CHAPTER II

REVIEW OF RELATED LITERATURE

2.0.0. REVIEW OF RELATED LITERATURE

Related literature is like a corner stone of a building on which the building is erected.A literature review is a written summary of journals, articles, books, and other documents that describes the past and current state of information on the topic of the research study (Creswell, 2012). The review of literature promotes a greater understanding of problem and its crucial aspects.The review of related literature enables the researcher to make: (1) appropriate hypothesis to problem can be prepared,(2) the things to be included in a problem becomes clear, (3) the necessity to solve the problem by research can be understood,(4) the source of information becomes clear, (5) proper guidance regarding proper instruments and tools for collecting information can be obtained .Also, review of literature builds the research skills of using various types of resources, locating needed materials in a timely manner and develops useful experiences for the investigator. It also provides comparative data on the basis of which the researcher evaluates and interprets the significance of one's proposed research problem with known findings. The review of related literature for the present study has been planned under following headings.

a. Value education in Education field

b. Trends in Science Education

c. Experiential learning in Science Teaching

d. Value Education in Science Teaching with reference to Experiential Learning

2.1.0. VALUE EDUCATION IN THE FIELD OF EDUCATION

Goswami (1983) explored a study on 'the value orientation of post-basic schools in Gujarat' with objectives (i) to study the educational moral, social religious, cultural, aesthetic and economic values in post-basic schools of Gujarat (ii) to study the value orientations of students and teachers of post-basic schools. The investigator used tools

like viz. Allport-vernon and Lindzey Value Questionnaire, researcher made Value Orientation Questionnaire constructed and a scale for Teacher's values (S.P. Kulshreshta). The tools were administered to 1,100 students of class X of 80 post-basic schools and 1,100 students of class X of 80 general schools selected at random. Statistical techniques like mean, standard deviations'-test' and mean differences were used to analyze the data. Major finding of the study were(1) the mean differences of scores on theoretical, social and religious values between teachers of post-basic schools and teachers of ordinary schools were highly significant and were in favour of teachers of post-basic schools. (2)Theoretical, social and religious values of teachers of post-basic schools were better than those of teachers of ordinary schools. (3) the post-basic schools provided a better atmosphere in schools to inculcate moral, social and religious values as compared to ordinary schools.

Paul (1986) conducted a survey study on the value orientations of adolescent boys and girls. The aim was to compare the rural and urban adolescent boys and girls going to schools and colleges with respects to personal, social, instrumental, terminal, and work values. The sample consisted of 1,076 adolescent boys and girls of classes XI and XII and first year of the degree course in arts, science and commerce groups from Baroda (Vadodara) district. Personal Value Scale was the tool used in the study. Analysis of variance and factor analysis with variance rotation were used to treat the data. Major finding reveals that there are differences between urban adolescents and rural adolescents, college adolescents and school adolescents, and the male and female adolescents with respect to different types of values.

Saraf (1986) in his book chapter 'Education in Human Values: Why and How' highlighted the essence of some of the great leaders in the field of education and spirituality. He quoted late PM Rajiv Gandhi, January 5,1985 address to the nation i.e Our education must promote national cohesion and work ethics. The beauty of freedom struggle and its significance for national integration have to be brought home to every student so that they can appreciate the hard fought freedom of our country. Our schools and colleges should acquaint the younger generations with India's ancient heritage and culture. The curricula and the text books should curb parochial and communal interpretation of our composite culture"(p65).Also referred sixth plan (1980-85) recommendations, "It is essential to transform the system of education

qualitatively in terms of its value content, standards and its relevance to life. The role of education to promote humanistic outlook, sense of brotherhood and a commitment to ethical and cultural values need to be re-emphasized (p67).

Bajpai (1990) carried out an experimental study on 'educational intervention curriculum for value development and its facilitative effect upon the level of moral-judgment of children'. The major findings reveal that the intervention programme greatly enhanced children's ability to judge and act as right and wrong and to understand the intention behind the act. Also variables like, intelligence, academic achievement, school adjustment and family structure were found significantly related to the concept of moral judgement.

Dubey (1991) explored a critical study of the concept of value education in India at school level since 1947 to 1986. The study focused on the concept and implementation of value education in India at school level from 1947 to 1986 in order to ascertain the status of value education in Indian education, and highlight its educational implications. Opinions from 404 schools of all denominations selected randomly from Delhi were collected with the help of a questionnaire. Findings revealed that values like national integration, brotherhood, secularism, and punctuality have been highlighted. Songs and legends which highlight socially accepted values are missing from the curriculum. Value crisis is due to lack of ideal leadership, neglect of affective domain in education, and concept practices in society.

Arora (1993) studied 'the relationship between the nature of scientific knowledge and values among university teachers and students'. One of the major objectives of the study was: to study the relationship between the nature of scientific knowledge and values among university teachers and students. The descriptive survey method was used. The sample consisted of 142 university teachers and 461 university students of Varanasi city. Random sampling technique was used to choose respondents. The tools developed by the researcher and used in this study were Value Reflecting Questionnaire (VRQ) and Scientific Thinking Style Questionnaire (STSQ). The conclusion that emerged from the study was that values do affect the understanding of the nature of scientific knowledge.

Sharma (1994) made an investigation on the effectiveness of value analysis model in developing value analysis competencies among B.Ed. trainees and school students. The study was conducted to see and compare the effectiveness of Value Analysis Model (VAM) in developing Value-Analysis Competencies (VAC) among B.Ed. trainees and school students when taught with or without the use of value-analysis model. The major values taken up are co-operation, dedication to teaching profession, nationalism, perseverance, and scientific temper. An experimental design using pre-test and post-test with parallel groups has been used. The detailed description about various approaches strategies, and models of value-based education has been provided. The significance of value-based education and the role of teacher have been highlighted. The finding of the study indicated the effectiveness of VAM over conventional method of teaching in developing VAC among the members of the both treatment groups, over control group under observation.

Kapoor (1995) Conducted a study, on the value change in secondary school students with one of the objectives,(i)to determine whether value change could be brought about through an intervention programme on secondary school students. The major values under consideration in the study were self-respect, freedom, wisdom, and a sense of accomplishment. Students aged 14+ and 16+ from 9^{th} and 10^{th} grades in equal member of boys and girls from the schools of Lucknow city were taken as sample of the study. Major findings of the study were (1)the modified Rokeach's value change instrument used in the experimental intervention programme was effective in bringing about desired value change among the students.(2)The experimental subjects showed significant change in self-respect, wisdom, and a sense of accomplishment and (3)The value-change programme was more effective for girls as compared to that for boys.

Joshi (1998) studied the `Development of democratic values through value analysis technique in civics at secondary stage' with the objectives to study the effectiveness of value-analysis technique(VAT) in terms of developing democratic values among students through teaching of civics, and trends in development of democratic values on different scores of different groups. The study followed experimental approach and time series design for the development of democratic values. The researcher used 21 null hypotheses, keeping in view the objectives of the study. The findings reveal that

VAT was found to be effective in terms of developing democratic value among students, through teaching of civics.

Gawande (2002) in his book entitled "Value Oriented Education (Vision for better Living)" emphasized human values. According to him Human values are like an axle of a wheel and other types of value are around it. Therefore if an individual is educated in human values, learning of all other values become easier. He found out the following seven human values through Inductive and deductive method. Those are: *Truthfulness* (to have constant practice to approach the reality or truthfulness),*Constructivity* (means to help for good undertaking), *Sacrifice* (to help without selfish motive),*Sincerity* (to work in stipulated time as assigned), *Self-control* (to have control on individual's mind for action), *Altruism* (to behave with others with love and to consider the wellbeing and happiness first),*Scientific Vision*(to find out scientific reasons of a problem).

Lina (2002) gathered the insights they gained at Clapham primary school in South Australia in developing values as a whole School community to initiate sustainable change. Method of constructivism was used for the development of a core set of values in whole School. The researcher observed that learning has been largely isolated and fragmented and has failed to assist students to make connections across different bodies of knowledge. Therefore the researcher delineates the importance of developing personal and interpersonal skills that will enhance the awareness of an emotional intelligence and assist learners to navigate their journey through successful life experiences. The finding shows that alongside knowledge and skill generation ,values like: 'critical values'(insight, knowledge, thinking, communication), 'creative values' (diversity, flexibility originality, individuality), 'caring values' (self-concept, self-respect ,Cooperation ,responsibility, respect for others) and 'life Long learning values' (resilience, optimism ,enthusiasm, positive self-concept, interdependence) were emphasized and results were astounding.

Sarangapani (2003) studied critically about the children of Kasimapur village explores the nature of the child's construction of school knowledge and the relationship between schooling and everyday knowledge. The study present a detailed account of the social context in which the schooling takes place and why schooling is important

in the village, the ideology of childhood, activities, discourses in the school and classroom, the construction of pupil and teachers identities, regulation of knowledge in the classroom and different aspects of children's epistemologies. Findings of the study reveal that the classroom's overwhelming emphasis on learning through telling and simple memorization overruns all considerations of empiricism, even the pedagogic utility of experiments. Ultimately, what is learnt in school is linked only to life within the boundaries of the school not with the life outside the school.

A comparative study entitled "Values and moral judgement of adolescent girls Studying in non-missionary and missionary schools in Kolkata' conducted by Gupta(2005) which shows that there was a significant difference only in the cases of democratic, aesthetic, knowledge, hedonistic, power and health values. Adolescent girls studying in missionary schools in Kolkata score more in the democratic and power values while the non-missionary ones do so in aesthetic, hedonistic, knowledge, and health values with no difference found in the religious, social, economic and family prestige values or in moral judgment.

Biswal and Srivastava (2006) made an in-depth study, on 'Designing and Implementing Co-Curricular Activities (CCA) to inculcate social values among B.Ed. Students'. The quasi-experimental design was selected for the study. The result revealed that the CCA programme was found to be effective in terms of students conceptual knowledge and value perception in all the taken social values for the present study like, kindness, equality, helpfulness, tolerance, fellow-feeling, cooperation, democratic leadership, respect for others, sacrifice, social responsibility, friendship, social service, sympathy, social justice, a sense of living together and social value as a whole.

Dhillon et al (2009) conducted a study entitled "Teacher Effectiveness in Relation to their Value Patterns". One of the major objectives of the study was: to establish the relation of teaching effectiveness with value patterns. Design of the Study was descriptive survey method. Statistical techniques like: mean, S.D, Critical ratio and coefficient of correlation was used for the study. The major findings were: The values of t-ratio on different dimensions of values i.e. Theoretical, Economic, Aesthetic, Social, Political and Religious of male and female teachers are 0.0065,

0.973,0,0.524,0.642 and 1.132 respectively which are insignificant at both levels of significance i.e. 0.05 and 0.01 which say that there is no significant difference in different dimensions of values of male and female teachers. There is no significant difference in different dimensions of values of government and private school teachers.

Fatema et al (2012) analysed "A Comparative Study of the Values of Bangladeshi Male Students in Public and Private Universities." Major finding of the study was: there were significant differences found in economic, social, and political, values between the male students of public and private universities whereas no significant difference in theoretical, aesthetic and religious values between the male students of public and private universities in Bangladesh.

Mohanty (2012) conducted a study entitled "A Study of Value Pattern among Professional Students" of Ambedkar University with specific emphasis on six interests in personality i.e Theoretical(belief in discovery of truth),economic(interest in usefulness),aesthetic(form and harmony), Social(love for People),Political(interest primarily in power),Religious(interest in unity).The study used an exploratory qualitative design and sample comprised of 200 students from professional courses. The major findings were**:** all selected professional courses have their own pattern. Profession wise, it was found that LLM (Law) students secured highest score (43.08) in theoretical value and political value (49.70). Similarly, MBA students achieved highest score (48.01) in economic value; MCJ students scored highest in aesthetic values (46.87) and religious value (43.12); and M. Lib students scored high (43.87) in social value.

Mundase (2014) in her article entitled "Value education: a pathway to global paradise" highlighted the Essentiality of value education: Without education, we cannot see beyond ourselves and our narrow surrounding; we turn blind to the reality of global needs. Similarly, without Value Education, we cannot realize how people of other castes and races as well as religion share the same dreams and the hopes. It is noteworthy that without Value Education, we cannot recognize the University of Human Aspirations. A growing consensus holds that value education can help both to reduce human right violations and contribute in building a peaceful society. The author also expressed deep concern over the issues like: socialization, cooperation, sharing, joint family system and national culture are disappearing from the society

day by day. Value Education prevents violations and abuses of human rights. Value education and character formation go hand in hand, as inseparable. Over the generations values provided foundation for social peace at national and international level. Value education therefore is the only pathway to Global Paradise.

Mustafa et al (2015) in his book '*Value Education*' highlighted power of values to shape our lives. Though climate, nature's beauty, diversity, and culture influenced ones decision, there must have been something more specific that compelled one – self to move to other region. This is because of appreciation of spirituality and eastern culture, a concern for the quality of the Physical environment, dissatisfaction with the mindless materialism of modern life, the rejection of conformity of the previous generation. These were the underlying values that drove one-self to the Eastern region. These were the ideals and beliefs that shaped one's life at the time, compelling a person to venture across country. According to them values are classified, such as social value, mental value ethical value, family value, aesthetic value culture value, spiritual value, personal value, behavioural value etc. One can call these as universal values, because ever since human beings have lived in community, they have had to establish principles to guide their behaviour towards others. In this sense, truth, honesty, responsibility, solidarity, cooperation, tolerance, respect and peace, among others, are considered universal values.

Paleeri (2016) studied attitude of teacher educators towards implementing Value education for B.Ed Students.. Major findings were: teacher educators have favourable attitude towards implementing value education for graduate level student teachers. There exist different levels of attitude among teacher educators towards implementing value education for graduate level student teachers.

Sadaphal (2016) in his article entitled "Swami Vivekananda's views on Education" emphasized that Education is 'Man–Making' process for Swami Vivekananda. It is arousing man to the awareness of his true self. It is harmonious development of body, mind and soul. Education is removing that veil of ignorance. Once the awareness is created in man, the knowledge will spring out like fountain from within. Education should aim at developing spirituality among people in social setting. This spirituality will lead to the development of spirit of fellow – feeling, sympathy, sharing and solution of common problems of people. Education is to recognize that to serve the

masses is to serve God. It should teach that 'Work is Worship'. A person with character must have strength, moral and physical both. He must be able to stand against odds and must be gentle towards weak and oppressed. Vivekananda maintain that students should be taught subjects like science and technology including various branches of science and engineering. Study of these subjects will develop scientific knowledge and will help in economic development of the country. This study will help students to attain self – sufficiency.

Bharambe (2017) took up a research on "Role of Co-curricular & Extracurricular activities in Holistic Development" and identified core issue that afflicts our education system i.e. holistic education is an open ended attempt to embrace the complexities and wholeness of human life. Holistic education demands such curriculum through which all round development of the student can be done. In holistic approach to teaching the appropriateness of content matter to cater to the demands of present time along with Cognition of the convention, terms, examples, concepts, principles and theories, establishing relationship with other disciplines, development of feeling faculty through inculcation of values, development of psychomotor skills, establishing relationship with the environment, development of life skills, and development of spiritual domain are more important.

Gupta *et al* (2017) in his article entitled "Science, Values and Ethics" articulated the intricate relationship between Science and Values. According to him Universal values are absolute and have Global approval, whereas context specific values differ with culture, religion or country. Seen from this perspective, values can seem subjective. In fact National values are mostly cultural ,social and moral .Gratitude indebtedness and ahimsa are vital values in Indian culture .We are grateful to our parents for our upbringing ,to our teachers for providing knowledge and skills so as to face the challenges of life confidently, and to mother nature for various gifts which make life so comfortable and enjoyable all these values particularly which forms part of Indian Heritage and Culture or are enshrined in our constitution, need to be stressed in education, fostering these will help create responsible thinking and law abiding citizens who will develop a mind-set to serve the society with sense of service .Lack of these values in society is bound to breed over emphasis on materialism, greed intolerance and corruption.

Singh et al (2018) conducted a qualitative research on" Policy perspectives in peace and Value education in the Indian context". Library research method was used for the present study. The objective of the research was to study peace education, value education and suggestions and recommendations for implementation in different education policies and other documents and literature. Major findings of the study were: the shift of focus, over the decade from religious and moral education for peace, via value education, parallels the shifting sense and sensitivities in the larger context of education. According to NPE1986, recommendations and suggestions are only possible with readjustment of curriculum in order to make education an important tool for the cultivation of social and moral values. Value education and education for peace have been the matter of concerns. Integrated approach has been suggested everywhere for peace education via value education. Major suggestion: At middle level, incident that took place in the societies related to different values should be taught in the form of stories and other form of literature.

2.1.1 Critical Reflection

The investigator has reviewed 24 studies pertaining to value education among which twenty two were Indian studies and two were foreign studies. Most of the studies were qualitative and have employed survey method except thirteen study which employed experimental methods. Tools used in these studies were researcher made tools and in some cases standardized tools. Education should develop spirituality among people in society which will lead to the development of fellow feelings, sympathy, and sharing (Sadaphal, 2016). Therefore, value education assures personal development and it is the mode to understand common language of humanity. Value education and character formation goes hand in hand as inseparable twins (Mundase, 2014). Through Co-Curricular Activities values like fellow feeling, Tolerance, Co-operation, Democratic leadership, Sacrifice, Respect for others, Social responsibilities, Friendship, Kindness, Equality, Helpfulness, Social service, Sympathy, Social justice, Sense of living together can be inculcated (Biswal and Srivastava, 2006). Values like democracy, national integration, secularism, and non-violence promote social cohesion and national unity. Also, it ensures reasonable quality of life for all during value crisis (Goswami, 1983). Neglect of affective domain in education and missing of social values are the major cause of value crisis in

society (Dubey, 1991). Values do affect understanding of the nature of scientific knowledge (Arora, 1993). What is learnt in school is linked only to life within the boundaries of the school and it has little to do with the life outside the school (Sarangapani, 2003). There is intricate relationship between Science and Values (Gupta *et al, 2017*).

2.2.0 TRENDS IN SCIENCE EDUCATION

Chatterjee et al (1978) made an attempt to find out 'the effect of scientific interest at different levels of potential ability with respect to science and to study the predictive values of interest in science and scientific aptitude in predicting success in higher secondary science'. The sample consisted of 115 students of std. IX in three different schools of Calcutta selected randomly from Bengali medium higher secondary Boys school. The tools used were scientific knowledge and aptitude test and Chatterjee non language preference record. The major findings were, there was a systematic positive relationship between science interest and probabilities of success in science at different aptitude levels except in the higher aptitude levels. The relationship between aptitude in science and probabilities of success in science and achievement in science was positive.

Cobern (1996) conducted a study "Constructivism and Non-Western Science Education Research". The researcher advocated that the curriculum development efforts and science education research in Non-western countries can benefit by adopting a constructivist view of science and science learning. The resulting level of science learning in non-western countries, however, has not met expectations. No doubt constructivism offers a very different view of science learning and on science, where in logical thinking is an inherently human quality regardless of culture, and processes of interpretation for understanding is always intended. The findings also reveal that Constructivism leads one to expect that students in different cultures will have somewhat different perspectives on science. Therefore, Science education research should guide curriculum planner to incorporate this point, thus making science curricula authentically sensitive to culture and authentically scientific. For instance Japanese elementary science education is based on the Japanese traditional love of nature.

Reinders (1996) studied “The constructivist view in science education – what it has to offer and what should not be expected from it”. Now a day in science education, there is certainly something fashionable about constructivism. No doubt constructivism has become also a most valuable guideline for science education -- for science teaching and learning as well as for research in these fields. This paper attempts to review the misunderstandings, the myths, the polemics and the serious critiques concerning constructivism. It will be argued in favour of a consistent and "moderate" constructivist view in science education that in fact may provide substantial progress in the field of science education.

Barot (2004) carried out a research on “Effectiveness of Computer Aided Learning in Science at Secondary Level”. The main aim of the study was: to study the effectiveness of teaching method on achievement of science subject, effectiveness of teaching method on confidence of science subject and effectiveness of teaching method on retention of science subject, with the help of a computer in comparison to that of traditional lecture method. In this research, the experimental method was implemented to examine the effectiveness of computer aided method of teaching science. The sample comprised of students of Std. 8, 9, 10, of two primary schools of Rajkot were chosen. Major findings were : the science achievement, retention, confidence of both boys & girls of Std.8, 9 and 10 who were taught by computer assisted teaching method was higher than that taught by lecture method.

Treagust (2004) studied “International Trends in Science Education Research”. The author has examined some of the unprecedented developments in science education research in the past three decades (1974-2004). The findings were: At the classroom level throughout the past 30 years, there has been a constant call for more relevant science education and for greater inclusivity in science education. During this period, there has been a great diversity of the types of research being conducted in science education. One hand there is large-scale assessment programs (like: Trends in Mathematics and Science Studies (TIMSS) and the Program for International Student Assessment (PISA) studies which provide both national data and international comparisons), on the other hand are small-scale studies of the work of science teachers in individual classrooms. In past three decades, there is growing acceptance of alternative genres of science education research and an acknowledgment of their

own strengths and weaknesses. Despite all the developments in science education curricula, research and assessment, there is still need for a greater understanding of the relationships between policy and practice and a realistic expectation of what science education research can contribute to practice should be the major part of the work of science educators in the next three decade.

Dora et al (2007) studied applying the Subject "Cell" through Constructivist Approach during Science Lessons and the Teacher's View. Major finding reveals that the t-test results analyse of the constructivist approach in the experiment and control group students and Traditional Instruction methods' success in telling the Cell subject group is X= 33,4643 and control group is X= 28,1250. (t = 1,120 ; p> 0,05) therefore there is no meaningful difference for the groups .The findings regarding the t -test result of the final test points to measure the sustainability of the success obtained by telling in the Constructivist Approach and Traditional Instruction Methods. Experiment group X= 34, 7857 and the control group is X= 26,750. (t = 1,178; p< 0, 05). Therefore, there is a meaningful difference between the groups.

Cakir (2008) conducted a study on "Constructivist Approaches to Learning in Science and Their Implications for Science Pedagogy: A Literature Review" with an objective to draws attention to the literature in conceptual change and cognitive development, in the areas of learning, specifically constructivism. In the first part of the paper, author concentrates on a critical review of the three most influential learning theories and constructivist view of learning. Also the researcher discusses the foundation upon which the constructivist theory of learning has been rooted in a detailed manner. It seeks an answer to the question of "What are some guiding principles of constructivist thinking that we must keep in mind when we consider our role as science teachers?". The second part of the paper describes, the ways of changing cognitive structure, the nature of students' alternative conceptions and cognitive aspects of learning and teaching science. Findings of the review provides: (1)guidelines for teachers, at all levels, in their attempt to have their students achieve learning with understanding, (2)Research about students' mental models, the constructive nature of students' learning processes and students' misconceptions have important implications for teachers who wish to model scientific reasoning in an effective fashion,(3) guidance

to teachers, textbook authors, and teacher educators who involved in the preparation of science teachers.

Desiraju (2008) conducted a review study entitled "Science Education and Research in India" with an objective to identify the problems associated with science education (i.e research & teaching, Science and engineering, Curiosity and courage),role of IITs, Central Universities, IISERs, State Universities, Research Institutes, Administration and bureaucracy, Non-governmental Involvement etc. Major finding of the study reveals that: Many aspects of the Indian scientific development are extremely unsatisfactory, lacking in both quality and quantity. Although the outreach of teaching and research programmes has increased considerably, populist political themes are favoured and special institutions have been created where research is undertaken independent of the university system. The present article reflects the present scene in science education and identifies the major lacunae and the challenges confronting the institutions involved in education and research. The author suggests that the government should restrict itself to broad policy issues rather than be involved in day-to-day affairs and university should be given enough autonomy to re-establish itself as the primary agency for education and research.

Smith et al (2008) studied "Students Experience SMART Board through Constructivist Values" with an objective to know "How do students experience learning from Smart Board technology by teachers using a converted PowerPoint lesson? The sample comprised of one veteran Biology teacher, one experienced Physics teacher, and students from two of their classes. Students in this study represent diverse backgrounds that can be found at most high schools. The findings of the study were: At least 80% of students were actively engaged for the entirety of the lessons. Students indicated their high level of engagement during the lesson was due to the interactive properties of SMART Board. They have a higher level understanding of the information. Students also identified their conceptualization during the focus group interviews.

Bell et al. (2010) Investigated, collaborative Inquiry learning: Models, tools and challenges with an objective to review the prominent existing models of inquiry learning. Comparative literature review was the method adopted for the study. A collaborative inquiry learning method was selected to create a culture of teaching and

learning into the classroom. Major findings of the study were: Graphical and structural representation of concepts and learning gains through predict-observe-compare-explain pattern was beneficial to students in developing their self-understanding about the concepts. It aroused interest and motivation. Focus attention, enabled progressive questioning, facilitated causal explanation, suggests a learning pathways, enable flexible sharing of learning objects, deepen and extend understanding, unbiased communication, structured and reflective knowledge building etc.

Lynn et al (2010) investigated "What teachers see as creative incidents in elementary science lessons." Qualitative survey method was used for the above study where in 36 short classroom incidents in three dissimilar science topics were constructed. The sample comprised of 23 primary school teachers of a rural, a small town, and a large town primary school in the North-East of England. Major finding of the study were (1) Teachers are often urged to nurture creativity but their conceptions of creativity in specific school subjects may have limitations which weaken their attempts to do so.(2) Some teachers saw creativity in essentially reproductive activities and in what simply stimulated interest in classroom setting.

Shashi (2010) undertook a study namely "Characteristics of a Constructivist Classroom in the Context of Science Education". Major findings of the study are: Constructivist classroom of Science exhibits some marked features that are different from a traditional classroom. The NCF-2005 emphasises on an environment in the science classroom which is conducive for constructivist learning. The classroom environment is maintained in such a way that students actively participate in learning which involves inventing, constructing knowledge and new ideas. The Science teacher applies various approaches to teaching learning process in order to make students as inquisitive thinkers, who reason, reflect, question, make association with prior learning, imagine and think. In the present paper some characteristics of a constructivist classroom in the context of science education like: child centred instruction, learner centred assessment, learning environment and learners' previous knowledge and its role in constructivism are discussed in a detailed manner.

Holbrook (2010) made an attempt to study 'Education through science as a motivational innovation for science education for all'. According to him science was introduced into the school curriculum to enable students, who were entering university to study science related subjects and to gain some background knowledge before beginning studies at the university level. This narrow objective is still very much prevalent among policy-makers and teachers today. The researcher opines that teachers and policy-makers should rethink their vision of science in the school curriculum and accept the view that the teaching of science subjects is part of the overall educational provision and it must not be viewed in a different philosophical light from other subjects. If education is the target, then the philosophy for the teaching of science subjects must be 'education through science'. This view argues for a paradigm shift in the purpose of school science education from the historical view.

Gerstner et al (2010) explored a study on Cognitive achievement and motivation in hands on and teacher cantered science classes: Does additional hands on consolidation phase (concept mapping) optimize cognitive learning at work stations? In the study the cognitive and motivational effects within different educational instruction schemes was monitored. In one hand, teacher-centred versus hands-on instruction; on the other hand, hands-on instruction with and without a knowledge consolidation phase (concept mapping) was tried out. The sample comprised of total of 397 high-achieving fifth graders participated in the study. Methods like pre-test, post-test, retention test design both to detect students' short-term learning success and long-term learning success, and to document their decrease rates of newly acquired knowledge was used. The study reveal that, to sustain the higher increase in knowledge caused by concept mapping, method should be applied regularly, before instruction takes place to improve for long term knowledge acquisition. Also the results show that fifth grade students had a high level of interest in hands-on instruction, although they were confronted as novices with an activity-based learning environment. Further the study also shows that science instruction is extremely effective where students' interest can be aroused by it.

Inderpal, et al (2011) conducted a research on 'Demographic variations in basic science education in India: a case study of CSIR UGC national eligibility test. The

article explores the demographic variations in basic science education across the country on the basis of the CSIR–UGC-National Eligibility Test (NET) held during the period 2002–2006. The states, representing different demographic zones, were ranked according to the number of qualifying students and the percentage selected. A simple scatter plot of selection versus enrolment shows that Delhi and West Bengal perform better than the norm, whereas Kerala and Tamil Nadu relatively underperform. The data envelopment analysis technique has been employed to further examine the relative efficiency of basic science education, in terms of the number of students qualifying NET in five subjects, viz. chemical sciences; earth, atmospheric, ocean and planetary sciences; life sciences; mathematical sciences, and physical sciences, across different states of the country. The position of a particular state on the efficiency frontier could serve as a measure of capacity building in these disciplines. These vast differences in efficiency scores across different states and union territories indicate the need for directed efforts to upgrade the overall standard of basic science education in the country. A transparent, accountable and discipline-specific quality assurance system would ensure the best educational outcome.

Raval (2012) studied in her dissertation, "Effectiveness of Constructivist Approach to the Teaching of Animal Classification in Science and Technology of Standard Ninth". The researcher used experimental research method. The researcher used (i) Pre-Experimental Design, (ii) True Experimental Design and (iii) Quasi Experimental Design. Samples were selected by 'Purposive Sampling Technique'. The investigator selected the students of standard nine from the sample schools. Major findings for the study were (1) the effectiveness of the Constructivist Instructional Program (CIP) was found considerable on entire sample as compared to traditional approach.(2)As compared to traditional approach the effectiveness of the CIP was found considerable on boys as compared to traditional approach.(3) the effectiveness of the CIP was found considerable on girls as compared to traditional approach.(4)the effectiveness of the CIP was found considerable on entire sample as compared to traditional approach.

Saha (2013) studied **"**Learning styles and its classroom application" wherein she reveals that Learning Style is a pattern of behaviour that human use for new learning. Every person is unique in their styles of learning. Teacher need to know and adopt

different teaching styles as one style does not fit for every pupil. Teachers need to plan their instruction based on individual differences and learning styles.

Arora (2015) studied "Effectiveness of Concept Attainment Model in Teaching of Science on Academic Achievement of Students at Secondary Level**".** In this study experimental control (pre-test and post-test) parallel group design was used. The study was completed in two phases i.e. Pre-test stage and Post-test stage. The study was conducted in private schools of North Delhi Region. Random sampling method was used for the study of 200 students. 100 male and 100 female students were selected and randomly assigned to two groups to be taught through two different methods viz., Concept Attainment Model and Traditional Method. Major Findings were: The concepts attainment Model was found more effective in raising the academic achievement in Science subject as compared to Traditional Method of teaching Science. In this study, Concept attainment Model has been found to facilitate academic achievement of female students in science. This has an important implication for teaching Science to the school children.

Talens,*et al* (2015) conducted an action research entitled "teaching Physical Science concepts through pop music :teachers and student experiences". The present study aimed to determine the experiences of physical science college teachers and second year college science Philippines students on the implemented P O P (Phy Scie Offbeat Project), considering that many students are interested in music. The present research paper gives an overview of teachers and students experiences that combined Art and Science .Descriptive method of research particularly participatory action research was used. Treatment of data was done through axial coding .Major findings were: concept that govern physical phenomena that are strengthened as both teachers and students enjoyed and appreciated everyone's preparation, participation and presentation. Student's deeper understanding of science concept and positive perception to the subject were also found enhanced using Science related musical compositions .Students had recommended that this activity be integrated as a requirement in other subjects.

Sarkar (2015) conducted a study on "Environmental Knowledge of Secondary School Students in West Bengal" with objectives to find out nature of environmental

Knowledge of Secondary students(rural & Urban), To measure the environmental knowledge of secondary students. The sample consisted of 622 students of std. IX from Gangetic planes of West Bengal. The major findings of the study were: There was significant difference in the mean scores of Environmental Knowledge of urban and rural students with urban students score was high. Similarly there was significant difference in the mean scores of Environmental Knowledge of urban and rural girls with urban girls score was high.

Bera, et al (2016) conducted an experimental study on 'Effectiveness of Concept Mapping Strategy on Cognitive Processes in Science at Secondary Level'. According to the investigator, learning is the act of modifying or acquiring new and reinforcing, existing knowledge, skills, behaviours, values or preferences and may involve synthesizing different types of information. The researcher investigated the effectiveness of concept mapping strategy on cognitive processes in science at secondary level .Major objective of the study was to study the effect of concept mapping strategy on cognitive process (applying, analysing, evaluating and creating) in science at secondary level in comparison to traditional teaching strategy. Experimental design involving pre-test, post-test equivalent group design was adopted for the study. Sample comprised 100 students from std.IX (Boys & Girls) of Kendradangal High Madrasah (H.S.) in Birbhum district of West Bengal. Results reveals that concept mapping strategy has significant effect on cognitive processes in science.

Hui Jin et al (2016) made an in-depth study on topic "Promoting cognitive and social aspects of inquiry through classroom discourse". Sample for the research were expert teachers who were actively involved in teacher preparation programs in universities and senior teachers who were actively involved in district professional development programs of Chinese mainland. The study was a qualitative study and it was limited to few provinces of China. Major findings were: After a monumental work on inquiry in science by Joseph Schwab, the goal of science learning has shifted from learning the end products of science to learning the process of 'doing' science. As a means of doing science; inquiry is emphasized as an important learning goal in science curriculum in many countries. As far as the cognitive aspect of inquiry is concerned, teachers in general recognized the importance of teaching the cognitive processes as

well as disciplinary reasoning. However, there was apprehension that teachers may be able to address common intuitive ideas about science concepts and principles. In a same way regarding the social aspect of inquiry, it was found the teachers frequently interacted with students in class. However, facilitating conversations among students and prompting students to talk about their own ideas are challenging for teacher educators.

Chandy (2017) conducted a study on empowering teacher Trainees for Quality Science Teaching. The study aimed at; 'to study the relationship between joyful science learning and academic achievement in the subject', 'to study development of interest in science through innovative science teaching method using mobile lab.kit among deprived adolescent children of society', 'to study the development of scientific temper among deprived adolescent children of society', and 'to study the effect of innovative teaching method on pre service teacher trainees'. The sample consisted of 200BMC students in age group 13-16 years. The major findings of the study were: The deprived students of standard VIII of municipal schools have better academic achievement in science with the innovative method of teaching. They have shown greater scientific temper with innovative method of teaching science.

Mukherjee (2017) in his article "Reflections on school science" pointed out that, once science considered as challenging subject, is now considered boring subject for students. This is due to the way science is taught in our schools and content overload .Thus school science has become collection of facts and memorization. The Hoshangabad Science Teaching Programme (HSTP) proved that it was possible to science curriculum where in science process finds due importance. The HSTP curriculum was managed by students through experiments in a group of four students and data collection, analysis, interpretation and conclusion was derived with the help of teacher. The HSTP core philosophy was to involve each and every child in handling experiments, chemicals and drawing inferences and to use locally available resources.

According to Arunan (2018) Science in India is several millennia old as well with Aryabhatta (the scientist) and Ayurveda (medicinal science) predating by many centuries, the modern science that engulfed the world in the second millennia. Any

critical analysis of science in India should ask the following question: If India had invented zero and Indian mathematicians had discovered calculus before Newton, why didn't India progress the way the Europe did after Newton's contributions in science? The answer is our conflict of interest and rigidity to promote the best mind for best job. On the contrary we claim about the eastern values and the strong tradition of family structure and criticize the west for moral degradation. From the time we are born, we are taught to respect and listen to elders and not argue with them. This indicates the systemic inertia in science which needs to be broken immediately.

Banu (2018) conducted a study on "Bio-diversity and sustainable development" and found that the gist of attainment of sustainable future lies in the basic nature of biodiversity and its establishment. Biodiversity is the root of sustainable future. Major causes of Biodiversity loss and ways to preserve biodiversity have been discussed in length. Major suggestion which emerge from the researcher is generating awareness i.e inclusion of environmental education in school curriculum be made essential as the national curriculum group has quoted in Habitat and learning position of NCERT. The researcher argued for the students' rigorous exposure towards the real life world (i.e natural and social) in which they live so as to enable them to analyze, evaluate and draw inferences about problems and concerns related to their immediate environment.

Ediger (2018) in his qualitative study on "Developing a philosophy of science instruction" found that, Science teachers need to develop a philosophy of teaching which provides direction in teaching and learning situations. A professional science teacher can inculcate reflective thinking , problem solving confidence, clarity in selecting vital problems, higher level of cognition, interest in science, foster learners learning attitude, Promoting inferential-analytic-creative thinking, allied skills development (like Observation, experimentation, recording data, drawing conclusions) in students. To make it possible science teacher must lay critical emphasis on components like: *inquiry learning* (students are to learn by discovery), *Objectivity* (students are to think and observe as things really are) and *problem solving* (creative and critical thinking to secure answers to questions involving dilemma).

Rajput (2018) attempted (through his article entitled "*Science communication as an Academic Discipline: An Indian perspective"*) to highlight scientific temper, scientific method of enquiry and scientific culture among the masses through an effective tool called Science Communication (Sci Com). This is a two-way dialogue between scientists and society by increasing the public understanding of science and scientists' understanding of the public as today, every citizen requires S&T knowledge and skills to better understand the Nature and perform their daily transactions in an efficient way. By Stopping or obstructing this flow of information creates a communication gap. It can be overcome with the popularization and communication of scientific knowledge, scientific temper, scientific method of enquiry, scientific thinking and scientific culture among the masses through 21st century workforce which are to be moulded in schools and colleges.

2.2.1 Critical Reflection

The investigator reviewed twenty nine research studies including fifteen Indian and fourteen foreign studies that covers wide areas of science teaching and learning like; Constructivism in science education, integration of concept map and learning cycle in science, use of CAL in science teaching, International trends in science education and research, effect of SMART board on science learning, learning styles and its classroom applications, cultivation of values through teaching science etc. There were sixteen experimental, two qualitative survey type and others were review type researches. Researcher found some of the important connects for the present study such as, learning science is not merely memorizing factual knowledge, instead it require students to apply their scientific knowledge in solving daily life problems, teachers need to know and adopt different teaching styles as one style does not fit for every pupil (Saha, 2013), there is a positive relationship between science interest and probabilities of success in science at different aptitude levels (Chatterjee et al ,1978), logical thinking is an inherently human quality regardless of culture(Cobern ,1996).Further research on students' mental models, learning processes, and misconceptions have important implications for teachers who wish to model scientific reasoning in an effective fashion(Cakir ,2008). Constructivism has become a most valuable guideline for science education, for science teaching and learning as well as for research in these fields (Reinders, 1996). Further, Bell et al. (2010) found that collaborative inquiry learning is one of the most challenging and exciting ventures for

today's schools that provides a new and promising culture of teaching and learning into the classroom which enables students to work in groups, engage themselves in self-regulated learning activities under the supervision of a teacher. Moreover, Indian scientific developments are extremely unsatisfactory, lacking in both quality and quantity (Desiraju, 2008). There is a need for directed efforts to upgrade the overall standard of basic science education in the country (Inderpal et al, 2011). Researcher felt that the integrated approach to teach science has a wider scope in India. Review of related literature focused mainly on two types of studies namely status studies pertaining to teaching science at different levels and the other one is effectiveness of developed strategies/methods of teaching science. Though many studies are conducted for science teaching, verifying the effectiveness of teaching strategies, yet very few are aimed to inculcate values while teaching science but no study was found in teaching science to inculcate values though experiential learning. Therefore, the researcher felt a research gap which can be taken up at secondary level to teach science through value integrated experiential learning.

2.3.0 EXPERIENTIAL LEARNING IN SCIENCE TEACHING

Uma (2004) undertook a study entitled "Learning Science and Maths through Computers "with major objective, to understand the role of computers and technology in classroom teaching and learning processes. Shell India (Oil based MNC) has given access to its web site 'goshell' and lessons in subjects Mathematics and Sciences were made available for the students. Twelve students who passed V class and entering VI class were selected purposively. Outcome of the study were: students scored better in the second test and revision helps in improving scores. The performance of the students is better after the teacher revision.

Kavyakishore et al (2014) conducted a study entitled "Achievement in Science of Secondary School Students in Relation to Achievement Motivation" with objectives,(1) to study the difference in achievement in science of boys and girls of IX Standard,(2) to study the differences in achievement in science of boys and girls of IX standard students studying in different types of schools, (3)to study the achievement in Science of IX standard students in relation to their different levels of achievement motivation. Major Findings of the Study were: There is a significant difference in achievement in Science between IX standard boys and girls (t=50269) of Bangalore

city. There is a significant relationship between Achievement in Science and Achievement Motivation (r=0.473) among the students of IX standard studying in Bangalore city.

Selvam et al (2016) studied effectiveness of computer aided learning approach on academic achievement in chemistry and attitude towards learning science among secondary school students of Jawahar Navoday Vidyalayas. The objectives of the study was (1) to find the effect of computer aided learning approach on achievement in chemistry based on the comparison between 10^{th} standard students of JNVs (2) to study the difference among 10^{th} std students of JNV Mysuru in attitude towards learning science and academic achievement in chemistry based on their gender, locality, fathers education, fathers occupation, mothers education, mothers occupation and migration. The study was an experimental one in which two group design was employed and Science Attitude Scale (by Avinash Grewal, 1977) was used. Major findings were: The ICT mediated learning approach is significantly influencing on the learning of chemistry and attitude towards learning chemistry. The ICT mediated learning approach is having equal effect on rural and urban students of 10th standard in JNV Mysuru. The ICT mediated learning approach is having equal effect on learning chemistry among students who's belonging to various community groups of JNV Mysuru.

Sethi et al (2016) conducted a study namely "Attitude of the Students towards Science in Relation to Certain Non-school Factors." The objective of the Study was, to study the effect of gender on attitude of students towards science, to study the effect of locality on the attitude of student's science, to study the effect of socioeconomic status on the attitude of students towards science. Major findings were: Gender does not affect the attitude of students towards science. There is significant difference between the attitude of urban and rural students. Rural students have more favourable attitude towards science in comparison to urban students. There is no significant difference between the mean attitude scores of different socioeconomic status groups (high socioeconomic status, middle socioeconomic status does not affect the attitude of the students towards science.)

Chaudhari (2018) in his study entitled "Rejuvenating Teaching and Leaning of Science" observed that the main drawback of science teaching in our educational

institutions is that instead of striking a balance between content and method or product and process, we have been emphasizing all through these years the knowledge or 'product' aspect of science. The process' aspect has been relegated to background. This misplaced emphasis has equated study of science to a stamp collection of facts' and a 'game of getting an exact answer'. Our children and youth have become passive consumers of scientific facts and concepts evading the process of inquiry that is necessary to make them active investigators.

2.3.1 Critical Reflection

In review process of Experiential learning in Science education the researcher found four experimental researches and one conceptual research that are spread over diverse aspects of science learning like, use of CAL, attitude of students towards science, achievement in science with regard to achievement motivation, process- product aspect of teaching science etc. The three major strands that emerge out of the review is that there is a significant relationship between achievement in Science, achievement motivation and teaching style (Kavyakishore et al, 2014 & Cahudhary, 2018). The ICT mediated learning approach is significantly influencing on the learning of Science (Chemistry) and attitude towards learning Science (Selvam et al, 2016). Socioeconomic status of learner does not affect the attitude of the students towards science (Sethi et al, 2016). From the reviewed research literature, the researcher found that there has been a great concern for science teaching process and teaching learning in science.(Cahudhary, 2018).In teaching science, the ‘process ‘aspect is a misplaced priority which needs to be bridged as soon as possible so that teaching learning in science can be more productive.

2.4.0. VALUE EDUCATION IN SCIENCE TEACHING WITH REFERENCE TO EXPERIENTIAL LEARNING

Weinberg, *et al* (2011) studied the Effect of an Experiential Learning Program on Middle School Students' Motivation toward Mathematics and Science. Researcher adopted mixed method to evaluate the effects of experiential learning programs on the interest and motivation of middle school students towards Mathematics and Science. Theoretical framework comprised of the expectancy- value model, for the exploration of 336 middle school student participants. Several data collection tools including a

student interview guide, the Science and Mathematics Student Attitude Assessment Survey, and an Instructor Online Questionnaire were used. Major finding reveals that, participants were generally positive and had relatively high mathematics and science motivation i.e greater gains were realized in science than in mathematics. Remarkably students remained neutral about the perceived costs associated with being successful in science. Students interest in science increased, $z = 2.54$, $p = .01$; as did student perceptions of the usefulness of science, $t(332) = -2.59$, $p = .01$. Similarly the importance of science on how students define themselves and expectations for future success in science, the values of t and p were $t(331) = -2.05$, $p = .04$; and $t(154) = -2.39$, $p = .02$) respectively. Also it was found that any students enter summer programs with high motivation and subsequently experience increased motivation over the course of the program offer positive prospects for experiential learning.

Danhui et al (2012) studied the effectiveness of the Integrated Experiential Learning Curriculum (IELC) in China. The IELC curriculum was developed with an objective to engage Chinese elementary students in science with an aim to cultivate a scientifically literate society by focusing science instruction on practical applications of scientific knowledge. Salient features of the approach adopted are Science–Technology–Society instruction and scientific inquiry. The experimental group consisted of 7 teachers and 201 students group whereas the control consisted of 6 teachers and 184 students, of elementary teachers and students. Intervention programme was designed for one year period. In order to track teachers' attitude about teaching science and student attitude about science as well as student citizenship beliefs, a Pre- and post-measures were used. Ordinary least-squares regression analysis, t-test were used in the study. Major findings of the study were: the IELC has shown promise for improving teachers' attitudes about teaching science and their teaching quality. When considering student measures, the IELC (1) improved students' attitude towards science, (2) their citizen beliefs and (3) their attitudes about the learning environment.

Choudhary(2016) in his article named “Interdisciplinarity: Classical and Contemporary” critically examined that contemporary knowledge situation is marked by its vibrant and variegated nature, hybrid character and myriad interdisciplinary configurations. Frequent boundary – crossings, increasing mutualism of different

disciplines, teamwork and collaborative ventures, desire for integration and synthesis figure more prominently in the contemporary intellectual landscape than ever before. With the rise of information revolution and Interdisciplinarity, human knowledge can no longer be likened to a single unitary tree. Now it is like a gigantic banyan tree which is constantly embracing wider and newer fields. Different disciplines have now considerably common conceptual base, mutually shared horizons of interface and intersection, analogous method and approach, and often undistinguishable problematics. What is trending is the celebration of crossing disciplinary boundaries, accepting inputs from seemingly divergent domains and recognizing the need for a holistic perspective towards them.

U Hla Win(---) the researcher was the headmaster of the Padegaw village school of Irrewaddy delta in Myanmar. He observed that children were materially poor and morally rich. He used several methods to arouse curiosity of students. One such method was '***Think- Pair - Share'*** i.e look at a problem individually, share reflections with partner, then meet as a group to develop solutions and generate new ideas. His premise was to help children's natural urge to do things on their own. He made significant contribution for the conservation of the environment by planting 2000 trees and encouraged villagers to use efficient earthen stove to save fuel with the help of students. He also involved students to do farming in school and produced fresh vegetables and generated money for poor children through this endeavour.

2.4.1 Critical Reflection

The review of literature related to Value integrated experiential learning comprised of three experimental studies and one review study in four different domains reveals that experiential learning has profound impact on motivation in mathematics and science learning (Weinberg *et al,* 2011).Integrated Experiential Learning Curriculum (IELC) has profound influence on students' attitude towards science, their citizen beliefs and their attitudes about the learning environment **(**Danhui et al, 2012). Interdisciplinarity nature of science has made its study more fascinating and complex one (Choudhary, 2016). Activities like Think-Pair-Share expresses true nature of experiential learning that involves both teacher and students (U Hla Win, **---).**Except U Hla Win, three other studies remained silent about value inculcation while teaching science using

experiential learning as a method. Therefore, value integrated experiential learning deserves a right place in researcher's quest to teach science to standard IX CBSE students.

2.5.0 SYNTHESIS OF REVIEW OF RELATED LITERATURE

The investigator reviewed sixty two studies of which forty four studies were Indian studies and eighteen studies were foreign studies pertaining to value education, science teaching and experiential learning which are someway related to the present study. These studies were related to Constructivism in science education, HSTP lead learning by doing, integration of concept map and learning cycle in science, use of CAL in science teaching, International trends in science education and research, Effect of SMART board on science learning, learning styles and its classroom applications, attitude of students towards science, achievement in science with regard to achievement motivation, Values, Attitude, Moral Values, Social Values, Value orientation among Boys and Girls, Value pattern, Teacher moral, and attitude of teacher towards value education etc. Further there were four studies on experiential learning, twenty four studies were on value education, 28 studies were on teaching science and five studies were on value integrated experiential learning in science. Most of the studies conducted abroad are related to constructivism and science instructional strategies. The researcher divided the review in three major categories i.e (1) status study, effectiveness of developed programme in Value inculcation in teaching science (2) instruction/process skill developmental domain in Value education and teaching science (3) understanding and acquisition of concepts in science and values.

After critical evaluation of the studies with regard to value inculcation, the investigator made the following conclusion. Values like democracy, national integration, Secularism, Non Violence promote social cohesion and national unity. Also, it ensures reasonable quality of life for all during value crisis (Goswami, 1983). Neglect of affective domain in education, and missing of social values are the major cause of value crisis in society (Dubey, 1991). Old values are not shared by the present youth. Value education and character formation goes hand in hand as inseparable twins (Mundase, 2014). Therefore, values like "Equality, Co-operation,

Simplicity, Dignity of labour, Determination, Honesty, Common goal, Curiosity, Quest for knowledge, Discrimination, Discipline, Environmental ethics, Spirit of inquiry, Gratitude, Compassion, Flexibility, Tolerance, Loyalty to duty , Team work and Learning to live together" finds unique place in our day to day life that needs to be inculcated though teaching of science.

Similarly for teaching science, researcher concludes that learning science is not merely memorizing factual knowledge, instead it require students to apply their scientific knowledge in solving daily life problems (Mukherjee.2017). Teacher's need to know and adopt different teaching styles as one style does not fit for every pupil (Saha, 2013). Constructivism has become a most valuable guideline for science education for science teaching and learning as well as for research in these fields (Reinders**,** 1996). There is a need for directed efforts to upgrade the overall standard of basic science teaching-learning in the country (Inderpal, et al, 2011**)**.This necessitates the emergence of an effective constructive pedagogy called integrated experiential learning. It not only enhances science achievement, science skill of students but also make them morally rich (U Hla Win, year), students positive attitude towards science.(Danhui et al, 2012).

In terms of understanding and acquisition of concepts in Science and Values, the researcher observed from the reviewed literature that: There is a significant relationship between achievement in Science and achievement motivation among the students (Kavyakishore et al, 2014**).** The ICT mediated learning approaches are significantly effective in learning of science and making positive attitude towards science (Selvam et al, 2016). Integrated Experiential Learning Curriculum (IELC) has profound influence on students' attitude towards science, their citizen beliefs and their attitudes about the learning environment (Danhui etal ,2012). Further teaching science for sustainability is another area of concern which is not reflected in any of the reviewed literature. Sustainable habits like proactive environmental knowledge (Sarkar, 2015), Biodiversity conservation knowledge (Banu,2018), learning to live together etc are the key habits that needs to be inculcated among secondary school students. Therefore, it has created an opportunity for the researcher to innovate such ideas through teaching science with the help of Value Integrated Experiential Learning.

The investigator would like to add few critical comments on the studies. Though most of studies were based on Value education, experiential learning and for teaching science hardly any study was found having value inculcation as an objective by using experiential learning method and none of the study found having three objective together i.e Value education, Teaching science and Experiential learning.

2.6.0. IMPLICATIONS OF THE REVIEW OF RELATED LITERATURE FOR THE PRESENT STUDY

The review of sixty two research studies reveals that, most of the studies have concerned themselves with Science curriculum, its transaction (methodology of teaching), evaluation etc. A very few studies has been conducted on value integration during classroom transaction. The review of related literature also indicated that the post basic schools provided a better atmosphere in schools to inculcate moral, social and religious values as compared to ordinary schools and there is difference between urban adolescents and rural adolescents, college adolescents and school adolescents, and the male and female adolescents with respect to different types of values (Paul, 1986). Therefore, value inculcation is one of the major part of teaching science curriculum to students which is missing in today's scenario. The pedagogy of teaching learning in science offers open challenge to teachers involved in teaching profession. Because with changing times, the pedagogical change is taking place at a rapid pace. Hence, there is a need to shift towards new pedagogy in teaching of science called constructivist paradigm. Experiential learning is one of the important constructivist pedagogy. This has catapulted the researcher to undertake a study which not only makes science learning joyful but also enhance value base in students life and hence the culmination of Value Integrated Experiential Learning(ViEL).

There has been no study which has consisted of the three variables (Experiential *Learning* with *Value Education* through *Teaching Science* called as Value Integrated Experiential Learning in Science (*ViEL*). The review has helped the investigator to have a clear perspective of the problem chosen for the present investigation. The review of the related literature has enabled the researcher to formulate the relevant assumptions for the suitability of the present study on the basis of the following actions.

- Develop a better understanding of how school students learn science by experimenting.
- Develop ways of organizing the content of secondary school science (standard IX) for more effective learning.
- Develop materials and other resources for the teaching and learning of secondary school science (standard IX).
- Integrate experiential learning approach for better understanding of secondary school science especially in standard IX.
- Develop an understanding about values associated with school science and development of strategies for value practices through science education.

Moreover, the classroom's overwhelming emphasis on learning through telling and simple memorization overruns all considerations of empiricism, even the pedagogic utility of experiments. Ultimately, what is learnt in school is linked only to life within the boundaries of the school. It has little to do with the life outside (EVSF-2012; NCERT).

It was also observed from the review that the experiential learning approach in teaching science in CBSE schools of Navsari had not been tried out. It was also realized that Science curriculum transaction had not been approached from the perspective of value inculcation. The role of teachers also need to be adequately explored in relation to curriculum transaction through value integrated experiential learning as this does not appear to have received sufficient research attention.

The present study is much more relevant today as everyone in today's world are engrossed with multistage value crises in our society and the findings of the study would be of great help to the schools of Navsari, teaching community, State government and Central government for policy formulation point of view. Hence, the present study is an attempt to deal science teaching learning with the help of constructivism and experiential learning for the purpose of achievement in science along with the value inculcation.

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