CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCHES

2.1 Introduction

One of the important steps in research is carrying out review of related literature and studies. Various sources like research journals, books, dissertation, and thesis can be used to review the existing knowledge and plan research carefully. To build a strong theoretical base the researcher needs to be aware of not only of the researches conducted in his/her country but also about researches conducted abroad.

2.2 Purpose of Review of Researches

The review of related literature helps the researcher to get familiar with up to date information in the area of interest in general with the following specific purposes:

- It helps to avoid unintentional repetition of research that has previously been done.
- It helps to spot the gaps and incongruity in the literature.
- It provides information about the methodologies and approaches of other researchers.
- It helps the researcher to delimit and define the research problem.
- It guides in choosing research designs and tools of data collection.
- It helps to gain an idea about the statistical methods to be used for the study as well.

In the present study, researcher has made an attempt to review the studies related to following variables.

- Researches on Learning Environment
- Researches on Basic Science Process Skills
- Researches on Scientific Literacy
- Researches on Scientific Attitude
2.3 Researches related to Perception of Learning environment

2.3.1 Studies conducted abroad

Ahmad A. and Ameen N. (2016) studied the role of the learning environment in the development of Scientific Thinking in Saudi Arabia. It was found that boys of first level differed significantly than the final level in the choice of scientific thinking style; girls did not show such differences and development of scientific thinking had an influence of learning Environment. The learning environment had moderate impact on development of scientific thinking.

Ayla, C. (2016) investigated the relationship between constructivist learning Environment and students’ motivation to learn Science. It was observed that there exists a negative relationship between constructivist learning environment and the level of student’s motivation. Traditional learning environment and chances of finding relationship with science with their personal relevance proved to be more motivating to learn science.

Joaquin D. et. al. (2016) focused students’ views about the quality of teaching and learning environment available during laboratory work for unit Cell biology. It was found out that students perceived the learning environment in a positive manner for the said unit.

Marlies B., et. al. (2016) investigated student teachers' instructional preferences for learning environments and its relation with approaches to learning. It is observed that majority of prospective teachers show preference to the teacher directed, constructive and cooperative learning environment which favored deep approach of learning. Approaches to learning and instructional preferences had a significant relationship. Students preferring constructivist and cooperative learning environment practiced a deep approach whereas students preferring teacher directedness and passive learning exhibited surface learning.

Young, J. et. al. (2016) investigated students' reflections on the relationships between safe learning environments, learning challenge and positive experiences of learning in a
simulated clinic. Results demonstrated positive relationships between safe learning environments, learning challenge and powerful learning experiences.

Ado S. (2015) compared the effect of ideal and dull learning environment on the higher secondary students’ achievement in mathematics in Yobe State-Nigeria. A significant difference was found between the achievements. The students studying in ideal learning environment performed better as compared to the students learning in dull learning environment.

Yang, X., (2015) investigated rural junior secondary school students' perceptions of classroom learning environments and their attitude towards mathematics in west China. It is observed that students perceive mathematics classroom environment unfavorable and possess negative attitude towards mathematics. Mathematics classroom learning environments and attitudes towards mathematics is perceived differently at different grade level. There is also gender difference in the perception and attitude. For the scales of Student Cohesiveness, Cooperation, and Equity, female students were found to perceive more positively than male students. While for the Involvement and Investigation scale, male students were found to perceive more positively than female students. Junior students showed positive perception towards mathematics classroom environment as compared to senior students.

Plackle, I., et. al. (2014) conducted a study on students' preferred characteristic of learning environments in vocational secondary education. It was found that students expected teachers to challenge and promote them for active learning. Students expected teachers to provide appropriate learning structure and scaffolding for assessment of learning. It was found that, students did not favored reflective dialogues with other students and instructor.

Kang M., Im T., (2013) examined factors in learner–instructor interaction in the online learning environment. It is found out that components of student-teacher interaction contribute to positive perception of learning environment and satisfaction as compared to social interaction. But, it is found that social intimacy has negative association with Perceived Learning Environment and satisfaction.
Chang C. (2012) carried out a study on the impact of Science Museum Invoked Learning Environment (SMiLE) on students. During this research, effectiveness of an instructional module and difference between preferred and actual perceptions was assessed. It is observed that student’s achievement of expected SMiLE Inventory was better as compared to actual SMiLE inventory scores.

Santiboon T., et.al. (2012) assessed Science Students’ perceptions of learning activities in physics laboratory classrooms in Thailand. Student’s perception and attitude towards the physics laboratory were also determined. Students’ attitudes were assessed with the Test Of Physics-Related Attitude (TOPRA). It was found that students prefer more solidarity, liberty, assimilation, rule clarity, and improvised learning environment in their laboratories.

Rukavina S., et.al. (2012) surveyed scientific and mathematical literacy through active learning project. It is observed that the direct experiences, active learning, participatory learning, opportunities for application of acquired knowledge is more valued by students. It is also revealed that science and mathematics is learned better in an active learning environment. Active learning environment catalyses development of positive attitude towards the subject.

Walker J., Brooks D., and Baepler P. (2011) explored the relationship between the type of learning space and student perceptions of the learning experience by holding the pedagogic approach constant. It was found that some students resisted the use of technology assuming more burdens and the time spent on solving technical fault as wastage of time. It was also observed an active learning classroom positively contributes to the achievement, perception of the learning environment and changes in faculty - student conduct.

Jennings P. et.al. (2011) conducted a study on improving classroom learning environments by cultivating awareness and resilience in education (CARE). Participants found the program useful to improve classroom management and student teacher relationships. Many teachers reported improvements in their students’ conduct and academic achievement. It is found out that teachers became able to identify stress and
emotional tides and developed skills for self-management during their hectic working hours.

Ly R. and Malone J. (2010) studied teachers’ perceptions of geometry instruction and the learning environment. It is observed that geometry teachers considered the learning environment provided by them is satisfactory. They also opined that student’s assumption regarding difficulty level of work is wrong. Teachers believed that they positively influenced students’ perceptions and attitudes towards geometry learning. The use of posters in classrooms, permission of individual learning, positive and receptive climate for doubt clarification, guarantee about students acceptance, expectedness and reception into each class positively impacted on learning.

Wang, J.; Lin, S. (2009) evaluated constructivist science classroom learning environment at primary and Secondary school level with the which has four dimensions namely; attitude towards instruction, interaction, scientific inquiry, and understanding. Data revealed three major findings. Scientific inquiry was less common in science classes of primary and secondary school as compared with the other dimensions. The learning environment was rated weak in two dimensions namely interaction and understanding. These two dimensions have major influence on perception of learning environment.

Bernardo, A. et.al. (2008) investigated Students’ Perceptions of Science Classes. Results revealed that child-centered pedagogy, science inquiry activities, concern towards students and students’ attitudes, feedback in the form of grades, support for self-learning and efforts for it are the aspects of students’ perceptions relating to the learning environment. It was found that students’ perception of support for self-learning was enhanced but a reduction in science inquiry activities in the higher grades.

Hoang T. (2008) investigated effect of grade level, gender, and ethnicity on high school students’ perceptions of learning environment. It was found that boys had slightly more positive perceptions of classroom environment and favorable attitudes as compared to girls. A direct relationship was observed between students’ attitudes and the learning environment. The increase in scores of Student interrelatedness, inquiry approach, and Equity scores and decrease in scores of Teacher Support, Task Orientation, and Student
Self-Efficacy between Grades 9 and 10 were found. Anglo students’ consistently scored high as compared to Hispanic students’. Schaper, E. (2008) examined high and low achiever’s perceptions of learning environments in secondary mathematics classes. It is found out that teacher support, equity, student interrelatedness and task orientation was differently perceived by both groups. Both groups pointed out that it is apparent that teachers show more affiliation towards high scorers. Also the students following classroom rules and answering question properly gains more affiliation. Low achievers felt in difficulty in gaining attention and teachers support for learning needs as compared to high scorer. Low achievers also complained that large amount of classroom attention is unnecessarily directed towards admiring students for recalling previously known facts as compared to latest learning. Students preferred to work in self chosen groups. High achievers were better in naming and describing classroom processes, tasks, and expectations as compared to their counterparts.

So H. and Brush T. (2007) studied the relationship between the students’ perception towards collaborative learning, social presence and overall satisfaction in a blended learning environment. It was found out that student perceptions of collaborative learning have statistically positive relationships with perceptions of social presence and satisfaction. Collaborative learning environment creates more satisfaction as compared to the distance course. Similarly, students favoring collaborative learning liked social presence. No statistically significant relationship was observed between social presence and overall satisfaction though it was positively correlated. Student’s perception of collaborative learning, social presence, and satisfaction was influenced by course structure, emotional support given by teachers, and medium of instruction.

Broka P., et.al. (2006) surveyed the science students’ perceptions about classroom learning environments by using What Is Happening In this Class (WIHIC) questionnaire. It was observed that female students’ perception of learning environment was more positive than male students. Positive relationship was found between the number of ethnic groups in the classroom and their perception of Student solidarity.
Ng and Nguyen, (2006) conducted a research on everyday situation and practical work of physics teaching in Vietnamese high schools by combining together the instances of integration. This research revealed that the Vietnamese teachers give importance to both practical work and contextual approaches of teaching and learning process in physics. Teachers reflected that, the facilities that are provided in school does not give enough opportunities / chance to bring out the integration of everyday situation and practical work in teaching. They also mentioned that the school does not have laboratory and lab assistant facilities.

Telli S., Cakiroglu J., & Brok P. (2006) conducted a study on students’ perception of their classroom environment in biology. They investigated the relationships between perception and students attitude towards biology. The study also focused on finding out the differences in students’ attitude towards biology by gender, grade level, and parental education. Correlation and regression analyses showed that students understanding of their learning environment in biology are significantly associated with their attitude. Apart from that - the results of the study also showed that, there is a great difference between gender and grade level. 9th grade students have more positive attitude compared to 10th grade students and at the same time girls have more positive attitude compared to boys.

2.3.2 Studies conducted in India

Sasidharan P. (2015) investigated influence of instructional learning strategies and classroom environment on achievement and retention in Malayalam language of standard VII pupils. It was found that there was significant difference in the mean Achievement; total and Objective wise scores in Knowledge, Comprehension, Application, Synthesis and Evaluation for the Total sample. Boys, achieved more score in the Knowledge & Application objectives, whereas girls achieved more score in the objectives such as Knowledge, Comprehension, Application and Synthesis. The cooperative classroom noted more interaction among students as compared to the traditional classroom.

Bas G. (2006) studied the correlation between the perceptions of the constructivist science learning environment and academic achievement of primary students by using structural equation modeling. It was observed that students’ academic achievement has
positive correlation with personal relevance in relation to the constructivist learning environment.

Koul R. and Fisher D. (2006) investigated student-teacher interactions and science classroom learning environments in Jammu, India. The results of the study point that student’s perceptions differed in relation to their learning environment and teacher-student interactions which was influenced by students’ cultural background i.e. mother tongue. More positive perception was exhibited by Kashmiri students in regards to classroom environment and teacher interactions than the Hindi, Panjabi and Dogri groups.

Mondal, H. & Mehara V. (2005) examined effect of teacher centered instruction, fellow mentoring and perception towards learning environment on high school students. Experimental group students showed positive results in regard to retention and achievement as compared to students who followed traditional teaching.

Sunitha N. (2009) compared influence of Learning Environment of aided and unaided high schools on academic achievement. The school learning environment schedule consisted 10 components; goal orientation, study habits, cooperation, involvement of students, physical facilities in the school, teaching materials, teacher student interaction, equality, qualification of the teacher and method of teaching. There was a remarkable difference in teaching-learning environments of aided and unaided schools by students’ perceptions. It is observed that in spite of not having highly qualified teachers and unavailability of teaching materials as are available with aided schools, the unaided school students experience more positive learning environment in terms of physical facilities and teaching methodology.

Suchitra K. (2004) studied physical science Classroom learning environment and achievement of students. Classroom Learning Environment did not significantly contribute to achievement in Physics, Chemistry and Physical Science subject.

Kaur J. (1999) studied Learning environment in residential and non-residential schools and its impact on academic achievement, initiative, mannerism and co-operation of high school students. Diverse pattern of curricular activities were practiced by schools during
classroom instruction; especially in relation to content knowledge, teaching skills, assessment tools, learning resources.

2.4 Researches related to Science Process skills

2.4.1 Studies conducted abroad

Ceylan S. and Gulsah S. (2016) aimed to determine the influence of inquiry-based teaching approach on prospective science teachers. A positive influence of inquiry-based teaching approach was observed on self-efficacy perceptions and scientific process skills of prospective teachers.

Sukiniarti (2016) carried out a research to improve quality of science instruction at primary level. During this study active learning was promoted by using process skill approach. The results showed that 81% of teacher followed the process skill approach while their science instruction. 98% of teachers had an agreement that students gets encouragement for active learning due to use of the process skills. 97% of teacher noted that the student’s satisfaction and enthusiasm was apparent while using SPS approach. 31% of Teacher mentioned uncertainty of availability of resources in carrying out process skill approach. 77% of teacher agreed that it is difficult to implement the process skill approach in school and have some limitations to do so.

Bulent A. (2015) studied basic process skills, integrated process skills and overall science process skills of science teachers. The results showed teachers’ dissatisfaction in carrying out integrated process skills. Results showed difference in frequency of use of during in service training and actual classroom practice. No significant difference was found among three skills regarding teachers’ interest, frequency of usage and competency in teaching by using SPS skills. Female teachers demonstrated higher SPS skill as compared to male teachers.

Metin, D. (2015) studied dimensions of scientific process used by third graders to explain the concept of science. Through this qualitative research 46 codes under seven themes were identified which were used by the students to explain the concept of science. It was found out that the students mostly used the codes classified under the theme of scientific
process compared to cognitive, affective, characteristics, process, product and scientific field dimensions.

Omiko, A. (2015) investigated the levels of possession of Basic science process skills by final year Nigerian Certificate in Education (NCE) Students in colleges of Education. It was found out that possession of these skills is gender related and skills of observation, experiment and measurement were high compared to inference and communication skills.

Nejla, G. and Ziya, K. (2015) examined effect of scientific argumentation on the development of scientific process skills in the context of teaching chemistry. Differences in integrated scientific process skills which include designing experiments, forming data tables, drawing graphs, graph interpretation, determining the variables and hypothesizing, changing and controlling variables were studied. Two approaches were followed; use of scientific argumentation approach and traditional teaching approach in Grade 11. Prior approach was proved much better and effective compared to the later one.

Elif O. and Sukran U. (2015) conducted a case study in a school about the nature of science lessons, argumentation and scientific discussions among students in science classes. It was found that even high achievers in science classes have zero understanding of fundamental concepts about nature and science. The science teachers opined easiness in carrying out inquiry-based activities by use of information technologies.

Akar. O., et.al. (2015) investigated prospective secondary science teachers’ argumentation skills. It was observed that the teachers with scientific conceptions and misconceptions had different trends of argumentation skills.

Kruea-In C. et.al (2015) studied Thai In-Service and prospective Science Teachers’ understanding of science process skills. It was found that teachers’ understandings of each science process skill varied from low to high levels. The in-service teachers possessed more understanding as compared to the pre service teachers.

Lalor S. & Rainford (2014) assessed the effect of use of concept maps to improve students’ lower- and higher-order cognitive skills in biology. It was observed that students used concept maps in different ways and experienced positive engagement while using it. Concept maps proved to be helpful in learning of advanced level biology as
compared to the traditional classrooms. The students of experimental group showed better performance than their classmates in the control group on the lower-order and higher-order cognitive items of the biology test.

Zhai J., et.al; (2014) explored primary student’s images of doing science in school and how they compare themselves with scientists. It was apparent that majority student’s image of doing science is comprised of laboratory experiment execution, learning under the guidance and supervision of teacher, workbook completion and a social process. Several students assumed themselves as a scientist as they performed experiments. Many girl students disliked scientist assuming that scientists work alone and executes risky experiments; showed disobedient conduct and did not complete the workbook. Students did not recognize importance of predictions but observation, inquiry, recording, generating hypothesis was important for them to be scientist.

Hırça N. (2013) studied the Influence of Hands on Physics Experiments on Scientific Process Skills according to pre service Teachers’ Experiences and their academic achievement. There found a significant relationship between the planning of physics lab activities and physics laboratory skills of students. This study pointed out that there is no relationship between each SPS i.e. observation, provide explanations, predicting, forming logic, making an inquiry, producing according to a plan with students’ achievement in physics.

Pai D. (2013) conducted a study on the effectiveness of instructional package in science teaching competencies over teachers’ performance and their impact over students’ achievement and process skills in science. The instructional package and the related service training program on science teaching competencies was found effective in enhancing the knowledge based science teaching / cognitive competencies of teachers. It is observed that students from rural schools performed much better in Science Process skills compared to students from urban schools. Students from urban schools performed better than semi-urban schools. Whereas the control group result was not so positive in consideration to rural and semi – urban area. Development of Science Process skills in aided schools was above average, moderate in unaided schools and below average in government schools. No positive result was obtained in case of control group. The
discussion from school local-group on Development of Science Process Skills regarding experimental group showed no difference in the result obtained from urban, semi-urban and rural schools. A great relationship was found between achievement, process skills and attitude towards science.

Hapizan E., Halim L., and Meerah S., (2012) conducted a study on perception, conceptual knowledge and competency level of integrated science process skill towards planning a professional enhancement program of primary school teachers. The findings showed that contradiction in perception and reality. Many teachers perceived that they possess higher understanding of an integrated SPS; but in reality they had less conceptual knowledge. It was observed that teachers possess insufficient conceptual knowledge and understanding of integrated SPS for teaching students to comprehend it in a meaningful manner. Practically these teachers performed better but failed at theoretical level.

Oloyede, O. I. (2012) carried out correlational study between Acquisition of Science Process and achievement in science from Bauchi state, Nigeria. A positive relationship was observed between formal reasoning ability and acquisition of process skills, formal reasoning and chemistry achievement and acquisition of science process skill and chemistry achievement.

Ozgelen S., (2012) studied Turkish primary Students’ Science Process Skills within a Cognitive Domain. Significant differences were observed between sixth and seventh grade students SPS at private and public schools. Seventh grade students performed better than sixth grade students on SPS. Private school students performed better in SPS as compared to public schools. Private school students had higher scores in SPS compared to public and bussed school students.

Sahin F. and Benzer E., (2012) examined the four question strategy for the development of the scientific process skills of science teachers and elementary students. The sample chosen was 14 prospective teachers and 111 primary school students. Questions were related to the optimum use of resources available for laboratory experiments, procedure, changing the set of equipment to alter the action and ways to measure or describe the responses to the change. It observed that both teachers and students improved their
scientific process skills in a meaningful manner due to the use of four questions for project development.

Ozer D., and Ozkan M., (2012) studied the effect of the project based learning on the science process skills of the prospective science teachers. The findings revealed that there is no significant difference observed in the experimental and control groups in Science Process Skills. But, the improvements in the effort of selection of subjects and problems, providing tools, use of method knowledge, preparing presentations, self confidence in presentations and effective communication was observed. It was also observed that, with the project based learning, the skill of estimation of the prospective teachers have not improved at all. There was no significant difference in making observation, classification, estimation, forming and testing hypothesis, designing experiments, measurement, numerical and spatial association, recording data, interpreting data and deducting, determining and altering variables between control and experimental group

Ari E. and Bayram H. (2011) investigated the influence of constructivist approach and learning styles on achievement and science process skills. It is found that if the students learning style and teaching approach matches, it helps in development of science process skills.

Cotabish A., et.al. (2011) studied the effects of professional development program on primary teachers' science process skills. The group receiving treatment showed development in SPS skills, science concept and scientific knowledge.

Ergul R., et.al. (2011) studied the effects of inquiry-based science teaching on elementary school students’ science process skills and attitude towards science. The data were collected through using BAPS Test, Integrated Science Process Skill Test and Science Attitude Scale. A significant improvement was observed by using inquiry based teaching methods on students’ science process skills and integrated process skills and attitude towards science in experimental group.

Duran M., et.al. (2011) studied the relationship between the pre-service science teachers’ scientific process skills and learning styles of students. It was found that the teachers with separating and internalizing learning styles have higher SPS scores as compared to
teachers having changing learning styles. The students with separating learning style showed better acquisition of SPS than the students with changing learning styles.

Akai E., et.al. (2010) compared development of science process skills and academic achievement by using problem solving method and traditional teaching. Both problem solving and traditional teaching methods positively contributed to the students’ achievement. But, problem solving method proved to be more useful than traditional teaching methods in developing science process skills of students.

Akinbobola A., Afolabi F. (2010) analyzed Science Process Skills in West African Senior Secondary School Certificate Physics Practical Examinations for a period of 10 years (1998-2007). The 5 prominent science process skills identified in the study are: manipulating (17%), calculating (14%), recording (14%), observing (12%) and communicating (11%). The student’s acquisition of basic process skills was found to be better than the integrated process skills.

Duran M. and Ozdemir O. (2010) examined the effects of scientific process skills-based learning approach. The study revealed that scientific process skills based learning approach positively contributes to the development of Science process skills; but, is ineffective in developing positive attitudes towards science.

Donmez F. And Azizoglu N. (2010) compared the students’ science process skill levels among five different kind (Girls, Industry, Health, Religious High School, and Technical Training) of schools. It was found that Science process skills of students of different schools differed significantly. The students of Health school possessed better science process skill as compared to the remaining schools. There was significant difference in the acquisition of science process skill among boys and girls. Girls showed more SPS skills as compared to boys.

Mbewe S., et.al (2010) studied primary pre-service teachers' familiarity, interest, and conceptual understanding of science process skills. It was found out that despite teachers being highly familiar and interested in science process skills; had poor conceptual understanding of the science process skills. The teachers possessed incorrect definition or had nil idea. Most teachers had confusion in the concept of measuring &
quantification; predicting & inferring. It was also found that teachers could not explain different science process skills satisfactorily.

Ozturk N., et.al. (2010), evaluated science process skills levels of seventh grade students in science and technology lesson. It was found that students basic science process skill were high as compared to integrated science process skills. There is no significant difference was observed between female and male students. The students’ science process skill increase with Parental academic background, economic status. The facility of personal room and technological facilities were in direct proportion to acquisition of science process skills.

Fah L., Lee J., and Hoon K. (2009) studied the relationships among integrated science process skills, logical thinking abilities, and science achievement among rural students of Sabah, Malaysia. In this study, instruments namely Integrated Science Process Skills Test (ISPST), Group Assessment of Logical Thinking Abilities (GALT), and Science Achievement Test (SAT) were used. It was found that girl students were higher in the acquisition of integrated science process skills and science achievement. No significant difference was observed in possessing logical thinking abilities between male and female students. Positively moderate and significant correlation among rural secondary students’ integrated science process skills, logical thinking abilities, and science achievement was found out.

Keil C. Haney J., Zoffel J., (2009) studied improvements in student achievement and science process skills using environmental health science problem-based learning curricula project. It was teacher professional development program prepared for middle grade teachers to design and implement integrative, problem based, environmental health curricula with over 1600 students. Increased Science Process skills and achievement was observed due to this project.

Feyzioglu B. (2009) investigated relationship between science process skills & efficient laboratory use with achievement in chemistry of university students’. It was found that there is a positive relationship between science process skills taught in laboratory applications and efficient laboratory use of the students, between their efficient laboratory use and their achievement in the course, and between their science process skills and
achievement in the course. All above three variables have linear and positive relationship among them.

Kanli U., Yagbasan R., (2008) studied the effects of a laboratory approaches on the development of university students’ science process skills and conceptual achievement at the university in Turkey. Laboratory approach was found to be more useful than the traditional laboratory approach to develop students’ science process skills.

Nyakan P. (2008) studied the influence of science process skills on students' gender disparity in performance, perception to enrolment and attitude to secondary school physics. The relationship between the instructional approach and the students' attitude towards physics subject was also examined. Results indicated that science process skill instructional approach improved performance in physics. Boys had better performance as compared to girls.

Mei G., et.al. (2007) conducted a study on promoting science process skills and the relevance of science through ‘Science Alive!’ for secondary school students. In this program, teachers designed four modules covering different topics from Biology, Chemistry and Physics. Students were allowed to choose any one module out of four: Aroma Chemistry, Biodiversity, Life Science and Water Rockets. In this program, content was delivered giving first hand experiences such as laboratory work, field trips, journal writing and group discussions etc. to increase student engagement. It was observed that the program enhanced students’ acquisition of Science process skills.

Bilgin I., (2006), investigated the effects of hands-on activities incorporating a cooperative learning approach on eight grade students’ science process skills and attitudes toward science from an urban area of Bolu. The experimental group was exposed to the active learning strategy whereas the control group was taught by using teacher centered method. According to the findings; hands-on activities incorporating cooperative learning approach positively enhances Science process skills as compared to teacher centered approach.

Myers E., (2006) studied science process skills of students in a general physics classroom. For this, specially devised curriculum based on the topics which have the scope for observation, inference, levels of truth, scientific method, and graphing were
selected and implemented by the researcher. Then the students were asked to develop and execute a laboratory experiment by themselves. It was observed that student’s knowledge and application of science process skills slightly enhanced in the test scores.

Temiz B., Tan M., (2006) developed and validated a multiple format test of science process skills. Data revealed that student scores were very low on all SPS except for the skills involving the manipulation and classification of materials. It was concluded that the students need to have knowledge of science subject in order to attempt the MFT-SPS test. Students also need to use logical thinking and research skills.

Rambuda A., Fraser W. (2004) studied perceptions of teachers about the application of science process skills in the teaching of geography in secondary schools in the Free State province. The research revealed that according to the perception of Geography teachers, a very clear distinction can be drawn between the basic science process skills and the more advanced integrated science process skills while teaching of geography. It was also found that though the teachers know the value of the Integrated Science process skills, they do not place emphasis on it.

Letsholo D. (2008) investigated whether primary school teachers use process skills in their teaching of science and pupils demonstrates the acquisition of certain process skills as they tackled various tasks. The results of the study showed that pupils from lower classes used more science process skills than the pupils from upper classes. The results also showed that teachers adopted the traditional chalk and talk method. The study also showed there was less provision of references and learning material that emphasizes process skills in upper classes.

2.4.2 Study Conducted In India

Hassan, T. (2016) compared students’ understanding of process skills across three grade levels and gender. The study aimed to assess the science process skills of students from grades 8, 10, and 12th. It was found out that the students do not have clear idea of process skills. It was observed that students integrated process skills were low. Also, the laboratory related skills were very poor.
2.5 Researches related to Scientific Literacy

2.5.1 Studies Conducted abroad

Yuenyong C. (2016) conducted an assessment study for enhancing scientific literacy in Thailand. Students' scientific literacy was assessed after every three years since 2000 to 2009 in the program for International Student Assessment (PISA). The results were disappointing as students’ performance over scientific literacy declined over the period and were below average.

Canay P. and Serkan Y. (2015) explored the influence of nature of science (NOS) activities based on explicit-reflective and historical approach on prospective elementary teachers' views of NOS aspects. It was found that students with exposure of explicit-reflective instruction showed significant improvement in the views of NOS aspects.

Hacieminoglu E. (2015) investigated student-and school-level factors helping to explain the difference in the nature of science (NOS) views. It was observed that physical infrastructure of schools and the educational resources in schools, parent educational levels, student achievement, self-efficacy, experience of meaningful learning, and learning goal orientation has positive relationship to different dimensions of student NOS views. Whereas performance goal orientation and rote learning approaches were negatively correlated with different dimensions of student NOS views.

Komek, E.; et al. (2015) investigated scientific literacy levels relevant to science and technology classes among gifted students. It was observed students scientific literacy levels were developed due to active participation in the enrichment activities giftedness and was not purely dependent on the giftedness of the student. Even some normal students showed higher scientific literacy levels that attended formal education than gifted students.

Krell, M. et.al. (2015) investigated the effect of Science, Technology, Engineering and Mathematics (STEM) curriculum on prospective teachers' Nature of Science views. The prospective teachers clearly stated views regarding nature and history of science, and conducted scientific inquiries independently. It was found that explicit approaches are effective to foster an informed understanding of NOS.
Genci M., (2015) studied the effect of scientific studies on students' scientific literacy and attitude towards science course. There is a significant increase in the students' scientific literacy level was observed and their attitudes towards science were more positive. There was no significant difference in case of gender and class level of the students for the levels of Scientific Literacy. Posttest scores were higher than pre test scores.

Fuselier, Linda; et.al (2015) examined interdisciplinary collaboration during teaching scientific literacy in an introductory women's studies course. Researchers found out three themes; challenges posed by disciplinary differences, creation of a space for interdisciplinary work, and evidence of boundary crossing. Student understanding of science content was enhanced by the participation of a woman scientist in the learning module. Use of a feminist science studies framework was successful at helping students to learn about the tentative nature of scientific conclusions.

Kuay-Keng Y. et.al. (2016) explored relationship between elementary students' scientific creativity and science inquiry. Convergent and divergent creativity was found to be significantly correlated with open-ended inquiry and multiple-choice inquiry test. It was found that the 3rd graders' performed low on scientific creativity and science inquiry as compared to 4th, 5th, and 6th graders.

Hamza A. Ahmet S. (2013) aimed to compare scientific literacy level of teacher of two universities. (Marmara University and East Mediterranean University), Data collection tools included a scientific literacy survey, both developed by researchers. Results reflected that the scientific literacy level of teacher candidates at Marmara University is relatively higher than those in Eastern Mediterranean University.

Lin, H. and et.al (2012) explored the role of emotional factors in building public scientific literacy and engagement with science. It was found out that emotional factors like interest, enjoyment, and engagement in science learning are significantly correlated with scientific Literacy. It was also found television has been proved to be better tool to involve adults in learning science.

Gucluer, E. and Kesercioglu, T.(2012) examined the effect of the use of scientific literacy development activities on students' achievement. It is observed that scientific literacy
development activities positively contribute to the academic achievement as compared to science and technology curriculum exposure.

Poluakan, C. (2012) conducted a research to determine the effects of high scientific literacy, self-efficacy, and achievement motivation on teachers' ability to compose effective tests among junior high school science teachers in Manado, Indonesia. The results showed positive influences of high scientific literacy on achievement motivation, self-efficacy on achievement motivation, high scientific literacy on teachers' ability to make tests and achievement motivation on teachers' ability to make tests.

Sarkar, M. and Corrigan, D. (2012) studied Bangladeshi Teachers' Perspectives, Practices and Challenges about scientific Literacy. Data revealed that participant’s higher perspectives of possessing scientific literacy. Actually, teachers were not highly capable bring it into practice during classroom teaching. Teachers were highly engaged in promotion of a academic science culture which develops scientifically literate students.

Koseoglu F. and Erdogan., (2012) analyzed 9th grade Physics, Chemistry and Biology Curriculums in the context of Scientific Literacy Themes. It is observed that Curriculums emphasized knowledge of science, the exploratory nature of science and interactions of science, technology and society very well. But, science as a way thinking theme was very less emphasized.

Farrar C. (2012) examined the effect of engagement in science journalism activities on scientific literacy among high school students. It is observed that experts asserted requirement of both- conceptual understanding and life experiences to formulate science related answers. Experts showed awareness of scientific factual inaccuracies, sources of information and targeted strategies for information seeking. But, Students were likely to close the eyes to factual inaccuracies, source credibility. The student suggested information seeking strategies were fruitless. Like experts, students mentioned both scientific and societal contexts during the discussion.

Soobord R. and Rannikame M., (2011) studied student's level of scientific literacy using interdisciplinary scenarios in the areas of problem solving and decision making. Results indicated that majority of the students had functional level scientific Literacy and very few students were at the multidimensional level. Students' enjoyed personal and social
context situations during problem solving. Students showed problems solving and decisions making ability by employing science knowledge and skills in various situations. In general, students hold functional level literacy as pointed out by their responses.

Impey C., et.al. (2011) carried out survey on science literacy among college undergraduates. It was found that belief in pseudoscience was high. Analysis could not detect any component which could predict of science literacy. Over the period of 10 years (1988-2008) no noticeable improvement was seen in undergraduate student’s scientific literacy.

Foster J. and Rolle N. (2011) conducted a research to build scientific literacy through summer science camps: a strategy for design, implementation and assessment in the rural international community. Findings suggested that short-term outreach activities (outdoor activities supported by lectures regarding flora and fauna of local environment, impact of fishing on the ecosystem, role of mangroves on health etc.) contributed to development of scientific literacy and career aspirations of the participants.

Sherkat D. (2011) examined relationship between religion and scientific literacy in the United States. Analyses showed that the fundamentalist (people believing in religion) possessed lower scientific Literacy as compared to secular people. It was also found out that belief in religion is stronger factor than gender, race, or income in deterring Scientific Literacy. Religious beliefs are negatively correlated to scientific Literacy and predict science achievement to a greater extent.

Ozdem Y., et.al. (2010) investigated Students’ Scientific Literacy Levels of the upper elementary grades (6th, 7th and 8th grades). It was found that though 8th graders were not proficient in items related to nature of Science; possessed high level of scientific Literacy as compared to 6th and 7th grade students.

Pongsophon P., et.al (2010) investigated promotion of scientific literacy on global warming by process drama of secondary students. It was found that process drama is a helpful strategy in promoting scientific perception of terms related to global warming and conceptual understanding of the causes, processes, and consequences of global warming after the workshop.
Oluwatelure T., (2010) studied effect of learning environments on development of scientific literacy. Results indicated that teacher’s perception of learning environment was different for different schools. It was observed that teachers association of school had an influence on the knowledge about optimum, average and poor learning environment and creativity in using locally available resources for teaching. The level of scientific Literacy was a significantly correlated with classroom learning environments which was dependent on school type. Old mission schools and government schools were better than the schools established 1970 and run by state government schools followed by the schools established in late 1980 with the aim of free and compulsory education and run by community.

Ste-fanova Y., et.al. (2010) investigated problems of science education in Bulgarian school. It was found that teachers were careless to establish conducive learning environment. Therefore students were not successful in active application of acquired knowledge, use of apt scientific processes while performing complicated tasks. The development of scientific literacy was not cautiously planned during teaching and learning process.

Ozdemir O. (2010) studied prospective science and technology teachers’ Scientific Literacy. The result showed that the teachers possessed medium level “knowledge and internalization”. Maximum prospective teachers had doubtful attitudes towards: the reliability of science, place & importance of science in life. Very few teachers followed the programs, read articles with scientific content, and participated in scientific and technological activities in the school.

Dani D. (2009) examined the congruence of eight private school teachers’ purposes for teaching science, and aspects of scientific literacy. All teachers cited purposes for teaching science as having interaction of science & technology with society; explore nature of science. Only three teachers mentioned purposes of teaching science is parallel to science as a way of knowing features of scientific literacy.

Evans R. and Leonie J. (2009) promoted understanding of, and teaching about, Scientific Literacy in Primary Schools. This research found that all participants possessed some understanding about scientific literacy although often they were not sure about it. By
teaching more science, teachers gave their students more opportunities to practice scientific literacy capabilities. Professional Development program helped teachers to apply the skills of scientific literacy (investigating and science communication) during science lessons, and covered science in daily life with some level to competence. The skills of decision making, skepticism, inquiry were developed to less extent.

The NAEP assessment results showed approximately only half students exhibited proficiency in Science. 21% of 12th graders performed at or above proficient levels. 34% of 4th graders and 30% of 8th grade students perform at or above proficient levels. Only 1% of students scored at advanced levels. In California, the results of the NAEP testing were particularly grim. The average score of 4th grade students in California was 136, lower than those in 43 states. By comparison, the average score for public school students nationally was 149. Just 22% of students scored at the proficient level and 42% scored below levels demonstrating a basic understanding of science. Latino and African-American students scored at significantly lower levels than White and Asian students.

Psalidas A., et.al. (2008) investigated the extent of PISA Science items to assess the knowledge and skills of 15 year-old Greek students. In this study the researcher examined the effect of gender, scientific processes and contexts (situations) on the students’ achievement in the PISA items. It was found out that the achievement in PISA Science items was likely to be independent of the student’s gender and depended on the context in which the knowledge and processes were assessed. Additionally, the relationship between the students’ performance and the factor of scientific processes seemed to depended on the learning environment available.

Coll R. and Mark C. (2008) investigated scientists’ views of scientific evidence and how scientists judge evidence claims. The first study was concerned with scientists’ views of what constitutes superstitious beliefs. The second was concerned potential conflicts between scientific theories and evidence, and religious beliefs. The research findings suggested that scientists, unlike their stereotype, hold particular views of what constitutes good scientific evidence & sound, credible testimony and scientists are rather more open to alternative thinking than might be supposed.
Coll R. and Mark C. (2008) examined scientists’ views of scientific evidence and how scientists judge evidence claims. There were two studies; the first study was based upon about scientists’ views of comprises superstitious beliefs. The second was based upon possible conflicts between scientific theories and evidence, and religious beliefs. It was found out that scientists had their firm standpoint to give recognition to scientific evidence & sound, credible testimony. Scientists were found more open to alternative thinking than assumed.

Erbaş, Kadir and Can M.,(2005) studied the factors related to scientific literacy of 15-year old students in Turkey in the Program for International Student Assessment (PISA). Two groups of variables were considered for the analyses. It was found out that factors such as teacher-taught relation, owning many books, exposure to preschool education, use of internet and basic computer skills positively contributes to scientific literacy. Student feeling of loneliness had negative impact on literacy skills. Attitude towards school was improved due to remedial classes held by schools and home assignments, but had null effect on development of scientific literacy skills of the students. Family background had direct relation with the scientific literacy. Scientific literacy had negative relationship r use of software programs and advanced computer skills.

Eijck M. and Roth W. (2007) conducted a study on rethinking the role of information technology-based research tools in students’ development of Scientific Literacy. It was observed that there were no significant differences between actual and preferred forms on the dimensions of Participation, Independence, Investigation, and Differentiation. The overall positive attitude toward the described physics classroom was highlighted by the essay-type evaluation of the classroom environment.

Nwagbo, C. (2006) studied the effectiveness of the guided inquiry and the expository teaching methods on the achievement in and attitude to biology of students of different levels of scientific literacy from secondary schools in Nsukka, Nigeria. The results showed that the guided inquiry method was significantly better than the expository method in enhancing cognitive achievement in biology for students of all levels of scientific literacy, especially the high ones.
Culliton B. (1989) in the study entitled “Dismal State of Scientific Literacy” found that only 6% of Americans and 7% of British meet standard for science literacy.

2.6 Researches related to Scientific Attitude

2.6.1 Studies conducted abroad

Baruch. Y.et.al. (2016) studied the pre-schooler's verbal expressions and behavioral responses as indicators of curiosity and attitudes toward science. It was found out that pre-schoolers used symbolic expressions to express various emotions. There was positive relationship between positive emotion expression and willingness to participate in sensory motor activities during a scientific activity were identified. Girls were more likely to express curiosity and positive attitudes toward science than boys in the context of this study.

Jho, H. et.al (2014) investigated the relationship of science knowledge, attitude and decision making on socio-scientific issues. A significant improvement is seen students understandings of science knowledge, attitude towards science and decision making on certain issues. A linear relationship between attitude and decision making was observed. No such relationship was observed in case of science knowledge and decision making.

Thomm E. and Bromme R. (2012) studied relationship between scientific Literacy and scientific attitude of common people. It was observed there is contradiction in people beliefs, talks and their actual behavior. It was also concluded that mere encouragement of scientific literacy will fail to imbibe scientific views in people; and needs special attention automatically. The acquisition of scientific literacy does not assure the practice of the same in common people day to day lives.

Saini A. (2011) studied impact of scientific attitude, event awareness and science popularization Attitude upon self concept of teacher trainees. Result revealed that Scientific Attitude is the strongest predictor of self concept among teacher trainees. The Combined effect of Scientific Attitude and Scientific Popularization Attitude of Teacher Trainees did not affect their perceived self concept, social self concept and ideal self concept.
Forbes, C. (2011) conducted a study on prospective primary teachers' adaptation of science curriculum materials for inquiry-based elementary science. It was found that prospective teachers adapted science curriculum resources so as to teach students using inquiry. It was resulted that the pre service teachers consistently attended inquiry in their curricular adaptations.

Hadzigeorgiou et.al. (2010) investigated the effect of feature film in promoting scientific inquiry of the higher secondary students of southern Greece from rural area. The plot of film was based on the wireless transmission of electrical energy. It was observed that film proved motivated real learning and improved attitudes towards physics.

Fidelis O. (2010) conducted a study on enhancing scientific attitudes through activity-based approaches of secondary schools. The attitudes considered were critical-mindedness, positive approach to failure, objectivity and honesty. The activity-based approaches proved to be effective in developing student’s scientific attitudes. Guided discovery approach was the best strategy. No significant interaction effect was observed between gender and activity-based approaches. There was no significant difference among students taught using demonstration, project and guided discovery approaches in their objectivity critical-mindedness, honesty and positive approach to failure. The result indicates that the three approaches: demonstration, project and guided discovery, significantly enhanced the cultivation of positive approach to failure, objectivity and honesty in the subjects. It was also revealed that gender has a significant effect in enhancing only critical mindedness in students. The interaction of activity-based approaches and gender has no significant effect in enhancing student’s scientific attitudes.

2.6.2 Studies conducted in India

Garg A. (2014) analyzed scientific attitude of high & low academic achievers of secondary school students. The scientific attitude of high and low achievers for Curiosity, open mindedness & faith in scientific attitude dimension shows that high and low achievers differ significantly on these dimension where as there is no such difference on other dimensions of the scale. The high achievers hold more scientific attitude than low
achievers. The Scientific attitude of boys and girls for the curiosity, open mindedness & faith in scientific attitude shows that boys and girls differ significantly on these dimension where as there is no such difference on other dimensions of the scale. Boys hold more scientific attitude than boys.

Ahmad J. (2008) in a study ‘Scientific Attitude : solution to all problems’ concluded that Scientific attitude is solution to all international problem, corruptions terrorisms, crime, theft, fake encounters, borders issues, water issues, and all other problems of national and international jewels to solve them peacefully.

Demirbas M, and Yagbasan R. (2006) studied effect of social learning theory based scientific attitudes on academic success, gender and socio-economical level among primary school students. Students’ scientific attitude was enhanced due educational activities based on social learning theory. Academic achievement was proved to be important while evaluating scientific attitudes.

2.7 Gaps

The researcher is aware that present review is not exhaustive. But this review has helped to get an idea of studies conducted till now in the field of Learning environment, science process skills, scientific Literacy and scientific Attitude.

The review of related literature has helped to get an insight into the methodology, tools, approaches used by other researchers and to study the contribution of the researchers. It has helped the researcher to decide on the procedure and tools that need to be used for the present study. The review of related literature and researches has helped to develop understanding the various issues related to the problem.

The review has identified the following gaps:

- Glance at the studies shows that Perception of learning environment is studied from various angles. Studies are carried out regarding factors contributing to better perception of learning environment or students’ disliked components of learning environment. Some studies are based on teacher’s perception of learning environment. Some studies are based on the relation between PLE and
achievement, motivation, infrastructure, instructional strategy, teacher competency. Some studies are conducted in relation to levels of BAPS & achievement. Few studies are conducted based on effect of innovative teaching strategy on acquisition of SPS. Some studies are carried out on finding the relation between components of SA like reasoning, creativity, problem solving, and logical thinking.

- Researchers have studied scientific Literacy to determine its levels and relation with educational level and specialization of subject. Very few studies are carried out to see the difference in proficiency in Scientific Literacy on the basis of age and gender. Some studies have focused on relationship of SL and perception of Learning Environment. But, researcher could not find any study concerning correlation between SL, SPS, and SA.

- Researchers have studied Scientific Attitude in relation with Motivation, creativity, personality and innovative teaching strategy, Scientific Literacy and Science Process Skills. The researcher could not found a study about the relation or effect of learning environment on development of scientific attitude.

From the number of studies reviewed, it is evident that researchers have studied learning environment, science process skills, scientific Literacy and scientific Attitude separately in relation to some variables. But nobody has taken up a holistic study of analyzing influence of learning environment, science process skills and scientific Literacy on the development of scientific Attitude. This was a research gap found.