CHAPTER V
SUMMARY, CONCLUSIONS
AND
EDUCATIONAL IMPLICATIONS
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5.1 INTRODUCTION

The concept of education has never been so important and central in the life of individuals, organizations, and societies in the history of our civilization as it is observed in the contemporary times. Today’s societies are living, developing, thriving, competing and improving on the pivot of knowledge only. To satisfy the needs of students of the 21st century, new experiments, creative innovations, and appropriate strategies are being developed and tried out to improve education at all levels. Strategy is the art of conducting a campaign. In education, it is a scientific way of presenting the subject matter, keeping in mind the psychological and physical requirements of children.

The task of knowledge representation has two parts: the first is to analyze body of knowledge and identify the relevant concepts, relations, and assumptions; the second is to translate the result of the analysis into some notation that can be processed. Neither part is easy, but the first is far more difficult (Sowa, 2006). The teachers who use the traditional method exclusively on the presentation of the contents to be learned, with all the imperfections which Ausubel points to the expository teaching, which is used in schools (Ausubel, 2003) in which the teacher uses "pure verbal techniques" too early, presenting information very often in a tactful and arbitrary way, without realizing at all the frameworks. So there is need to clear concepts in the minds of the learner. More simply, knowledge is constructed in the mind of the learner (Bodner, 1986). Cognitive psychology places emphasis on understanding how the mind works, on how learners learn, and on meaningful learning. The constructivist learning theory, with its roots in the learning theory of Ausubel et al. (1978) clearly states that every learner actively builds or constructs her or his own private understanding of the world. (Markow & Lonning, 1998)

So the demand of today education is to shift from verbalism or lecture method to learning by doing, learning by actively involving i.e. collaborative learning, cooperative learning, Concept Mapping “The most important single factor influencing learning is what the learner already knows, ascertain this and teach accordingly” (Ausubel, 1968). It
clearly demands a strategy that would transform the position of the teacher from being active speaker to facilitator

5.1.1 Concept Mapping

Concepts are the basic unit of all types of learning. The concepts are the ways by which facts and experiences can be integrated and remain impressed in the mind much longer than facts. According to Weil and Joycee (1978) “Helping children learn concepts and teaching them how to learn concepts is a fundamental purpose of schooling. Constructivist approaches to teaching and learning science emphasize deep understanding of concepts (as opposed to memorization), discussion, explanation and exploration to students’ implicit knowledge”. So to be successful in learning, students have to take possession of knowledge actively by seeking experts conceptual linkages between new concepts and those, they already possess.

Originally the method was developed by Novak at Cornell University in the 1960s. This concept emerges in the field of learning after new school of constructivism, which accepts active participation of the learner in construction of knowledge.

Jonassen (1996) considered Concept Mapping as an important tool, as it provides an external representation of structural knowledge in the form of two-dimensional semantic network, which potentially extends working memory, and encourages critical thinking. So, concept map is a “mind tool” which facilitates strategic actions.

According to Sowa (2000) Concept Mapping also known as cognitive mapping or semantic networks, is a graphic notation for representing knowledge in patterns of interconnected nodes and arcs.

According to Asan (2007) Concept Mapping is a method to visualize the structure of knowledge. Since the knowledge expressed in the maps is mostly semantic, concept maps are sometimes also called semantic networks.

Nelson (2007) defined Concept Mapping as a non-linear, graphic representation of unstable domains, depicting major concept nodes and the interrelationship of those nodes. It is a learning strategy identified as having a significant impact on retention and retrieval of information, with continued processing of data over time.

Ling and Boo (2007) report on a quasi experimental study examined the effectiveness of Concept Mapping as revision tool in enhancing pupil examination
performance in Primary Science. The research report showed better results by Concept Mapping method rather than teaching by traditional method.

Beyerback (1988) defined Concept Mapping as a technique of graphically representing concepts and their hierarchical interrelationships along two dimensions to examine the growth of students’ knowledge.

Wanget al. (2006) remarked that concept maps have been widely put to educational uses. They possess a number of appealing features which make them a promising tool for teaching, learning, evaluation, and curriculum planning. Ruiz-Primo and Shavelson (1995) discussed more research needs to be done to provide reliability and validity information on the effect of different concept-mapping techniques.

To conclude, we can say that earlier education was based on traditional methods of teaching, which were teacher centered but with the advancement and modernization these methods were replaced by new innovative methods like concept attainment learning, computer assisted instructions, co-operative learning, collaborative learning and Concept Mapping, which are learner centered methods. Concept map is a list of concepts with relational links and labels for these linking relationships. Concept Mapping is a graphic notation for representing knowledge in a connecting mode.

5.1.2 Achievement

Achievement signifies accomplishment or gain or a performance carried out successfully by an individual on the completion of task. It means all those behavioural changes which take place in an individual as a result of learning experiences of various kinds.

Crow and Crow (1954) defined achievement as the extent to which learner is profiting from instructions in a given area of learning i.e. achievement is reflected by the extent to which knowledge or skill has been acquired by a person from the training imparted to him.

Traw (1960) defined academic achievement as the attainment ability or degree of competence in school tasks usually measured by standardized tests and expressed in grades or units based on norms, derived from a wide sampling of pupil’s performance.

Stagner (1962) defined achievement as a degree of proficiency or progress made by pupils in the mastery of school subjects.
Good's Dictionary of Education (1973) defines achievement as the knowledge attained or skills developed in school subject usually designated by the test scores or by marks assigned, by the teachers or by both.

According to Saxena and Dwivedi (1979) the term scholastic achievement refers to the attainment or accomplishment in the field where a subject receives some instruction or training. According to Morgan et al. (1986), “Achievement is the task oriented behaviour that allows the individual’s performance to be evaluated according to some internally and externally imposed criterion.”

According to Stephens (1980), “Achievement is the unique responsibility of educational institutions established by the society to promote the scholastic developments of pupils.” According to Rao (1980), “Achievement is concerned to a great extent with the development of knowledge, understanding and acquisition of skills.

In the words of Verma and Upadhyay (1981) achievement is the attainment or accomplishment of an individual in some or particular branch of knowledge after a certain period of training.”

According to Webster Dictionary of Education (1989), “Academic achievement is the performance by a student in a course based on formal study in an institution of learning.” Random House Webster’s College Thesaurus (1997) Academic Achievement means those qualities or attributes or characteristics or traits of an individual which contribute to or have a learning or effect or influence or accomplishment or proficient of performance pertaining to any activity scholastic in nature.

Ladson-Billing (1999) stated "At its best, academic achievement represents intellectual ability to participate in the production of knowledge. At its worst, academic achievement represents inculcation and mindless indoctrination of the young in to the canons and orthodoxy."

5.1.3 Achievement in Chemistry

Chemistry is one of the main branches of Science dealing with chemicals and reactions. Here Achievement in Chemistry is considered as mean gain scores obtained by the students in the achievement test in chemistry.

5.1.4 Achievement Motivation

Every person wants to have a unique accomplishment, an accomplishment of
excellence. When a person tries to manifest concern for excellence in his work, we call it as behaviour backed by achievement motive. Achievement Motivation is considered to be deep rooted and fixed in human nature. Achievement Motivation is a system of good direction that is closely associated to competence, higher standards of excellence, hope of success, aggressiveness, dominance perseverance and fear of failure. It is a desire to do well. Achievement Motivation sometime refers to as “The motive for mastery”.

Achievement Motivation is an important ability. Ability determines what a person can do and motivation determines what a person will do, thus motivation plays an important role in improving the level of performance. This desire is as basic and natural as the other biological or psychological needs. However, in a competitive society or set up the desire to excel over other or achieve higher level than one’s peers is intensified which in turn lead to a stronger may derive or motive to achieve something or everything that is essential to beat the other in a race and consequently experience a sense of pride and pleasure. This type of motivation produced by such desire for achievement is called Achievement Motivation.

Generally Achievement Motivation has two aspects- positive and negative. The person who has more positive approach or aspect is called high motivated person and a person having more avoidance is called a low motivated person.

It was Murray (1938) who first of all used the term Achievement Motivation to refer to achievement needs. According to him, Achievement Motivation means to accomplish something difficult, to master, to manipulate or to energize physical objects, human beings or ideals and to do this as rapidly and independently as possible so as to overcome obstacle and attain a high standard.

As said earlier the concept of an Achievement Motivation was put forth by Murray (1938). But it was through the hard work of McClelland (1953) and his co-workers that this topic has assumed practical importance in education and other fields. Theory of Achievement Motivation was developed by McClelland (1953) at Harvard University and Atkinson (1964) at the University of Michigan.

Some Psychologists consider that all human behavior is intended to reduce tension and reach a state of psychological and physiological equilibrium. But McClelland (1953) concluded that motive, rather than being essentially tension states are also derives towards action based on expectation. There is a great need to create a ‘need’ in a child to
learn and thus he has to be motivated. According to him, “Achievement Motivation is the desire to do better, to achieve unique accomplishment, to compete with standard of excellence and to involve oneself with long term achievement goals.”

Atkinson (1964) states “the theory of Achievement Motivation attempts to account for the determinants of the direction, magnitude and persistence of behaviour, in limited but very important domain of human activities.”

Finger (1966) investigated some characteristics of Achievement Motivation as persistence (work success), planning (time orientation), self control, deliberateness (morality) which presents usually in high motivation individuals and lack in low motivation group. One can also add personal responsibility, risk taking, level of aspiration, innovating activities and vocational goals as features of achievement motivation.

Achievement Motivation has also been defined by the German exponent Heckhausen (1967), “The striving to increase or keeping as high as possible one’s own capability in all activities in which a standard of excellence is thought to apply and where the execution of such activities can therefore, either succeed or fail.”

De Charms et al. (1955) contended the Achievement Motivation as disposition to strive for success in competition with others with some standard of excellence, set by the individual.

Mehndiratta (1997) defines Achievement Motivation as psychological need and energetic drive that prompts an individual to strive for and work towards mastering his/her environment by the successful accomplishment of a goal or goals accompanied by a sense of satisfaction and self worth called achievement needs.

So based on the above definition we can conclude, Achievement Motivation is the way through which one desires to obtain a higher standard with the help of goal directional human activity. It plays a significant role in shaping the total behaviour and personality, which in turn shapes the economic and social destiny of a given society.

5.1.5 Study Habits

The task of learning is not dependent on teachers’ alone. It is not only teachers’ responsibility but also of the learners’. Efficient learning depends not only on good teaching but also on satisfactory learning procedures. Efficient learning depends on
learner's ability to schedule his time, the plan of his study, the habit of concentration, note taking, mental review, over learning, the judicious application of whole and part methods, massed and distributed learning and so on. In other words learning involves the development of Study Habits.

Good (1959) defines Study Habits as the basic features involved in the application of the mind to a problem or a subject, the characteristic pattern which an individual follows in learning about things and people."

According to Good (1973), “Study habit is the tendency of a pupil to study when the opportunities are given, the pupil's way of studying whether systematic or unsystematic, efficient or inefficient etc.”

Edel (1969) described study habit as the time preferred, the time lapse between study sessions, the degree of noise or music tolerated or invited as physical conditions of the study, the extent to which the extra-curricular activities and the particular study mechanisms employed by different students. Study Habits can be interpreted as a planned programme of subject matter mastery.”

According to Biswas and Aggarwal (1971), "Study Habits are methods of study. No one method should be considered the best for all. It may vary from subject to subject. It is not enough that a student knows how to study but he should practice it ardently so that he may not lapse into his old ineffective Study Habits."

Goldenson (1984) stated that habits are persistent patterns of learned behavior which becomes so ingrained that it is almost automatic. It develops habitual ways of thinking, feeling, perceiving, talking and walking as well as habitual attitudes, reactions; verbal expressions and mannerism. These patterns help to structure one’s behavior, but if they become too rigid, they hinder adaptation to new situations.

According to Onubugwu (1990), “Study Habits is a technique, a student employs to go about his or her studies which are consistent and have become stereotyped as a result of long application or practice.”

According to Dictionary of Education (2008), "Habit is a state of body, natural or acquired, aptitude acquired by practice, custom and manner, whereas study is described as earnest endeavors, application of books and subjects, which one studies. Therefore study habit is the endeavour towards studies acquired through state of body which is natural or acquired."
Thus, Study Habits are true indicators of individuality of a person. These are planned programme of subject mastery. They characterize the learner's learning character. In fact, every learner has a peculiar method of style of pursuing his or her academic tasks. These Study Habits also serve as the vehicle of learning.

5.2 REVIEW OF RELATED LITERATURE

The term ‘Review’ means to organize the knowledge of specific area of research and to evolve body of knowledge. Survey of relevant literature is a precondition for meaningful and useful research. To make our research effective, presentation, adequate familiarity with all the research work already done in the field of study is essential.

The present investigation is aimed at exploring the effect of teaching through Concept Mapping on the achievement of students in relation to their Achievement Motivation and Study Habits. Thus the review was divided and presented under these major heads:

- Teaching through Concept Mapping and achievement
- Achievement and achievement motivation.
- Achievement and Study Habits.

5.2.1 Teaching through Concept Mapping and Achievement

Various studies had been done in order to evaluate the effect of Concept Mapping on the achievement in various subjects and it is also equally true that majority have been conducted in western countries. Some studies on Concept Mapping as Montiel (1980), Cohn (1987), Jegede and Okebukola (1990), Stensvold and Wilson (1992), Horton et al. (1993), Wilkes et al. (1999), Sungur et al. (2001), Chang and Chen (2002), Novak (2002), Preszler (2004), Snead and Snead (2004), Wang and Dwyer (2004), Novak and Canas (2006), Saquma and May (2007), Olgun and Sila (2008), Aydin et al. (2009), Chiou (2009), Okoye and Okechukwu (2010), showed that teaching through Concept Mapping has significant effect on the achievement of the students whereas studies of Brandt et al. (2001), Deyu Hu (2006), Adlaon (2012), Abdulkarim and Hassan (2013) found no significant differences in the academic achievement between Concept Mapping and traditional method but majority of studies were the positive effect of the strategy on the achievement.
Concept Mapping not only improves theoretical aspect but it was found that the construction of prelab and postlab Concept Maps help students understand the concepts involved in the experiments they perform (Markow & Lonning, 1998). Results of study of Slotte and Lonka (1999) indicated that merely including the relevant concepts in a map has little effect on the comprehension of concepts, whereas the extent and complexity of concept maps plays a powerful role in the understanding of scientific texts. If we talk about use of Concept Mapping individually and in groups, here study of Ritchie and Volkl (2000) assessed no difference was found between students working as individually or in groups, however the findings of Chularut and DeBacker, (2004) showed that Concept Mapping in group had significantly greater gains from pre-test to post-test than the individual study group.

Study of Ahlberg and Ahoranta (2002) showed that the Concept Map was only an accurate representation of the main features of cognitive structure. Yeh (2004) shared that cross-domain Concept Mapping can be an efficient mental tool in understanding a students’ creative thinking, improved students’ higher order thinking skills (De Wispelaere & Kossack, 1996), longer retention of concepts (Sharma, 2010; Patrick 2011) The findings of (Wheeler & Collins, 2003) suggested that Concept Mapping was effective in helping students to develop critical thinking skills. Not only students with normal abilities but slow learners were also benefitted with Concept Mapping, specifically, female slow learners taught with the Concept Mapping instructional strategy performed significantly better than their male counterparts taught by the same method (Udeani & Okafor, 2012) while results obtained by Cheema and Mirza (2013) showed that male students taught through Concept Mapping performed significantly better than the female students, on the contrary findings of Bello (1997), Bilesanmi-Awoderu (2006), Simon (2007), Okoye and Okechukwu (2010), Ezeudu (2013), Abdulkarim and Hassan (2013) revealed that there was no gender influence on students’ Concept-Mapping ability and their achievement in the subject. Anderson-Inman and Zeith (1993) found young students who still struggle with handwriting skills benefit greatly from Concept Mapping tools.

Apart from these different researchers experimented to check the importance of Concept mapping on various subjects. Studies of Pankratius (1990), Alias (2006), Karakuyu (2010) showed that concept map instruction was more effective in improving

Apart from Science subjects this technique has positive impact on the achievement in case of Mathematics (Novak, 2002; Novak & Canas, 2006; Awofala, 2011), History (Miandoab, Mostafaei & Ghaderi, 2012) and English course (Tiimen & Taspinar, 2005), it was also recommended that; while using concept maps in language teaching, teacher-made maps firstly should be used. The students should be encouraged to develop their own concept maps.

To conclude we can say there was significant difference of instructional strategy on achievement taught through Concept Mapping and conventional teaching on the academic achievement of the students. Hence we can say Concept Mapping helps in easy understanding of concepts to the students, irrespective of their grades and also affects their improved performance in various aspects. So, Concept Mapping also helped to bring all desired effects in the field of education whether its better academic performance, learning and retention ability.

5.2.2 Achievement and Achievement Motivation

between Achievement and Achievement Motivation but the results of studies by Rajput (1984), Kalie and Kour (1990), Reddy (1990), San Juanita (1998), Hernandez (1998), Kaur (2001), Onete et al. (2012) and Emmanuel et al. (2014) confirmed no significant relation between Achievement and Achievement motivation. Kingra (1986) found significant negative correlation between Academic achievement and Achievement motivation.

According to Malik (1977) Achievement Motivation is too little extent helpful in academic achievement in Chemistry. Bandhana and Sharma (2012) revealed positive effect of Achievement Motivation on the academic achievement. They also found that boys have higher level of Achievement Motivation in comparison to girls whereas the results of the study of Abesha (2012) showed that regardless of students’ gender, Achievement Motivation had a significant and positive direct effect on Academic achievement.

5.2.3 Achievement and Study Habits

The study of related literature suggests that the achievement of the students is related to the Study Habits of the individual but the studies of Rajyaguru (1997) found other variables as better correlates of achievement than Study Habits. Studies of Dube and Khuntia (2000), Chaudhary (2001), Lawrence (2014), and Siddiqui and Fatima (2014) found that Study Habits of students have no effect on achievement, however, majority of the studies conducted in this field indicated a significant positive relation between Study Habits and achievement (Singh, 1984; Kasat, 1991; Stella & Purushothaman, 1993; Gelat, 1999; Alude & Onelemhemhen, 2001; Nancy & Sheeba, 2001; Kumar & Sohi 2013; Adeyemi & Adeyemi, 2014; Sandhu, 2014; and Chamundeswari et al., 2014). Few studies were also in agreement with the concept that Study Habits puts more effect on girls than over boys having high achieving desirability and good Study Habits (Ramaswamy, 1990; Patel & Patel, 1996).

5.3 Emergence of the Problem

Most of the studies had been undertaken only in foreign countries. A little work had been done in India covering population of Chandigarh (Kumar, 2009; Sharma, 2010; Rani, 2011; and Sood, 2012), Amritsar (Aggarwal, 2012), Kapurthala (Jena, 2014) on effectiveness of Concept Mapping. But, no study has been found specifically done on the population of Punjab Government school students on subject of Chemistry. The proposed
study thus seems fully justified as it check the effect of teaching through Concept Mapping on achievement in Chemistry of grade IX on Punjab Government school students.

5.4 STATEMENT OF THE PROBLEM

EFFECT OF CONCEPT MAPPING STRATEGY ON ACHIEVEMENT IN CHEMISTRY OF IX GRADERS IN RELATION TO ACHIEVEMENT MOTIVATION AND STUDY HABITS

5.5 OPERATIONAL DEFINITIONS

5.5.1 Concept Mapping

Concept Maps in the present study are taken as two-dimensional representations of cognitive structures showing the hierarchies and the interconnections of all the Chemistry concepts for class IX of Punjab School Education Board. Various Concept Maps were prepared using steps recommended by Novak and Gowin (1984). Here hierarchical type of Concept Mapping was selected keeping age and grade in mind.

5.5.2 Conventional Teaching

In conventional teaching lecture discussion method was used in present study. The teacher presented the subject matter by active verbal interaction with the students.

5.5.3 Achievement in Chemistry

Achievement is defined as the extent to which learner is profiting from instructions in a given area of learning, Here Achievement in Chemistry is indicated by the mean gained scores (difference of scores of post test and pre test) of the students in the test of Achievement in Chemistry as constructed by the investigator.

5.5.4 Achievement Motivation

Achievement Motivation is operationally defined as the inherent motivation of an individual to perform better and strive towards excellence. In the present study Achievement Motivation refers to academic motivation, need for achievement, academic challenge, achievement anxiety, importance of grades, meaningfulness of task, relevance of school to future goals, attitude towards education, work methods, attitude towards teachers, warmth of interpersonal relations, individual concern, general and social interests, mountaineering, boating, dramatics, music and sports as factors of Achievement
Motivation as mentioned by Deo and Mohan (2011) in their Achievement Motivation scale. Here the scores obtained by the student in this inventory are termed as his Achievement Motivation in the present study.

5.5.5 Study Habits

Study Habits implies a sort of more or less permanent mode or method of studying. In the present study, Study Habits refers to comprehension, concentration, task orientation, study sets, interaction, drilling, supports, recording, language etc. as the factors of Study Habits as mentioned by Mukhopadhyaya and Sansanwal (2011) in their Study Habit Inventory. Here the scores obtained by the student in this inventory are measured as his study habits in the present study.

5.6 OBJECTIVES OF THE STUDY

The study had been designed to attain the following objectives:

1. To investigate the significance of difference in Achievement in Chemistry of the groups taught through Concept Mapping and conventional teaching.

2. To investigate the significance of difference in Achievement in Chemistry of the groups having high and low Achievement Motivation.

3. To investigate the significance of difference in Achievement in Chemistry of the groups having good and poor Study Habits.

4. To investigate the significance of interaction between teaching strategies and Achievement Motivation on the Achievement in Chemistry.

5. To investigate the significance of interaction between teaching strategies and Study Habits on the Achievement in Chemistry.

5.7 HYPOTHESES

The study was designed to test the following hypotheses:

$H_0 \ 1 \quad$ There will be no significant difference in Achievement in Chemistry of the groups taught through Concept Mapping and conventional teaching.

$H_0 \ 2 \quad$ There will be no significant difference in Achievement in Chemistry of the groups having high and low Achievement Motivation.
H0.3 There will be no significant difference in Achievement in Chemistry of the groups having good and poor Study Habits.

H0.4 There will be no significant interaction between teaching strategies and Achievement Motivation on the Achievement in Chemistry.

H0.5 There will be no significant interaction between teaching strategies and Study Habits on the Achievement in Chemistry.

5.8 DELIMITATIONS OF THE STUDY

The present study was delimited to the following areas:

- a) The present study was restricted to students of class IX studying in schools affiliated to Punjab School Education Board, Mohali, Punjab.

- b) The study was restricted to the Government Secondary Schools of Ludhiana district of Punjab only.

- c) The Study was restricted to the selected six topics of Chemistry from Punjab School Education Board Science syllabus (2012-2013) prescribed for class IX.

- d) The study was restricted to two classifying variables i.e. Achievement Motivation and Study Habits.

5.9 DESIGN OF THE STUDY

Experimental design of the study

To study the effectiveness of Concept Mapping strategy on the Achievement in Chemistry in relation to Achievement Motivation and Study Habits, randomized groups pretest- posttest design was used. Here in the first phase concept maps were constructed and Chemistry achievement test was constructed and standardized also test of intelligence was used to form two groups A1 and A2 experimental and controlled groups respectively. In the second phase Chemistry achievement test was applied as a pre test, apart from this Achievement Motivation and Study Habits was applied to classify the sample into two groups. In the third phase students were of controlled and experimental group were exposed to traditional teaching and Concept Mapping method respectively. In the last phase Chemistry achievement test was applied again as a post test. The difference of scores of pre and post which is termed as mean gain scores is index with which effectiveness of two methods could be compared.
The layout of the two 2×2 factorial design to be used in the present study for analysis of data on the gain scores is given in the following figures:

\[ 2 \times 2 \]

\[ \begin{array}{c}
A_1 \\
B_1 \\
A_1B_1 \\
A_1B_2
\end{array} \quad \begin{array}{c}
A_2 \\
B_2 \\
A_2B_1 \\
A_2B_2
\end{array} \]

**Fig. 5.1: Layout of factorial design including strategy and achievement motivation**

Figure 5.1 depicts teaching strategies designated as A and its two strategies exposure through Concept Mapping strategy and traditional teaching as A_1 and A_2 respectively. Achievement Motivation is designated as B and its two levels B_1 and B_2 represents high and low Achievement motivation, respectively.

\[ 2 \times 2 \]

\[ \begin{array}{c}
A_1 \\
C_1 \\
A_1C_1 \\
A_1C_2
\end{array} \quad \begin{array}{c}
A_2 \\
C_2 \\
A_2C_1 \\
A_2C_2
\end{array} \]

**Fig. 5.2: Layout of Factorial Design including strategy and Study Habits**

Figure 5.2: depicts teaching strategies designated as A and its two strategies exposure through Concept Mapping strategy and traditional teaching as A_1 and A_2, respectively. Study habit and is designated as C and has two levels, C_1 and C_2 which represent good and poor Study Habits, respectively.
5.10 SAMPLE
For the study, sample of 302 students of 9th class of Government Schools were selected through the multistage randomization technique from Ludhiana district. Investigator went on collecting clusters judiciously till the required number of sample is obtained. Classification is as shown in the figure 5.3

![Fig. 5.3: Classification of the sample](image)

The high and low groups in Achievement Motivation and good and poor Study Habits were framed on the basis of 27% criteria. The upper 27% on the variable were considered as high group and low 27% were considered as low group.

5.11 TOOLS USED
The following tools were used to collect data:

1. Concept Maps on different topics of Chemistry for Class IX prepared by the investigator.
2. Criterion Referenced Test measuring achievement on selected topics of Chemistry of IX class developed by the investigator.
3. Achievement Motivation Scale (Revised) (2011) by Deo and Mohan.
4. Study Habits Inventory (Revised) (2011) by Mukhopadhyaya and Sansanwal.
5. Mixed Type Group Test of Intelligence (MGTI) (2008) by Mehrotra.

5.12 STATISTICAL TECHNIQUES EMPLOYED
SPSS software was applied on the data in order to analyze the descriptive and inferential statistics. First of all the t-ratios of controlled and experimental groups were worked out for checking their homogeneity on the basis of Intelligence, Study Habits and
Achievement motivation. Descriptive statistics such as measures of central tendency and dispersion was computed to study the nature of the distribution of data by calculating mean, median, standard deviation, kurtosis and skewness t-ratios of controlled and experimental groups were worked out to find out the significance of difference between means of pre-test scores and post-test scores and on other variables. Two-way analysis of variance was computed to find out the main effects and interactional effects of independent variables on dependent variables. To investigate the significance of interactional effect t-ratio was computed.

5.13 RESULT AND CONCLUSIONS

The following conclusions were drawn from the present study:

- Achievement in Chemistry of group taught through Concept Mapping is significantly more as compared to group taught through traditional method. Thus Concept Mapping proved to be a better instructional strategy over traditional method in increasing achievement in Chemistry.

- Students with high Achievement Motivation score significantly better in Chemistry than the students with low Achievement Motivation which means that the students having high Achievement Motivation and low Achievement Motivation significantly differ in their Achievement in Chemistry i.e Achievement Motivation is an important factor of achievement.

- Students with good Study Habits score significantly better in Chemistry than the students with poor Study Habits which means that the students having poor Study Habits and good Study Habits significantly differ in their Achievement in Chemistry i.e. Study Habits is an important factor of achievement.

- Interaction between Achievement Motivation and method of teaching does not affect the Achievement in Chemistry significantly whereas Students with low Achievement Motivation of experimental group are significantly better in Achievement in Chemistry than the students with low Achievement Motivation of controlled group and students with high Achievement Motivation of experimental group are significantly better in Achievement in Chemistry than the students with
high Achievement Motivation of controlled group leading to insignificant interaction between Achievement Motivation and method of teaching

- Interaction between Study Habits and method of teaching does not affect the Achievement in Chemistry significantly whereas students with poor Study Habits of experimental group are significantly better in Achievement in Chemistry than the students with poor Study Habits of controlled group and students with good Study Habits of experimental group are significantly better in Achievement in Chemistry than the students with good Study Habits of controlled group leading to overall insignificant interaction between Study Habits and method of teaching.

5.14 EDUCATIONAL IMPLICATIONS OF THE STUDY

- The findings of the present study clearly reveal that Concept Mapping is the strategy leading to higher achievement of students which is also supported by the studies of (Pankratius, 1990; Julius & Wachanga, 2013; Fatokun & Eniayeju, 2014; Nwagbo & Okonkwo, 2014). As with the changing time everyone whether its institution, parents or students is focused on the increased achievement, so this method is sufficient to fulfill the needs of everyone.

- The present study also supports that the strategy of Concept Mapping can be introduced in the theory classes not only at the secondary level (Pankratius, 1990; Julius & Wachanga, 2013) but also right from the primary level (Cheema & Mirza, 2013); middle level (Hwanget al., 2012), senior secondary (Fatokun & Eniayeju, 2014; Victoria & Paul, 2014; Nwagbo & Okonkwo, 2014) even at the university level (Markow & Lonning, 1998; Abdulkarim & Hassan, 2013), so this technique is helpful to cater the needs of the students at every level.

- Results of present study also supported that Concept Mapping is useful for all categories whether high or low Achievement Motivation, good or poor Study Habits i.e. all types of categories get benefit out of this. This technique is thus strongly recommended for the teaching of Chemistry. The teachers can use this technique to get better results.

- Construction of pre-lab and post-lab concept maps helps students understand the concepts involved in the experiments they perform and it was stressed that
constructing pre-lab and post-lab concept maps helped them understand the conceptual Chemistry of the experiments. (Markow & Lonning, 1998).

- Concept Mapping was effective in helping students develop critical thinking skills (Wheeler & Collins, 2003). Concept maps play a powerful role in the understanding of scientific texts. (Slotte & lonka, 1999) as it was rightly remarked Concept Mapping is a teaching and learning strategy that establishes a bridge between how people learn knowledge and sensible learning (Novak & Gowin, 1984).

5.15 SUGGESTIONS FOR THE FURTHER STUDY

- As in the present study Concept Mapping was found to affect Achievement in Chemistry significantly, it can be equally useful in other subject areas also. Study of Chiou (2008) also indicated that Concept Mapping helped them to understand, integrate and clarify accounting concept and also enhanced their interest in learning accounting. They also thought that Concept Mapping could be usefully useful in other curriculum areas. Same study can thus be conducted on the subjects like Social Sciences, Language, and Mathematics.

- The study was restricted to two classifying variables i.e. Achievement Motivation and Study Habits. It can be done on the other variables like styles of thinking and learning, Science aptitude, cognition styles.

- This strategy was found to improve retention of content also (Agboola & Oloyede, 2013; Ezeudu, 2013; Jack, 2013; Victoria & Paul, 2014), Saeedi et al. (2013) concluded the best way for use of concept maps is teacher-generated concept maps with texts. Experiment can be conducted to investigate the effectiveness of Concept Mapping on the retention of Chemistry concepts.

- Present study was restricted to secondary school level, it can be expanded to different age groups by experimenting on higher secondary, senior secondary or university level. Apart from these rural and urban expansion can also be taken into research.

- The present study dealt with students of Government schools only, private schools can also be taken, moreover study can also be expanded to compare whether Government students are more benefitted or private with this strategy.
Other correlates of achievement can be included in the experiment. Present study was confined to Ludhiana district of Punjab only; other areas can also be explored. Same study can be conducted in professional colleges also.

Here investigator has focused on hierarchical types of concept maps, study can be done on other types of concept maps i.e. mixed types of maps can also be included in research programme.

Computer assisted concept mapping is has emerged globally. It can be tested in Indian schools. Experiment can be conducted to investigate the effectiveness of computer assisted concept mapping on the achievement in Chemistry and other school subjects.

The strategy of Concept Mapping is relatively new in India, so more research works is needed to adapt this techniques according to the needs of Indian schools.