CHAPTER I

INTRODUCTION
The cultural shift of the 1970's places both science curriculum and science teaching in a new perspective. The present day society demands that scientists should assume more social responsibility in choosing research problems. Scientists should not only stress upon the fundamental and laboratory based research but also they should take up research problems to extend the benefits of technological developments to general public. The greatest domain of science for general education is in terms of its applications to the human conditions. The way to spread and popularise science education among masses is to make it more activity-oriented. These activities should not only be chosen from laboratory activities but also activities concerning the non-specialist or general man.

Recent trends in science teaching lay emphasis on the accumulation of knowledge to the development and employment of analytical skills and away from memorization to the utilization of an inquiry approach. Science, therefore, should be a favourite subject of most students. But this is not the case. It is viewed
by the students as a difficult subject and meant for very bright students. At middle school and junior high school level, a time of self-awareness and exploration, students do not experience the joy of scientific inquiry. And at the high school level, the number of students offering Physics and Chemistry courses is dwindling every year. How can science educators cultivate in all students a more positive attitude towards science. The science curriculum model which utilizes an inquiry strategy and language rich experiences offers a partial solution to this vital problem. The model is based on a student centred curriculum and it uses science as the medium to achieve skills of questioning, thinking, speaking, listening and reading. The conceptual frame work is based on the proposition that students learn more readily when they are involved in some task. Piaget emphasized that "Learning is possible only when there is assimilation". It would be meaningless to deal with science on an abstract level. The results of studies by Piaget indicate, children pass through a series of developmental stages and if they do not have concrete experiences, their later intellectual development will be hampered. Science curriculum provides for the needs of the students who are at the concrete, as well as at the formal operational level of development. The ultimate goal of this science curriculum is to help each student to become an effective learner under his own power. With growth, his awareness of knowledge will increase. If through inquiry, the learner has a hand in building his own
knowledge structure, he will be in a better position to determine, what he knows, how he knows it, how the parts are related to each other and how to expand it. To be effective with the curriculum model, the teacher needs to be willing to allow students to learn at their own pace and to allow them to select materials which maximize their potential. The teacher should be personally involved with each student so that he can best respond to individual needs. A learner's self-confidence is strengthened through teacher's acceptance. Inquiry oriented teaching should be preferred. Recent research has shown that knowledge gained through observation and inquiry is more meaningful to the students, more readily applied to novel situations and not easily forgotten. The science curriculum, therefore, should be activity based. In science, students should work in groups because group activity encourages maximum development of each member's resources. It also fosters thinking, speaking, listening and writing skills. In addition, students learn to co-operate with one another. Piaget believed that intellectual development is contingent upon cooperation among children as well as others.

Researches in the field of teaching methods have clearly established that no single method of instruction is capable of teaching the whole course or a unit of a course. Teacher has to employ different methods at various stages within a unit or a topic. Now, most of the researches are carried out to develop new teaching strategies. A teaching strategy may be operationally defined as an arrangement of learning events in such a way so as to achieve the objective of instruction.
An important characteristic of the new science-curricula has been an increased emphasis placed on concept formation, scientific principals, inquiry processes and critical thinking. Implicit in this approach is the assumption that the teacher and the way he deals with the curriculum may direct and discipline student's thought processes and so influence their cognitive styles. The interest is not in whether the student can identify correct or incorrect information but rather in what he is likely to do with information intellectually.

The following four different modes in which an individual can attend to scientific information have been suggested by Heath.

- acceptance of scientific information for its own sake i.e. without consideration of its implication, application or limitations. This mode is designed as recall.

- acceptance of scientific information because it exemplifies or explains some fundamental scientific principals or relationship. This method is called principal.

- critical questioning of scientific information as regards its completeness, general validity or limitations. This method is designed as questioning.

- acceptance of scientific information in view of its usefulness and application in a general social or scientific context. This mode is referred to as application.
These modes have formed the blue print for several cognitive preference tests.

Recent Educational studies stressed the child's involvement with the phenomena, confident that he would gain practice with the process and understanding about valuable concepts. School curriculum improvement study stressed concepts and phenomena with process learning and implicit by product of the children's experimentation, discussion and analysis. American Association for the advancement of science education (A.A.A.S.) stressed the child's practice with the processes, and used phenomena only as vehical and concepts as tools.

In 1960's, the developers of science project began a real effort towards the education of special population. The biological science-curriculum study committee developed special material for the academically unsuccessful learners. In 1969, this centre also started to conceive of a science programme for another neglected population, the mentally handicapped.

Mager (1962) stressed that curricula should be described in terms of their objectives. Gagne (1970) gave following five categories of objectives expected as learning outcomes, namely intellectual skills, cognitive strategies, verbal information, motor skills and attitude. According to Gagne, intellectual skills are the capabilities that make the human individual competent.
The phases of curriculum development can be characterized by one or more of the three main sources that influence the process of curriculum construction. Tyler (1932) identified these sources as: (i) learner, (ii) society and (iii) subject-matter. These sources of influence recognise different needs at different times and so reflect different outcomes. During 1930's and 1940's the emphasis was on social reconstruction through schooling. Science education reflected this approach well. During 1950's, progress of industrial technology and science continued to increase and when in 1957, Soviets won the space race by launching sputnik, further questions were posed about the quality of science and mathematics education in schools. More and more scientists became interested in science curricula for various reasons. Many new curriculum centres as Biological Science Curriculum Study (B.S.C.S.), Physical Science Curriculum Committee (P.S.S.C.), School Curriculum Improvement Study (S.C.I.S.), Council for the Advancement of Secondary Education (C.A.S.E.) for developing programs appeared in U.S.A. Each project developed its own characteristics.

1.1 REVIEW OF RELATED STUDIES:

Many research studies concerning curriculum development and its effectiveness in relation to various process, psychological and support variables have been conducted in the past. Some findings of the studies having relevance to the present study are given below:
Gagne and Others (1962) found no significant effect of ability upon success in the learning task.

Lambert, Miller and Wiley (1962) observed that intelligence was significantly associated with immediate acquisition.

The findings of the investigation by Rao, S.N. (1963) revealed that the high and low achievers did not show significant difference in general mental ability.

Rastogi, K.G. (1964) found significantly positive relationship between intelligence and achievement both in Science and English.

Sinha, D.N. (1965) found that in their intellectual capacity, the more successful students were significantly superior with a mean I.Q. of 112.98 as against that of 102.49 of the low achievers.

Study by Singh, B.N.K. (1965) revealed that academic achievement was significantly and positively related to intelligence, concept formation ability and academic motivation.

Feldman (1965) reported that on transfer test, subjects of high ability did better than those of low ability, but subjects of low ability did better from study by text than study by programme.

Rao, D.G. (1965) concluded in his study that intelligence, study habits and school attitude were significantly related to the prediction of scholastic achievement.
Varma, M. (1966) revealed that intelligence had positive correlation with the achievement.

Vidhu, M. (1968) revealed that the correlation between intelligence and academic performance was positive and highly significant.

Joshi, J.N. (1970) concluded in his study that superior intelligence is associated with higher scores on the algebraic concepts.

Jha, V. (1970) found in his study that there was a significant positive relationship between achievement in Science and general intelligence but there was no relationship between achievement in Science and extroversion.

Findings of study by Puranik, G.A. and Kundley, S. (1971) revealed that educationally backward and bright children differed significantly on intelligence, vocabulary, and arithmetic ability, bright ones scoring high on each test.

The findings of the study by Chaudhary, N. (1971) concluded that n-achievement and intelligence were not significantly and positively related to each other.

Pathak, A.B. (1972) revealed in his study that the high achievers had a significantly higher mean I.Q. (131.2) than the lower achievers.

Neel, T.E. (1972) found that experimental groups scored significantly higher than the control group in the cognitive dependent variables.
The study by Gupta, R.C. (1972) concluded that there is significant positive correlation between intelligence and achievement in mathematics.

Vasantha (1972) investigated into the work values of students in relation to their intelligence, achievement and socio-economic status.

Thomas Gene (1981) while comparing the significantly different mean scores of high mental ability subjects over low mental ability subjects revealed a definite relationship between high mental ability and high achievement and concluded that mental ability appears to be a powerful predictor of achievement.

The study by Adaval, S.B. and Others (1961) revealed the causes of failure in high school examination. According to their study, majority of the students who failed were below average in intelligence; and they were introverts.

Brierlay (1961) has shown that intellectual performance may be broken down into at least three independent components. When this is done, it is found that the extroverts tend to be faster but less accurate and less persistent. In other types of performance (e.g. learning and psychomotor functions), the extroverts start well but slip back progressively relative to introverts.

Rao, S.N. (1963) revealed that differences in achievement were significantly related to aspects of personality like, neurotic difficulties, morale and sense of responsibility.
Doty and Doty (1964) reported that the achievement through programmed instruction appeared to be related to personality traits.

Sinha, D.N. (1965) found that a comparison of anxiety scores revealed the low achievers to be significantly more anxious.

Gaur, J.C. (1967) in his study found that girl isolates are introverts, lack common sense and fail to find immediate solution of problems. They are below average in intelligence. Isolate boys are introverts, aggressive, poor in intelligence and their academic achievement is very poor when compared with the academic achievement of the normal group.

Vidhu, M. (1968) revealed that extroversion and academic achievement were negatively associated. The introverts were found to take less time than extroverts on the Raven's Progressive Matrices in the age group of twenty to twenty five.

Abraham, P.A. (1969) revealed in his study that the influence of the temperamental dimensions of neuroticism and introversion-extroversion on academic achievement showed sex differences.

The analysis of study by Mirchandani, D.V. (1970) revealed inverse relation between intelligence and intensity of behaviour problems. A direct relationship was established between nature of behaviour problems and degree of neuroticism and introversion.
Vanarase, S.J. (1970) revealed that the achievers were found to be more self-confident, more independent, more mature, emotionally more stable and more conscientious when compared with the under achievers.

Saxena, P.C. (1972) revealed that the over achievers were those who inspired to higher achievement had sufficient endurance and possessed a capacity for fighting out their case while the under achievers were meek, submissive, timid, brooding, impulsive and dependent type of immature individuals.

Mohan and Kumar (1973) conducted a quantitative analysis of the performance of introverts and extroverts on the standard progressive matrices test. The performance of 100 students (50 male and 50 female) was examined in terms of items done correctly, wrongly, abandoned and not attempted; as a function of difficulty level and time spent on the test. The extroverts began with an edge over the introverts but showed a greater performance decrement allowing the introverts to draw ahead by the end of the test. In terms of overall I.Q. scores, the two personality types came out about equal.

Wankowski (1973) found that extroverts had obtained better grades at secondary school and were more likely to obtain a good degree at university. He concluded that, "generally high neuroticism and extroversion combine to inhibit academic achievement". Wankowski also found that personality was related to choice of subject. Introverts preferred
theoretical subjects, whereas extroverts chose practical and "people-oriented" areas of study.

Leith (1974) studied the interactions between personality and different teaching methods in determining achievement on a genetics course. Over 200 students who had no previous knowledge of the material to be learned were involved in the study. Two teaching strategies were compared: Discovery learning stressed individuality, personal interaction, flexibility and spontaneity in teaching, tolerance of uncertainty and error making and concern with global effects rather than precise detail. The other approach, 'reception learning' emphasized obedience, regularity, attentiveness, formality and direct instruction. These two methods were equally effective overall, but there was a clear tendency for the extroverts to benefit more from the informal discovery learning and for introverts to learn better from the formal reception approach. This interaction was observed when achievement was tested one week after the learning period and was even more marked when subjects were retested without warning, a month later.

Leith's another experiment (1974), showed that the extroverts are more easily bored by formal and isolated learning conditions. Apparently, they need a greater amount of stimulation to maintain their interest and attention and this may be provided either by novelty and variation in the method of instruction or by social
contact with fellow students. Given these conditions, they may even respond better than introverts, who are likely to feel overwhelmed by excessive uncertainty, and noisy companionships. The introverts, however, do better when conditions are structured and quiet; thus, introverts are not intrinsically better students than extroverts, it may be simply be that our current teaching methods happen to favour introverts.

Eysenck (1974) found that generally introverts do better at school and achieve higher university grades, although extroverts are sometimes rated better by their teachers at primary school level. The advantage of introverts become progressively clear into the university years. This may be because there is less variance in intelligence, and personality differences therefore become relatively more important.

In India, Education Commissions and Committees expressed the need for renovating and revitalising the curricular trend or historical development of curriculum at different stages, and in different periods and area of the country.

Gothiverkar (1947) was first to make comprehensive study of the secondary schools curriculum in the province of Bombay. He recommended the construction of a new curriculum catering to all aspects of development of learner.

Kelkar (1950) suggested course in general science which consisted of ten units, each of which represented some major problem of living, a wide area of human experience or an important aspect of environment.
Gupta (1953) recommended that rigid syllabus and traditional nature of questions should be changed.

Veerapa (1958) found that due to lack of proper laboratories well-equipped and trained science teachers and effective teaching methods, Science Education in India was not on proper footing.

Khushdil (1960) compared the integrated and traditional method of approach and found that in respect of assimilation and acquisition of knowledge, the former was more effective than the later.

Dave, R.H. and Saxena, R.C. (1965) found in their study that in mathematics most syllabi did not specifically mention any objectives and even where these were recorded, consideration was given to the computational skills and abilities including knowledge of mathematical concepts, facts and principals, utility of mathematics, application of mathematical knowledge to solve everyday problems, select the relevant facts etc. In all books problems were provided but no book encouraged problem solving as a method of learning mathematics.

Chanana (1967) made a historical survey of high school curriculum in Punjab and advocated a new and effective secondary curriculum.

Patole (1967) explored the existing weakness of teaching science in rural primary schools and found that activity-based method of teaching the subject was superior to traditional one.
Patede (1967) found that activity based method of teaching the subject was superior to traditional one.

Pillai (1968) investigated into the changes in the content and scope of the primary and secondary school curriculum in Kerala during the last thirty years since 1934.

Srivastava (1968) studied the important characteristics of achievement of students in different areas of curricular learning and the effect of intelligence and sex on the achievement in different areas.

Pillai (1970) found that back-dated and unsuitable text books and uninteresting traditional curriculum and methods of teaching responsible for making study of science and mathematics uninteresting.

Charles Bunner, Bogart and Warrenhenry (1971), while making comparison of Pontoon transitional design and traditional programme for teaching mathematics found that project teachers were highly favourable towards their experience in Pontoon curriculum because it gives opportunity to use of their skills and ability.

L.Cole (1971) found that computer assisted instruction is effective in improving computational skills and promoting student attitude towards Maths.

D'Souza (1971) experimentally compared the teaching of Geography by 'Systematic' and 'regional' methods and found that
The regional method was superior, the variables of school being statistically non-significant.


Study by Mock Wellington Lewis (1974) recommended implementation of work-study programs, project method and activity based curriculum.

Bharatendu Prakash (1976) found that discovery-oriented approach in science teaching was more effective in improving learning of science and he recommended for practical work and experimentation involving the use of local resources.

Tamir (1976) examined achievement scores of Israeli high school students using B.S.C.S. and found that scores for this group were significantly higher than for other students in non-B.S.C.S. curriculum.

A study by Fraser (1976) revealed that students who experience the Australian Science Education Project (A.S.E.P.) showed favourable changes in their attitude about Science Class.

Davies (1977) studied the effect of student-selected mini-courses in their science programme compared to conventional non-elective science courses and reported no significant differences in achievement and student's attitude for these two methods of instructions.
Gabel and Herron (1977) found that students who work alone had a higher learning rate than had those with partners. Their retention scores showed a significant difference favouring self-pacing.

Wright (1977) studied the effect of School Curriculum Improvement Study (S.C.I.S.) material on the process skills and attitudes of seventh grade students. No significant differences were found between the S.C.I.S. experimental and control (traditional text-books) groups using a measure of process skills. Other research indicated that teachers must specifically teach process skills if they expect achievement of them.

Ghosh, A. (1977) found that out of many causes of backwardness, unscientific curriculum, want of necessary books and teaching aids and unsuitable teaching methods were the effective factors.

McCormick (1978) studied a comparison of the impact of selected individualized curriculum organizations on faculty perceptions, student attitude and student achievement. He found that students' attitude did not demonstrate any statistically significant differences on the eighth, tenth and eleventh grade level. The attitude of the high ability students also did not demonstrate any statistically significant differences. Verbal achievement for tenth grade students in the partially individualized school significantly exceeded that of students in the traditional school.
Dewa Sthalee, R.B. (1978) recommended for vocational course at school level.

Shiner, Sandra, Miriam (1979) studied the curriculum implications of the profits of gifted high school students and revealed that different organisational structures were needed by the high creative and low-creative, gifted students and these gifted students stressed the importance of personal relationships with teachers and a comfortable social milieu as well as academic enrichment.

Wareing (1979) concludes in his study that the scientific attitudes of male and female six grade S.C.I.S. students were not significantly affected by the field-dependent-independent dimensions of cognitive style. And the combinations of cognitive style, I.Q., sex and school significantly affect the scientific attitude of the S.C.I.S. students in grade six.

Scotts, Nancy Anne (1981) found that incidental learning was greater when objectives were placed prior to content than when interspersed in content incidental learning was greater when objectives were placed after content than when interspersed in content. Intentional learning was found to be equal at the two cognitive levels (knowledge and application) as was incidental learning.

Cook (1975) investigated the effects on learning and retention of a group of students informed of the behavioral objectives and learning hierarchy of a new unit of instruction.
and a group of students receiving of the same unit of instruction but not so informed of the behavioral objectives or learning hierarchy. The data did not substantiate the thesis that informing students of the behavioral objectives and the learning hierarchy enhanced their performance on an achievement test. The study did suggest that the instructional method of providing students with statements and examples of the behavioral objectives results in resistance to forgetting based on a two-week retention test.

Olsen (1975) wrote behavioral objectives for a unit of a published science curriculum and provided them to ninth graders, objectives significantly enhanced achievement and retention although the effects of initial achievement on the retention test were uncontrolled.

Stedman (1975) found that (1) achievement was not significantly influenced by treatment which varied the nature of the objectives (behaviorally or nonbehaviorally stated) received prior to a learning experience with programmed materials. (2) Significant differences were noted between the cognitive levels of comprehension and application. Comparison of knowledge with comprehension and application with analysis levels produced no achievement gains. The results leads to the inference that these levels may demand independent consideration in the cognitive process involved.
Yelon and Schmidt (1975) concluded that objectives when utilized alone rather than in combination with other instructional aids, may indeed hinder learning.

Dalís and Nelson's study (1975) also revealed that objectives lead to enhanced achievement.

Elajne, J. Anderson; Hermest, T. Demelo Michael Szabo and George Toth (1975) in their paper concluded that science achievement on inquiry-oriented biology material was facilitated by the use of behavioral objectives.

Sodhi, G.S. (1976) investigated programmed learning in Chemistry in relation to taxonomy of educational objectives, intelligence and personality traits at the higher secondary level and concluded that intelligence acted as a redundant variable so far as overall achievement in science and achievement in various taxonomic categories is concerned. Some personality traits were reported to be significantly correlated with achievement.

Khoynejael (1980) studied the effects of behavioral objectives, prequestion and combination of both on intentional and incidental learning from written text by secondary school students and found that all the experimental groups were superior to the control group in intentional learning.

Hogan, James Peter (1981) concluded that behavioral objectives may be a useful experimental method for increasing achievement when the recommendations for more effective use of behavioral objectives are incorporated into the design. His study
indicated that behavioral objectives, while increasing achievement did not increase achievement significantly.

Carter, Joann (1981) found significant difference in the evaluation of pre-and post-test individualized programs, I.E.P.'s based on curriculum goals. He further found that there was no significant differences in the pre- and post-test evaluation of I.E.P's based on process deficit goals.

1.2 EMERGENCE OF THE PROBLEM:

From the review of related literature in the field of curriculum development and structure, it can be gathered that due to abrupt changes in the needs of individual and the society, the development as well as the structure of the curriculum should acquire the dynamic character. The modern curriculum designers are more concerned with providing the framework of the curriculum to match the instructional objectives. The selection of content material and its arrangement within a course is left to teachers. In modern instructional process, the role of the teacher is not to transmit knowledge through lecturing or through printed matter but his role is to facilitate learning by providing suitable learning activities to the students. Modern man and modern society are greatly influenced by scientific achievements and their application in technology. In the past, the researches in the field of science have been carried to generate new knowledge and new ideas and for technology to generate new products. But
the need analysis of the society reveals a shift from generation of new knowledge towards application of existing knowledge to help young people adjust to change and to solve the future problems. The teacher of science needs to be competent to relate science and technology to the conditions of a living. He has a responsibility for bridging a gap between the science, technology, society and an individual. This shift in aims and objectives in science teaching and curriculum at school level, makes the role of science teachers most important as well as difficult.

So far, many researches have been conducted concerning curriculum, methods and text-books. Most of the researches conducted have tried to analyse or examine the curricular trend or historical development of curriculum at different stages and in different periods and areas of the country. Few researches have been conducted by taking objectives, process skills and intelligence and other personality traits as independent variables. Very few studies have been conducted to see the achievement in terms of taxonomies of educational objectives as given by Bloom et al. (1956) and studies made by Hoare et al. (1969). Sharma (1974) studied only achievement in first three categories of educational objectives. Development of objective-based curriculum at different levels of learning, according to taxonomic categories, assumes a new dimension in the research field. The attainment in categories of educational objectives in cognitive domain as dependent and
personality and intelligence as independent variable of the learner; looked at the research strategy in this perspective, give rise to following issues.

- Whether objective based curriculum is superior to conventional curriculum of science at high school level in terms of achievement?

- Whether intelligence contribute significantly to achievement or not?

- Whether objective-based curriculum is superior to conventional curriculum of science at high school level in the terms acquisition of process skills?

- Whether intelligence contribute significantly to the acquisition of process skills among high school science students?

- Whether personality traits (Extroversion and Introversion) with respect to types of curriculum contribute significantly to the acquisition of process skills among high school science students?

- Whether there is significant interaction between types of curriculum and intelligence on achievement and acquisition of process skills?

- Whether intelligence interact with personality traits or not?
Whether personality of the learner interacts with modes of curriculum or not?

Whether there is significant interaction between learner's characteristics (personality and intelligence) and designs of curriculum.

1.3 STATEMENT OF PROBLEM:

"Development of objective based Science Curriculum and to study its efficacy in the acquisition of process skills among high school Science students".

1.4 HYPOTHESES:

The study was advanced on the basis of the hypotheses given below:

(i) Objective-based curriculum is significantly more effective than the conventional curriculum of science in respect of achievement (knowledge, comprehension, application) at high school level irrespective of intelligence and personality traits.

(ii) Significant differences exist in terms of achievement irrespective of curriculum design and personality traits among high school science students with differential intelligence.
(iii) Personality traits (Extraversion and Introversion) do not significantly effect the achievement of high school science students.

(iv) (a) There is no significant interactional effect of curriculum and intelligence on science achievement.

(b) There is no significant effect on science achievement due to interactional effect of curriculum and personality.

(c) Interactional effect of curriculum and personality do not effect significantly science achievement.

(d) There is no significant interactional effect of curriculum, intelligence and personality.

(v) Objective-based curriculum accounts for significant differences in acquisition of process skills in Chemistry among high school science students as compared to conventional curriculum of science.

(vi) Significant differences exist in terms of acquisition of process skills among high school science students with differential intelligence.

(vii) Personality traits do not effect significantly the acquisition of process skills, irrespective of curriculum design and levels of intelligence.

(viii)(a) There is no significant effect on acquisition of process skills due to interactional effect of curriculum and intelligence.
(b) There is no significant effect on acquisition of process skills due to interactional effect of curriculum and personality.

(c) Interactional effect of intelligence and personality does not effect significantly the acquisition of process skills.

(d) There is no significant interactional effect of curriculum, intelligence and personality on the acquisition of process skills.