang (2000) investigated the relationship between thinking styles and personality types with in the Sternberg theory of mental self government. A total of 600 University students from Hong Kong responded thinking style inventory. The findings revealed that thinking styles and personality types overlap to a certain degree.
DeBoer and Steyn (1999) attempted to identify the thinking style distributions that were most preferable to students and methods of developing these styles. The sample included 31 first year students who did not fulfil admission requirements and thus attended an extended science program to meet admission conditions for University of Pretoria, preferred learning styles were measured using Hermann’s brain dominance instrument. Students distribution on thinking styles were A = 32.2%, B = 48.4%, C = 12.9% and D = 6.5%. The dominance of (B) and weakness of (D) modes were accounted for by the fact that the teaching delivered by the schools was more focussed sequential thinking skills (B) than on creative thinking skills (D).

Sadler and Smith (1999) conducted study on 130 University students and examined the relationships between cognitive styles and learning approaches. Although results indicated that analysts tended to adopt a deeper approach to learning than did the intuitive and that intuitive exhibited a stronger preference for collaborative approaches than did the analysts. They concluded that the evidence found in the relationship between cognitive styles and learning approaches was not strong and style and approach were independent to each other.

Zhang and Sachs (1997) found that natural science and technology teachers in Hong kong prefer global thinking more frequently than social sciences teachers do. The results of these studies suggested that thinking styles, as defined by Sternberg theory, also could be identified among University students in Hong-kong. Results indicated that student’s thinking styles were different, depending on such variables as age, sex, college, class, college major and travel experience.

Sadler and Smith (1997) did a comprehensive study on framework and instruments of learning styles. Grasha Reichmann and Honey and Mumford learning style questionnaire was used. Total 245 University students responded to these questionnaires. No statistically significant relationships were identified between cognitive styles and any of the other styles constructs investigated.

Shelnutt et al (1996) conducted a study to identify thinking styles in a group of engineering students from University of North Carolina. The study used Hermann’s
brain dominance scale as a self-awareness instrument. The sample consisted of 500 students. Following the administration of Hermann’s instrument to students, the results found that mean degrees of items related to four quadrant of the brain (QA, QB, QC, QD) were A = 86%, B = 78%, C = 54%, and D = 69%. The results confirmed the dominance of A and B quadrants among engineering students.

2.4 Studies related to thinking styles and academic achievement

Zhang and Fan (2014) examined the association between student’s perceived general learning environments and their thinking styles. 752 undergraduates responded to Thinking style inventory. Results indicated that student’s perceived learning environment statistically predicted their thinking styles beyond gender, grade, socio economic status.

Sharma and Sharma (2011) highlighted the relationship of thinking styles with academic achievement of students. The data were collected from 333 students at random studying in Government and private schools of Himachal Pradesh. The data was analysed by using t-test. A significant relationship between judicial thinking style and academic achievement was observed. Moreover, females were found to be disposed more towards the use of executive and judicial thinking styles than their male counterpart.

Golshokooh et al (2009) examined the relationship between thinking styles, achievement and creativity. The sample included University students. The study indicated that legislative, local thinking styles were predictors of creativity and achievement.

Yenice and Karasakaloglu (2008) compared the thinking style profiles of students registered to elementary education department in Adnan Menderes University. Researchers studied the relationship between academic achievement and thinking styles. The most preferred thinking styles were found to be legislative, executive and judicial whereas least preferred styles were liberal and local. Gender was considered as another variable and both male and females preferred global thinking compared to local thinking but at the same time male were found to think more globally compared to the females.
Albaili (2007) examined the differences in thinking styles among low, average and high achieving college students. A total of 228 undergraduate students at United Arab Emirates University participated in the present investigation. Thinking styles inventory was used to assess student’s thinking styles. Results indicated that low achieving students scored significantly lower on executive, hierarchical, anarchic, local, conservative and internal styles and significantly higher on legislative, oligarchic and liberal styles. It was found that the use of hierarchical thinking style significantly contributed to better achievement in social sciences and humanities and that the use of judicial styles uniquely contributed to better achievement in the natural sciences. The use of the monarchic thinking style significantly predicted student’s achievement in design and technology.

Fer (2007) conducted a study to determine whether the thinking styles of student teacher differ due to gender, age, educational level, type of University attended and the field of study. The results revealed in terms of gender variable that male students scored higher on the monarchic and conservative styles while females scored high on legislative and hierarchical styles. When age variable was considered, the younger student scored significantly higher on the legislative and liberal styles than older ones did. As the findings of the study was examined in terms of thinking level, males prefer global style to local and males scored higher in global thinking as compared to females. When age was considered, the older students preferred global thinking to local thinking style.

Bulus (2006) conducted a study to determine the thinking styles of students. Sample of 4th year students of University was taken. Hierarchic style was found to be positively related to academic achievement. Bulus also examined the effect of the year at University on thinking styles and stated that 4th year students prefer legislative style more as compared to first year students but prefer external style less than first year. Significant difference between males and females were also found on global, internal and conservative styles.

Imamipour et al (2003) investigated the correlation of thinking styles of the University and high schools students with creativity and achievement. The study indicated that there was a significant relationship of age, grade and achievement
with thinking styles. The results also showed that females surpassed males in the use of legislative, executive and judicial styles.

Bernardo et al (2002) administered Sternberg and Wagner thinking style inventory to 429 Filipino University students. The results of the item analysis, scale intercorrelation, and factor analysis were consistent with the general provisions of the theory. Co-relational analysis between thinking styles and grade point average showed that thinking styles were positively related to academic achievement. Study found that executive style; judicial styles were positively correlated with grade point average (GPA). No significant relationship between the legislative style and academic achievement was found.

Zhang (2002) studied thinking styles in relation to student’s modes of thinking and academic performance. A sample consisting of 212 US University students responded to the thinking styles inventory and styles of learning and thinking. Results from convergent statistical analysis procedures indicated that thinking styles and modes of thinking share common variance in the data. Study found that conservative style positively predicted student’s grade point averages, whereas global and liberal styles negatively did so.

Zhang (2001) studied on thinking styles contribution to academic achievement beyond self rated abilities. Participants were 209 University students from Hong Kong and 215 University students from China. Participants responded to the thinking styles inventory based on Sternberg theory of mental self government. Participant’s academic achievement scores were also used. Results indicated that individual differences in academic achievement were attributable to thinking style over and above what could be explained by self rated abilities. Academic achievement and thinking styles were related differently in the two groups.

Cano Gracia and Hughes (2000) examined a study among University students in Spain to find the relationship of thinking styles to academic achievement. Findings from the study supported the relationship. Study found that higher academic achiever tended to be those who preferred to adhere existing rules and procedures (executive style), preferred to work individually (internal style), preferred not to
create, formulate and plan for problem solution (legislative style).

Zhang and Sternberg (1998) found relationship between thinking style and academic performance. The sample of the study was 622 Hong Kong students. Study found that conservative, executive, hierarchical and internal styles were positively related to academic achievement. Higher achievement was negatively correlated with the use of legislative, liberal and external styles of thinking.

Sternberg and Grigorenko (1997) examined the relationship between thinking style and academic achievement of American gifted children. Study found that the judicial and legislative thinking styles correlated positively to student’s success in a variety of academic tasks and executive thinking style tended to correlate negatively to success in these tasks. The results of the study revealed relationship between judicial style and academic achievement.

2.5 Studies related to learning styles, thinking styles and academic achievement

Negahi et al (2013) investigated the relationship between learning styles and thinking styles with academic self efficacy of English students of Islamic Azad University. Samples of 367 students were selected. Data analysis showed that judicial and legislative thinking style had a significantly positive relationship with academic English lesson self efficacy of students. Study also showed that executive thinking styles and academic self efficacy were negatively related.

Sharma and Neetu (2012) explored learning and thinking style of secondary school students in relation to their academic achievement. The sample was 140 secondary school students and normative survey method was applied for this study. Study found positive and significant relation between learning and thinking styles and academic achievement.

Vengopal and Mridula (2007) studied to examine the hemispheric preferences for information processing and styles of learning and thinking in children. A sample of 250 students of 8th class which included both boys and girls from five English medium schools were selected. The tool styles of learning and thinking (SOLAT) was administered. Results revealed that there was significant difference in the right and left hemisphere preference for information processing among children and boys
who were more right hemispheric oriented in information processing. Significant difference in the styles of learning and thinking and concept preference among right and left hemispheres was also observed with respect to both genders.

Cano Garcia and Hughes (2000) examined whether college students learning and thinking styles were interrelated and if these could predict academic achievement. A total of 210 college students completed two inventories. The results of the canonical correlation analysis revealed presence of a moderate relationship between both types of styles. The results of regression analysis indicated that student’s academic achievement was related to student’s thinking styles. Students that prefer to work individually were legislative in thinking style and those that had adherence to existing rules and procedures were those who obtained higher academic achievement.

2.6 Salient discussion from review

In order to avoid unnecessary duplication and to provide an insight essential to frame the hypotheses for the objectives outlined in the study, the review of the related study has been accomplished. There is an abundant literature that signifies the importance of learning and thinking styles. Few studies related to learning styles with academic achievement and thinking styles with academic achievement have been carried out across the globe. Also, there are many studies that correlate intelligence with learning in general way, relating learning and thinking styles with other variables. However, there is little research available on the interrelationship of thinking and learning styles and most of these studies are conducted in abroad. The studies conducted in India in this arena are lamentably inadequate. Without doubt, this void deserves the insistent attention of researchers. This scarcity of studies also manifests the need for further exploration of relationship between learning and thinking styles and academic achievement. Hence, this is an area of great relevance to the work of educators. It is pertinent for them to know the influence of styles on pupil’s academic achievement and from the generated information, it is necessary to design possible means of intervention for promoting effective learning, thinking and academic achievement.
2.7 Hypotheses

Once the problem of research is finally identified and instituted, the next important step is to formulate tentative solutions or answers. The proposed solutions or explanations constitute the hypotheses which the researcher would need to test on the basis of the already established facts or uncovered or likely to be known. Unless these hypotheses are formulated, the researcher’s investigation cannot be preceded fruitfully.

A hypothesis is a conjectural statement of the relation between two variables. It is a tentative generalization, the validity of which remains to be tested. In its most elementary stage, the hypothesis may be any hunch, guess, imaginative ideas which become the basis for action or investigation. After carefully going through the review of related literature, following hypotheses were formulated:

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 achieving 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.