CHAPTER II

REVIEW OF RELATED LITERATURE

2.0 Introduction

Research is a co-operative effort carried out by individuals to enrich the existing fund of knowledge. Review of research work carried out by others in the forms of articles, abstracts, books, research reports, dissertations and electronic media helps the researcher to view own study in the mirror of reality. Reviews provide the framework of the studies already conducted in the area of the study, which in turn helps the researcher to visualize the research work in all possible dimensions. It provides the understanding and insights necessary to develop a logical framework for the present study. The design, methodology and procedure adopted in the research work of other researchers endows with a feeling of what the actual field could be. Reviews help to bring clarity in an individuals' research work. Critical review of the related literature facilitates a researcher to avoid duplication and indicate one's contribution to fund of existing knowledge. It facilitates to discover the research trend in the area of study.

The review of related literature forms an important aspect of any research work. It helps in avoiding the ambiguity and brings clarity in stating the objectives and structuring the methodology. The tools and analysis techniques used in the reviewed research work assist the researcher to choose the appropriate statistical computation for the present study. Hence, review of related literature provides inputs to strengthen the present study and endow with a strong rationale for the present study.

2.1 Review of studies

A total of 46 studies in 3 sections were reviewed. Among them seventeen studies were carried on development and implementation of instructional packages, ten studies were carried on teaching-learning of different subjects, and ninteen studies were conducted on constructivist approach in different subjects.

The studies reviewed have been classified as follows:

- Studies on development and implementation of instructional packages
- Studies on teaching-learning of different subjects
- Studies on constructivist approach in different subjects

2.1.1 Studies on Development and Implementation of Instructional Packages.

Total 17 studies conducted in the fields of development and implementation of instructional packages were reviewed for the present study.

Linda, J. and Jones, M. (1991) studied on **beliefs of science teacher and their influence on curriculum implementation**: Two case studies were done. Curriculum implementation was explored by the influence of teacher's beliefs in two different contexts. Two teachers teaching at Middle-level implemented a 20-lesson curriculum package with participant observers. Field notes and interview transcripts were used as data sources. Tentative assertions were developed daily from the reviewed data. Weekly examination of assertions and their accompanying evidence was done. Then case studies of each teacher of the belief structures were prepared. Curriculum implementation was influenced by four major categories of beliefs, in both cases. These emphasized on beliefs of learning pattern of students, a teacher's role in the classroom, the ability levels of students in a particular age group, and the influence of topics to be taught. Conclusion of both teachers was that the most important was factual knowledge outcome of each student, that middle-grade students learning can be enhanced by repeated drill and practice, and they need a great deal of direction, beliefs about a teacher's role in the classroom and regarding the curriculum and its content topics were also the major concern of the study. The success of curriculum implementation was enhanced by both teachers' belief structures; overall successful implementation was achieved by the incongruent underlying philosophy of the existing belief structures by both the teachers.

Karandikar, C. (1996) conducted a study on **Evolving a video-instructional package and studying its effectiveness to teach balanced diet to the students of standard VIIin terms of student's achievement**. Junior Index of Motivation Scale, Socio-Economic States (SES) Scale, Anxiety Scale, Achievement Test were the tools used in the study. Sampling was Purposively done. Design employed to this study was

control group post-test only. Analysis of variance statistics was used for data analysis. The study concluded that video instructional package was found effective and there was a significant difference found between mean achievement scores of high SES and low SES group of students studied through video instructional package.

Hewson, G.(2003)conducted a study on **learning science by using students' prior knowledge and conceptual change strategies effects of instruction on science learning.** Students' learning is greatly affected by their existing knowledge prior to instruction in learning science. It provides an indication of the alternative conceptions as well as the scientific conceptions possessed by the students. To determine the effectiveness of Students' alternative conceptions and instructional strategies on learning scientific conceptions was the objective of the study; Students of black high school in South Africa were the population of the study. The instructional strategy and materials were developed using their previously identified prior knowledge and incorporated the principles for conceptual change. Mass, volume, and density were the involved concepts. Special instructional strategy and materials were used to teach to the students of experimental group. And traditional strategy and materials were used for teaching control group. The change in understanding concepts were checked statistically by Pre- and post-tests. An effective improvement in acquiring the concepts in science was found with the use of the instructional strategy and materials used for teaching to student alternative conceptions.

Sharma, R. (2004) developed and implemented a strategy for standard III and IV for teaching environmental science in multi grade. The study was based on the following objectives: Identifying the problems occurred at administrative and pedagogical levels in multi grade teaching and developing and studying the impact of a strategy in teaching with respect to students academic achievement, competencies acquired, Comparing the achievement of schools and studying the teachers reaction and perception regarding workshop. 20 schools of Dabhoi Taluka in Gujarat were selected as a sample by cluster sampling technique. Tools used for the study were: Questionnaire for situational analysis, Teachers Semi structured interview, observation of classroom. To determine achievement of the students, Achievement test was prepared and Semi structured interview data sheet was made. Data was collected in three phases: a) pre intervention phase b) intervention phase and c) post

intervention phase. Data was analyzed statistically analysis of data was done using statistical techniques of Mean, Median, Mode, Percentile, Standard deviation, Skewness and Kurtosis. To test the null hypothesis ANOVA was computed. Major findings of the study were 1) the package was found effective wherein 97% of the students mastered items which were found difficult. 2) Overall majority of the students improved in academic stream and all of the teachers agreed regarding the information about environment in multi grade teaching.

Romould, J. (2006)developed an Enneagram Educational Program for student-teachers to enhance emotional intelligence. This study dealt with development and implemention of an Enneagram Educational Program made for student-teachers and assessing its effectiveness. Null Hypothesis was selected. Purposive Sampling was done. Tools used for the study were 1) Emotional Intelligence EI Scale. 2) EQ Map Questionnaire 3) Casual Observation 4) Interview scheduled for the student-teachers. Pre-test Post-test control group design was selected for the study. Statistical technique was ANCOVA. Findings of the study were 1) The developed modules were effective in raising EQ level of student-teachers. 2) Mean scores for emotional expression another component of EQ, were found significantly greater.

Karl, M.and Fargo, B.(2007) studied the effect of sustained, whole-school professional development on student achievement in science. The study was longitudinal in nature of the middle school science teachers, to explore the relationship between teacher participation in sustained, collaborative professional development and student achievement in science. The purposive selection of eleven teachers was done from Glendale Middle School. The teachers participated in the 2-week summer session which was followed by professional development sessions and focused on implementing instruction outlined in the *National Science Education Standards*. *Discovery* Inquiry Test was conducted to assess the students achievement in Science. The same sample of students had earlier qualified the test in their earlier grades of 6–8. Students of teachers at Glendale Middle School significantly outperformed students at the control school. Positive impact and sustained collaborative professional development was found. The findings also suggested that such programs can narrow down or eliminate the achievement gaps in the science subject.

Ghanney, R. (2008) *studied* **the impact of use of Instructional Materials in the Primary Schools Teaching-Learning of Environmental Studies.** The study was conducted to examine the extent to which use of instructional material was done in the teaching-learning of Environmental Studies in the Primary Schools in Winneba. 80 respondents comprising 60 Environmental Studies teachers and 20 pupils were purposively selected which were drawn from six public schools in Winneba. Questionnaire and an observational guide were mainly used tools for data collection. Frequency counts and percentages were used for coding and qualitative interpretation. Major findings of the study were that about 83% of teachers in the primary schools did not use teaching aids such as lasses, globe, resources persons, objects or artifacts, radio, television and computers and conduct teaching with the use of only chalkboard and textbooks for lesson delivery on Environmental Studies. The inability of teachers to use instructional materials led to: passive listening by students in class which resulted in boredom, poor participation in lesson, and poor performance in the subject matter. Suggestions to enhance the effective use of instructional materials was done to improve the teaching learning process of environmental studies at primary school level.

Pathak,A. (2008) conducted a study on **Preparation of a creativity program for pre-service teacher trainees at primary level and a study of its effectiveness.** The study was conducted to Construct and standardize a creativity test for pre-service teacher trainees (PSTT) at primary level, identifying the creativity level of pre-service trainee teachers at primary level and preparing a Creativity Program (CP) for PSTT's, and studying the effectiveness of the program with respect to creativity components, caste category and academic stream. Null hypothesis was selected. Experimental method using Pre-test Post-test design was selected. Purposive sampling method was chosen for the study. Tools applied to the study were creativity test for identifying the creativity level of PSTT's constructed by the researcher and a Creativity Program (CP). Statistical technique ANOVA and ANCOVA were used to analyze the data. The study concluded that treatment on PSTT's was significant for the creativity. There was no significant difference in the different caste category and academic stream in case of experimental group in the mean score of PSTT's. Mean creativity score of PSTT's was not affected by interactions effect of caste category and academic stream of experimental group.

Donkor, A. (2010) comapared the **Instructional Effectiveness of Print-Based and Video-Based Instructional Materials for Teaching Practical Skills at a Distance.** The objectives of the study were: 1) to examine the comparison between instructional effectiveness of video-based instructional materials vis-à-vis traditional print-based instructional materials for teaching distance learners of a Block-Laying and Concreting practical skills programme. Experimental design was adopted for the study and randomly assignment of participants was doneto two treatment groups, i.e. Users of video-based instructional materials or users of print-based instructional materials. Data was collected by a researcher-designed performance test and an achievement test of 20 multiple-choice items from 34 participants who used print-based instructional materials and 35 participants who used video-based instructional materials to learn practical skills. The instruments were based on the instructional objectives of lessons on mortar and wall finish. Cronbach's alpha of 0.84 was assessed by Pilot test data for the achievement test. Data analysis was done by using Descriptive statistics and t-test at a 0.05 level of significance. Pedagogical equivalence in terms of theoretical knowledge was indicated in the results on the two instructional materials used. however, were higher practical skills were acquired among users of video-based instructional materials. Significantly superior craftsmanship was displayed by the users of video-based instructional materials.

Aina, J. and Jacob, K. (2013) conducted a study on **Instructional Materials and Improvisation in Physics Class: Implications for Teaching and Learning.** This study looked at the availability, uses and improvisation of instructional materials and their implications on teaching and learning of physics in secondary schools. The sample of the study comprised of all secondary schools offering physics as a subject and one technical college in Education, Patigi and Ilorin west local government of kwara state. 23 physics teachers and 39 students studying physics as a subject were the participants. 64 items both for teachers and students were designed for Questionnaire. It was analyzed using Frequency and percentages; Findings of the study suggested shortage of instructional materials; inadequate use of the available ones and teachers' not using local teaching aids to improve physics teaching. Recommendations to government were made for funding science education.

Mathew, A.(2013) conducted a study for the **development of an instructional strategy on color and form for design education and determined its effectiveness.** The objectives were 1) To identify the difficulties faced by the students while using color 2) To prepare an instructional strategy for teaching the course in color and form for design education. Design of the study was Single group pre intervention test post intervention test design. Tools used were 1) Questionnaire for students was developed by researcher to understand the difficulties in learning process. 2) A pre intervention test and post intervention test in the form of one day equivalent assignment were developed. 3) Pre intervention Focused group discussion 4) Feedback on continuous basis 5) Observation of students works by the researcher 6) Post intervention Focused Group Discussion. Sample of the study was one batch of Post graduate students from National Institute of Design (NID) in the year 2012-2013 was taken. Data collected were qualitative and were analyzed qualitatively by assigning different categories. Major findings of the study were 1) there had been a marked change in the skill level of student as per the package. 2) Entry level of the student varied and the inputs received in their previous courses had a lot of discrepancies. 3) The ability to apply color on the composition with appropriate control was improved. 4) The right usage of terminology was clear to students and improved the communicative quality of the product.

Pillai, T. (2013) conducted a study to **Develop and implement an Intervention Programme in Science and Technology for standard IX physics subject.** The objectives of the study were 1 To identify the topics of physics from standard IX Science and Technology for intervention 2 To develop and implement an Intervention Programme in the physics content of standard IX Science and Technology. 3 To study the effectiveness of the developed Intervention Programme in terms of i) achievement of students on the conceptual understanding of the physics concepts. ii) Interpretation of physics concepts from the stories. iii) Identification of physics concepts from the images of events projected. IV) Logical sequencing of physics concepts from the images of events projected. 4 To study the reactions of the students towards the developed intervention programme. Sample of the study was randomly selected using lottery method. Design of the study was Quasi-experimental post test control group and experimental group. Tools used were Interview schedule for students, Information schedule of physics, Entry Level Test and Field notes. Data Analysis was done

qualitatively through content analysis of interviews and previous years answer sheets. Data collected through achievement test was analyzed by the statistical technique ANCOVA. Data collected through interpretation of physics concepts from the stories were analyzed using frequency count, percentage and chi-square technique. Findings of the study were the adjusted mean score of the experimental group on achievement test was found to be significantly greater than that of the control group when the entry level test scores were considered as covariate on achievement test score.

Singh, A. (2013) conducted a study to **Develop and Implement a multimedia package to teach Geography at standard IX CBSE students.** The objectives of the study were 1 To develop a multimedia package in subject of Geography for standard IX CBSE students. 2 To implement the developed multimedia package in subject of Geography for standard IX CBSE students. 3 To study the effectiveness of multimedia package in terms of achievement of students. 4 To Study the effectiveness of multimedia package in terms of reaction of students towards the developed multimedia package. Purposive sampling was done for the study. Quasi-Experimental control group and experimental design was done. The tools used for the study were Achievement Test and Reaction Test. The data analysis was done by statistical technique Mean, Standard Deviation, Standard Error of Mean (SEM), Mann-Whitney U test and Intensity Index (II). Findings of the study revealed that the developed multimedia package was found to be effective in terms of enhancing students' achievement in Geography in comparison to the traditional approach and the developed multimedia package to teach geography was also found to be effective in terms of students towards the package.

Thomas, M. (2013) conducted a study to determine the e**ffectiveness of cooperative learning for science teaching in class VII.** Objectives of the study were 1) To develop a strategy based on cooperative learning for science teaching in class VII. 2) To study the effectiveness of cooperative learning for science teaching in class VII in terms of a) their academic achievement b) gender c) units of science d) 5 essential elements of cooperative learning in science. The study sampled English Medium School with upper primary classes following Kerala State Board. Tools were science achievement test, rating scale. Study was quasi-experimental in nature by the Pre-test-Post-test non-equivalent group design. Data was analyzed by ANCOVA. Rating scale

was used to assess students at five essential elements of cooperative learning. The Wilcoxon signed-Rank test was used to see the significance of the development of essential elements. Major findings of the study were there was a significant difference between mean score of achievement of student who were taught with cooperative learning than that of the students taught with conventional method and also with respect to chapters. There was no significant difference between the scores of achievement between the genders. There was a significant difference in positive interdependence of experimental group before and after implementation of cooperative learning. A significant difference was found in individual accountability, leadership skills, communication skills, trust building skills, decision making skills and cooperative learning.

Patel, A. (2014) developed an instructional strategy to teach creative and critical thinking skills for primary school teachers. Objectives of the study were selecting appropriate thinking tools for enhancing creative and critical thinking skills and developing an instructional strategy using selected combination of thinking tools using appropriate content to enhance critical and creative thinking skills and to enable teachers to develop Instructional Designs incorporating the creative and critical thinking skills and to determine the effectiveness of the instructional strategy. Null Hypothesis was selected for the study. The study was delimited to Guajarati Medium Primary School teachers following syllabus of Gujarat State Technical Education Board (GSTEB). Pre-experimental design of one group Pre-test Post-test was applied. Reaction Scale pertaining to the trainees liking, understanding, retention and the media, method, approach during the intervention were the tools. Qualitative data was obtained and was analyzed using correlated t-test. The study was found effective in enhancing creative and critical thinking skills also there was an improvement in the attributes of fluency, flexibility, and ability dimensions of creativity through the instructional strategy of sampled teachers.

Ogbole, J. (2014) conducted a study at **Upper Basic Education Level** of impact of e**ffects of improvised instructional materials on student's achievement in Geometry.** Improvised instructional materials were used. Two hypotheses were tested at the level of 0.05 significance. It involved on-randomized pre-test pos t-test control group quasi-experimental design. The population of the study comprised of 1680

Universal Basic Education (UBE) students from Makurdi metropolis. Out of it, 139 students were selected as a sample from four schools out of the 22 UBE schools. Geometry Achievement Test (GAT)was used as the tools of the study. Descriptive statistics were used for analysis of the study. Formulated hypotheses were tested at 0.05 level of significance by the technique of Analysis of Covariance. The findings of the study stated that student's taught with improvised instructional materials performed better. Also both male and females equal improvement on geometry was found as compared to control group. Recommendations were made to use improvised instructional materials in mathematics classroom by mathematics teachers.

Thaker, A. (2014) studied the **effectiveness of science teaching using mastery learning programme.** The major objectives were: To construct and test the influence of a 'Mastery Learning Programme' with reference to students' Science Learning Interest at the level of standard VIII and standard VI. Experimental method was used selecting 'Quasi' (Pre-test/ Pos t-test). Two classes each from one school of standard VIII and VI from another school were selected as the sample for the experiment. One class was taken as Experimental Group and other another was taken as Control Group. 'Mastery Learning Programme' was developed and implemented as experiment-effect. ANOVA and t-test were used as statistical method. The major findings were Science Learning Interest was found higher among the students taught by 'Mastery Learning Programme' than students taught by the 'General class teaching' at the level of standard VIII and standard VI with reference to Science Teaching.

2.1.2 Overview of the studies of development and implementation of instructional packages:

The studies reviewed above are categorized at three levels: School level of students, at college level students and for pre service teacher's level.

The studies of Pathak, J. (2008), Romould, J. (2006), Patel, A. (2014), Karl, M. (2007), and Donkor, A. (2010) were performed on pre service teachers and on student teachers using instructional strategies. Purposive Sampling was done in the above studies. The studies were experimental in nature and purposive sampling was done. Data was analyzed using statistical technique ANOVA AND ANCOVA. Null

Hypothesis was selected. Findings of the studies revealed that instructional packages were effective with respect to students' achievement. Also positive impact was found and it was revealed that there was a significant role of sustained and collaborative professional development programs on student achievement, emphasizing that programs of this type could be a means to narrowing or eliminating achievement gaps in different subjects. The study of Linda, J. (1991) was a case study in which Science teacher beliefs and their influence on curriculum implementation was studied. It included beliefs about how students learn, a teacher's role in the classroom, the ability levels of students in a particular age group, and the relative importance of content topics. Both teachers believed that the most important student outcome is factual knowledge, that middle-grade students learn through repeated drill and practice, and that middle school students require a great deal of direction.

The studies of Karandikar, C. (1996), Sharma, R. (2004), Aina, J. (2013), Hewson, G. (2003) were done at school level. Wherein Purposive Sampling was done. All were experimental studies. Data was analyzed using Statistical techniques. The findings of the studies revealed that there was a significant difference between mean achievements of students studying through different instructional packages.

2.1.3 Studies on teaching-learning of different subjects:

A total of 10 studies conducted in the fields on teaching-learning of different were reviewed for the present study.

Pandit, V. (2000) experimented **in teaching general science to standard VI students without the prescribed textbook.** The objectives of the study were: To find out the relative effectiveness of teaching science between control group (taught with text) and experimental group (taught without text but with reference material) on certain criterion variables, to find out which of the following type of students benefited most in terms of science achievement low scholastic aptitude or high scholastic aptitude, any major contradiction in the opinion of teachers with less experience (less than 10 years) and teachers with more experience (10 years and above) regarding the effectiveness of teaching science without the textbook, to find out the view of teachers on the quality of standard VI science textbook in particular and science textbooks in use in general, to find the views of teachers in different

aspects of teaching science and the problems involved in it. The study was carried out in two phases. In the first phase, the experimental method was followed. The design was two parallel groups pos t-test. The sample comprised of 180 students. The tools used were Scholastic Aptitude Test (SAT), Nafde's Non-verbal Test of Intelligence (NVTI), Otis Self Administered Test of Mental Ability (OTIS), and Achievement test in Science (unit-1, unit-2 and unit- 1+2) developed by researcher. ANCOVA was used for data analysis. In the second phase, the survey method was used. The sample comprised of 211 teachers from 50 different schools. A scale to measure opinion of teachers regarding the effectiveness of teaching science without textbook and questionnaires to study the opinion of teachers were used. The findings of the study were: In regard to the total achievement in science of the total of both the groups, the experimental group performed significantly higher as compared to control group. In regard to total group, the scholastic aptitude has a significant effect on the performance of the students in achievement in science. The interaction between treatment and scholastic aptitude was not significant. Opinion of the teachers with less experience (less than 10 years) and teachers with more experience (10 years and above) regarding teaching science without the textbook was not found different from each other, they were of the view that teaching without the textbook gives you better opportunities to teach students to discover the facts of science.

Clement, M. (2006) conducted a research on **bridging analogies and anchoring intuitions to deal with students' preconceptions in physics**, in which Lessons were designed to deal with students' alternative conceptions in three areas of mechanics: static normal forces, frictional forces, and Newton's third law for moving objects. Class discussions between a target problem and an intuitive anchoring example, forming a structured chain of intermediate bridging analogies were used as Instructional techniques. Large differences were found at pre–Post-test gains favoring the results of experimental group. Argument was made in formulating a model of learning processes that can be explain these results that the lessons have a more complex structure than a simple model of use of analog; rational methods can play a very important role using analogy and other plausible reasoning processes in science instruction; more effort should be focused on helping students to make use of an analogy; and students prior knowledge should be made useful using focused attention by researchers and curriculum developers.

Wiggins, F. (2006) studied the effects of hands-on-science instruction on the science achievement of middle school students. The sample used for the study were one hundred and twenty sixth grade students in six classes. Lecture/discussion and hands-on-activities were used as instructions which were implemented for three weeks This also additionally assessed the effect of the variables gender, ethnicity, and socio-economic status on the attitude of sixth grade students towards learning science. Prentice Hall unit ecosystem test and the Scientific Work Experience Programs for teachers study (SWEPT) student's attitude survey were used as tools in the study. Statistics used to analyze data was One-Way ANCOVA and the One-Way ANOVA. The findings of the study revealed a statistically significant difference in the science performance of middle school students exposed to hands-on science instruction. These students had significantly higher scores as compared to the science scores of middle school students taught by traditional instruction. Also no significant difference among scores of male and female middle school students was found and a significant difference was revealed in the socioeconomic status of students who were not provided with assisted lunches.

Haver, C. (2007) determined the relative effectiveness of a Multi-sensory Learning designs based on constructivist approach (MIP) to traditional teaching on the science achievement and attitude test scores of middle-school English Language Learner (ELL) and English-speaking VI< VII VIII school students. Two instructional strategies: ELL and English-speaking (non-ELI) status, and three grade levels were the dependent variables for the study. The sample of the study involved 282 students from above mentioned three grades with ELL and Non-ELL middle-school students. To determine learning-style preferences Learning Styles: The Clue to You! (Burke & Dunn) was administered. Science was taught traditionally to the control groups and MIPs were used to teach to the students of the experimental groups. Attitudinal differences were revealed administering Semantic Differential Scale (SDS). Both traditional and multi-sensory instruction in all three sub-units was experienced by all the three groups. MIP was significantly scored higher as compared to traditional approach for teaching science content to both ELLs and English-speaking middle-school students. Significant impact on achievement scores was calculated statistically by Analysis of variance (ANOVA). The students also indicated a positive and significantly more positive attitude by teaching with an MIP approach.

Grosshans, K. (2008) investigated on the way science teachers engage students under the 4 X 4 block schedule and the how the teachers' understanding of the use of instructional strategies influenced their lessons. The National Science Standards have adopted an inquiry-based approach; block scheduling provides more time for teachers to incorporate varied strategies is suggested by researches as inquiry-based and cooperative learning do have philosophical roots in a social constructivist philosophy. Qualitative methodology was used in study which involved multiple case studies of three high school science teachers at a large rural country high school. Pre-observation Interviews, classroom observations, post-observation interviews, and the collection of documents and artifacts such as learning designs, student hand-outs, worksheets, laboratory exercises, homework and other documents the teacher used to prepare for or implement a lesson were used as data sources. Strategies used by three science teachers were found mostly didactic in nature and were consistent with their scientific realist views concerning the nature of science, as per the evidences. Social constructivist approach to teaching and learning views these scientific realist philosophies as antithetical as also suggested by the National Research Council to be adopted by science teachers.

Murray, J. (2008) investigated the impact of a balanced science pedagogical approach to scores on the Texas Assessment of Knowledge and Skills. This was an applied dissertation designed to investigate whether a balance between inquiry methodologies and vocabulary instruction would affect science curriculum and increase student achievement as measured by the Texas Assessment of Knowledge and Skills test. Science test scores of fifth grade students' of two successive school years were analyzed. In the first year, only the inquiry methodology was used. A balanced curriculum approach, where inquiry methods were balanced with vocabulary instruction, was implemented in the classroom in the second year,. Results were analyzed for the total population, as well as the subpopulations of Hispanic, low socioeconomic, and gender. Statistically significant gains were obtained from the data analysis for the total population of students. While the same gains were not found in the Hispanic and low socioeconomic student populations.

Hake, R. (2008) surveyed on **Interactive-Engagement versus traditional methods: A survey for introductory physics courses of mechanics test data conducted on six-thousand-student.** Halloun–Hestenes Mechanics Diagnostic test and Force Concept Inventory of pre test and post-test data conducted on 62 introductory physics courses enrolling a total number of students N=6542 was reported. For a rough measure, of the average effectiveness of a course in promoting conceptual understanding was taken to be the average normalized gain, a consistent analysis over diverse student populations in high schools, colleges, and universities was obtained. Normalized gain is defined as the ratio of the actual average gain to the maximum possible average gain (100%). Fourteen "traditional" (T) courses (N=2084) that made no use of interactive-Engagement (IE) methods secured an average gain with Standard Deviation =0.23±0.04. In sharp contrast to that, 48 courses (N=4458) which made substantial use of IE methods achieved an average gain with standard deviation =0.48±0.14 was obtained which was almost two standard deviations above that of the traditional courses. The enhancement in the results was found for 30 (N=3259) of the above 62 courses on the problem-solving Mechanics Baseline test of Hestenes–Wells which implies, IE strategies enhance problem-solving ability. The conceptual and problem-solving test Statistical analysis also strongly suggest that the use of classroom IE methods increase the effectiveness of mechanics-course beyond obtained by traditional practice.

Kessner, M (2008) assessed the effects of hands-on, inquiry based instruction on student science achievement in a high-stakes testing environment. A quasi-experimental design was used employing quantitative and qualitative methods. Data collected from student surveys and individual science achievement scores for fifth-grade students of three schools from suburban school district implied the quantitative portion of the study. Data collected using a Science Kit Usage Checklist which is an open ended Teacher Survey of 3 fifth-grade science teachers, and teacher interviews for 3 fifth-grade science teachers framed the qualitative portion of the study. Emerging codes and themes were identified for science kit training and understanding its implementation, teacher education was done by Descriptive analysis. Data triangulation was done to obtain results based on Berg, 2006; Pattern, 2005. General improvement in the scores of students was found meeting mastery of the fifth-grade science state assessment when kits were implemented. Student and Teacher Surveys

implied Teacher fidelity and validation of high implementation. Themes emerged involving training, time, student response, impact on instruction, impact on achievement scores, instructional organization, and instructional changes in future implementation. Implementation then led to higher fifth-grade science achievement scores.

Hazari, M. (2015) conducted a **Comparative study on obscuring power structures in the physics classroom Linking teacher positioning, student Engagement, and physics identity development.** An emergent theme can be found around differences in students' level of Engagement, including behavioral, affective, and cognitive Engagement, and physics identity development was done by comparative case studies of four high school physics teachers, use of a teacher positioning. Data collection was done from each classroom over the course of one week by two observers in multiple formats which included student and teacher interviews and surveys, video recordings, and field notes. Constant comparative approach was adopted to compare the qualitative data and regression with the quantitative data across the four teachers. Influence on teachers' physical, structural, contextual, and social cues was found on the extent to students Engagement in physics class. The teachers' social cues appeared to be the most important for affective and cognitive Engagement, and subsequently physics identity development. Contextual cues were less prominent, which may indicate the difficulty in making physics content contextually meaningful for students. Structural physical cues appeared to be important for behavioral Engagement. In sum, the way that physics teachers position themselves can moderate students' level and type of Engagement with the class and ultimately affect the physics identity development of students.

2.1.4 Overview of studies on teaching-learning of different subjects

The researcher reviewed researches related to teaching-learning of different subjects such as Science, Mathematics, Physics, English and Social Science. Many of the reviewed studies have proved that Hands-on, inquiry-based science have proved an effective way of teaching. The above studies of Haver, C. (2007) and Wiggins, F. (2006) were quantitative studies done on school level and revealed that learning is an active process through the instructional material provided according to the level of students. Also it indicated a positive attitude of students towards the teaching

approach. The Quasi-experimental study of Kessner, M. (2008) viewed an improvement in student scores when kits were implemented also an effective improvement was found in the performance of science learning at middle school study. The findings of the studies proved that the students indicated a positive and significantly more positive attitude when instructed with instructional strategies.

2.1.5 Studies on constructivist approach in different subjects

A total of 16 studies conducted in the fields of constructivist approach in different subjects were reviewed for the present study.

Burrowes, P. (2003) studied the results of **a controlled experiment that tested the effectiveness of Lord's constructivist teaching model** in: 1. Helping the students achieve better grades on standard midterm exams. 2. Developing higher order thinking skills. 3. Modifying students attitude towards biology in Urban University. Two large sections of General Biology I Cellular and molecular biology were taught by the researcher. From that one section was arbitrarily chosen as control group of 100 students and was taught in the traditional manner, based on lecturing, wherein student interaction had less opportunity. The other section was chosen as the experimental group of 104 students and taught following Lord's constructivist method. Formation of groups was done by four students seated next to each other in a row. After all cooperative group were established; each group received a legal size manila envelope that contained important information: 1.One cooperative group composition sheet. 2. Four student profile sheets. 3. One group answers to class worksheets. 4. Quiz Sheet. Findings of the study revealed sustained evidence that teaching in a constructivist, active learning environment is more effective than teaching with traditional instruction in promoting academic achievement, increasing conceptual understanding, developing higher level thinking skills and enhancing students interest in biology. In their final course evaluations, students in the experimental section commented that they enjoyed their class much more than their traditional classes; they felt theory had learned more, made valuable friendships in their collaborative groups.

Diane, J. (2005) conducted a study on **Constructivism and Instructional Design as an exploration using an asynchronous online nominal group technique.** The objectives of the study were to identify the Principle tenets of constructivism as a theory of learning, and to suggest processes of instructional approaches that flow from this theory for the development of online learning. Design of the study was based using the consensus building methodology, the Nominal group technique (NGT) wholly online. The findings were that the constructivism encourages and values the personal understanding/knowledge construction by the learner and the design of learning is student-centered.

Kim, J. (2005) studied the **Effects of a Constructivist Teaching Approach on Student Academic Achievement, Self-concept, and Learning Strategies'.** Investigations were done effects of a constructivist approach on students academic achievement, self-concept and learning strategies, and on student preference. Two groups were made of 76 six graders. Constructivist approach was used to teach to the students of experimental group while the traditional approach was used to teach the students of control group. Implementation of the experiment was carried out for the duration of 40 hours in nine weeks. Mathematics tests administered by the teacher, self-concept inventory, learning strategies inventory, and a classroom environment survey were the tools of the study. Findings of the study indicated effectiveness of constructivist teaching in academic achievement to traditional teaching. While constructivist teaching was not found effective in relation to self-concept and learning strategy, but had some effect upon motivation, anxiety towards learning and self-monitoring, also a constructivist environment was preferred to a traditional classroom.

Avila, L. (2006) conducted a study to **Design, implement, and evaluate two laboratory courses making use of constructivist learning environments.** First year students of chemistry, of Columbia University were the sample. The study was designed to motivate the students to major in chemistry and sustaining the interest of declared major subject by the experiences at undergraduate till the final year for constructing effective graduate programs in chemistry subject. Qualitative design was followed for the study. Students' group and individual reports were analyzed at the beginning and end of the courses. Tools used in the study were Open ended questionnaires and student responses. The study concluded that there was an

outstanding increase in the performance grades of the students's taught in constructivist learning environment. Also external evaluators who attended the students' public presentations appreciated the performances of students.

Cook, M. (2007) determined the **effectiveness of constructivist science instructional methods on high school students' motivation to** complete classroom activities. A substance theory of motivation and personal investment in students learning was developed by the constant comparative analysis of open, axial, and selective coding of participants' interview responses and classroom observations were selected. The study revealed that students improve the performance of classroom activities when learning underwent through constructivist methods and students learn content objectives well in cooperative groups, problems-based learning and enquiry questions. As social beings, motivation to students helped in participating in activities and working with peers for contribution of their ideas. Lesson plans based on formulation of these ideas increased student motivation and achievement. Activities involving multiple intelligences and real life situations were found effective as a variation of instruction.

Seimears, C. (2007) determined the impact of constructivist-based teaching on English language learners' understanding of science in a middle school classroom. The objectives of the study was discovering patterns emerging after close observations, careful documentation, and thoughtful analysis of the research topic. Two variable clusters were examined in the study: one was the independent variable cluster of the constructivist teaching practices of one selected teacher; and other was the dependent variable cluster of the middle school English Language Learners' understanding the science concepts being taught. The study was qualitative in nature. The findings of the study revealed that Steve Loos, was an expert constructivist-based teacher who taught science in eighth grade middle school. His teaching influenced English Language Learners' understanding of the science concepts that were taught. Variety of pedagogical strategies were used by him to impact English Language Learners. It was concluded by the study that Constructivist teaching helps learning science positively to middle school English Language Learners.

Templeton, K. (2007)discovered the impact of museum-based science methods on 14 early childhood/elementary pre-service teachers' self-efficacy and ability to develop curriculum using a constructivist approach. Tools used to collect data were STEBI-B, modified by Bleicher (2004). Data was analyzed statistically by a paired –samples t test which indicated a significant change in the self-efficacy of pre-service teachers' in pre-and post-museum course participation. Analysis of student-created learning centers indented for the use in the students' future classrooms was also done. Increase in ability to create constructivist-based materials was shown by a paired-samples t test. To determine common themes and beliefs derived from written reflections and audio taped focused group discussion qualitative analysis was done. It was reported by students that the constructivist approach in science teaching helped to increase their confidence, excitement and ability to develop and use recourses for science instruction.

Bonnie, S. (2007) investigated an **interpretive research study using developmental research to design a constructivist learning environment for a Grade 8 Social Studies classroom** in which students researched information, wrote scripts, acted in and directed short video clips of events in Canadian history. The theoretical background for the design was based on ideas surrounding constructivist learning theory and instantiated by identifying nine elements that seemed to be important elements in a constructivist environment and guidelines for designing constructivist learning matched each element. Reported students' experience centered on themes of construction and reorganization of knowledge; tool mediation; group work and multiple perspectives. Barriers in the classroom concerned lack of time and difficulties with technology. Facilitators included students' positive attitude; and alternative modes of learning allowing success for non-traditional students.

Kingsley, J. (2007) conducted **a qualitative inquiry on Literacy instruction in a constructivist elementary classroom**. The study examined the literacy practices of a grade two/three elementary teacher. Qualitative research methodology was used in the study in which documentation of dynamic interactions between and amongst teacher and students was done. Tools used for the study comprised of Investigator's observation of students during instructional process, photographs, audio and video taped lessons, semi-formal interviews as well as work done by students and teaching

aids to study detailed class room practices. Data Analysis was done by using both categorizing and contextualizing strategies which were complement to each other in a rigorous and systematic process. The richness of the study apparent by Visual research methodology. The findings of the study were: four major steps between teacher and students nurtured self-esteem and self-regulation in learners and developed literacy skills in a caring environment. The study uncovered teacher's role in a spiritual dimension. Harmonious balance was created by teacher's spiritual epistemology which enabled the responsible freedom within a flexibly structured environment. It also supports that there is a need of literacy practices to include an examination of the role of teacher in developing students as a self-confident members of a literate community.

Bijas, J. (2007) conducted a **qualitative action research for constructivist informed pedagogy and middle school students' perceptions of content relevance in social studies**. The sample of the study was seventh-grade students in a suburban middle school in New Jersey. Data included student interviews and numerous work samples collected during three units of study. Predetermined and inductive categories were done to analyze the data. And it was reviewed for evidence of relevance. The study concluded that scores of the students improved if Students were provided with the opportunities to construct relevance of the content by relating new learning to personal experiences of the students and prior knowledge by using constructivist informed pedagogy. Constructivist informed pedagogy hold promise for all teachers facing the challenges of making learning meaningful and relevant to their students.

Warren, J. (2008) investigated **A comparative study of traditional and constructivist teaching methods used in algebra classes for pre-service elementary teachers.** The objectives of the study led to determine the effectiveness of constructivist instruction on the mathematics achievement of intermediate algebra students at a private college in Arizona. Students from 1999-2002 who were taught with the traditional instruction were compared with the students taught after 2002 who were taught with constructivist instruction. Data analysis was done using parametrict-test for unpaired independent samples. The results indicated that, overall, the mathematics achievement of the treatment was not significantly higher than that of the

comparison group. It was concluded that there was no negative impact found by adoption of a constructivist methodology in algebra classes.

Tandel, S.(2012). Studied **Development of meta cognitive skills in science student-teachers through constructivist approach.** The population of the study conducted of all the students studying in Bachelor of Education (B.Ed) Course having science as their one of the method in B.Ed Colleges affiliated with Hemchandracharya North Gujarat University, Patan of 2009-10 academic year. Sample of the study comprised of purposively selected 10 students of Master of Science degree holders coming from rural and urban area of palanpur tehsil of Banaskantha district. Hypothesis for the study were that there will be no significant difference between the pre test score and post test score of meta cognitive knowledge in science student-teachers. The tools used for the study were 1) Observation, 2) Interview, 3) Reflection Essay and 4) Meta Cognitive Skill Inventory. Data was collected through implementing MSI. Data was analyzed qualitatively as well as quantitatively. Major findings of the study were that engage, explore, explain, elaborate and evaluate phases of the constructivist approach provided more Meta cognitive writing and Meta cognitive Regulation (MR) behavior. There was significant development of evaluating skill, metacognitive regulation in science student-teachers through constructivist approach.

Pradhan, H. and Mody, J. (2012) developed **and implemented Constructivism applied to physics teaching for capacity building of undergraduate students**, a Supplementary Programme of Capacity Building for Physics Undergraduate Students, using a *constructivist approach*. The course was given to about 30 undergraduate physics students of Mumbai University studying in first year and second year B.Sc. of affiliated colleges. It was four weeks in duration and the students met for about seven hours per day for six days a week. The results, which are presented, were quite encouraging. A pre-, a post- and a retention test before the course, and after the course and about two months after the course respectively. The tests contained three parts: (a) Multiple choice questions, (b) Short answer questions, (c) Full-fledged problems. The pre and post tests were designed to be equivalent. The corresponding items on pre-post and retention tests addressed the same subject content and involved the same principles although the context was different, so that the items were equivalent but not identical. The tests were validated by careful introspection and through evaluation of

them by experts. A group of additional students which was equivalent in academic record to the experimental group was given both the pre and pos t-test. Results of the study were: The pre-post score analysis of 27 students from various colleges of Mumbai who took the course showed that averaged student's score in pos t-test was higher than the pre-test score. The difference between pre and post test score was statistically significant to high level (0.1%).It was found that control group pre-post test scores were not significantly different. This indicates that the treatment (course) which resulted in better performance of experimental group in the pos t-test thereby indicating the effectiveness of the problem solving course. Besides the quantitative statistical analysis, qualitative observations of students behavior indicated positive changes.

Rajendra, M. (2012). Conducted **A qualitative study on constructivist approach to Enviornment Education among primary pre-service student-teachers.** The study was conducted at Tirupattur Teacher Training Institute, Tirupattur, Vellore District in Tamilnadu. Sample was purposively selected and it comprised of 49 student teachers of first year and 50 student teachers of second year B.Ed Course. The common methods and strategies used were cooperative learning, collaborative teaching, Problem Based Learning (PBL) , Inquiry learning, Field visits. The process of data collection was in two phases. Phase I (with student teachers) and phase II (with student teachers teaching in school). Data was analysed during 1. field work and post field work. Data was analyzed with student teachers and learners participation in constructivist classroom on environmental themes (concepts) and 2. Student teachers and learners perception about constructivist approach to environmental education. The findings were expressed in five assertions that constructivist classroom facilitated student teachers and learners to develop better understanding on environmental concepts. Constructivist approach was a key factor of student teachers'. Organisation of learning resources proved important for successful constructivist classrooms. The student teachers were found to be willing to change ideas brought out through interaction among peers and learners and teachers in school.

Akanwa, M., Alphonsus, J. and Ovute, M. (2014) conducted a study on **The Effect of Constructivist Teaching Model on SSS Physics Students' Achievement and Interest**. The effect of constructivist teaching model on senior secondary school

(SSS) physics students' achievement and interest was examined. Quasi-experimental design was employed. Using a stratified sampling technique, a sample of 160 SSS physics student were drawn, and categorized into experimental and control groups. The experimental group (80) was taught using constructivist approach while the control; group was taught the same physics concepts (waves and sound) using conventional (chalk board) approach. A validated physics achievement tests on the lessons covered were administered to both groups of students before and after the experiment. Also a researcher developed and validated interest inventory was administered to the two groups. Mean, standard deviation and z statistics were tools for the data analysis. Findings revealed that constructivist approach had a significant effect on both the achievement and interest of SSS physics students.

2.1.6 Overview of Studies on constructivist approach in different subjects.

The above reviewed studies have highlighted advantages of constructivist based instruction in relation to positively impacting attitudes and feelings towards the science subject taught. The studies of Cook, M. (2007) and Templeton, K. (2007) suggests that teachers to teach with constructivist sessions wherein cooperative groups, problem-based learning is done and students are encouraged to enquiry for teaching content objectives. And Templeton's study also indicated that the students reported that the constructivist approach did increase their confidence, excitement and ability to develop and use resources for science instruction. The studies of Seimears, C. (2007) and Avila, L. (2006) suggest that middle school English Language Learners understands positively with constructivist teaching, and also students' performance increases positively". The common feature found in the above studies is that the learning by constructivist approach shows to have significant relevance and effectiveness in learning of science.

From the studies reviewed above, the studies of Diane, J (2005) and Esmaiel, Y. (2006) pointed out that constructivism encourages and values the personal understanding/knowledge construction by the learner and the design of learning is student-centered and the constructivist approach enhances the students' learning. Also the studies of Bonnie, S. (2007), Warren, J. (2008) and Bijas, J. (2007) conducted studies using constructivist approach at middle school level and reported its significance as positive impact on the learners. Bosbea, S. (2006) has pointed out that

the art appreciation instructors have an opportunity to facilitate high levels of student thinking and encourage metacognitive skills through constructivist method that helps in understanding multiple ways of knowledge construction. The findings of the study of Jennifer, L. (2006), pointed reference that the students developed an appreciation for constructivist practice and viewed learning as a process of constructing knowledge. Akanwa, M., Alphonsus, J. and Ovute, M. (2014) studied the effect of Constructivist Teaching Model on SSS Physics Students' Achievement and Interest and its findings revealed that constructivist approach had a significant effect on both the achievement and interest of SSS physics students. The studies of Burrowes, P. (2003), Tandel, S.(2012) and Rajendra, M. (2012) showed Constructivist approach was a key factor of student teachers'. Organisation of learning resources proved important for successful constructivist classrooms. The student teachers showed willingness to change ideas in the light of evidence brought out through interaction among peers and learners and teachers in school.

2.2 Implications of the Review of Related Literature for the present study

The reviewed were conducted in different subjects such as algebra, mathematics, social studies, computers and non-art majors at different levels; school level, college level, in pre service teacher education level using statistical techniques for data analysis for finding out the effectiveness of constructivist approach to teaching learning. They showed to be effective in terms of students' achievement scores and memory retention. Thus, it can be concluded form the above studies that constructivist approach if adopted at different levels and in different subject it may be effective as a teaching- learning approach. Avila, L. (2006), Bijas, J. (2007), Cook, M. (2007), Diane, J. (2005) and Esmaiel, Y. (2006) and Siemears, C. (2007) have found that constructivist teaching is effective in teaching English, Science, General Studies, learning, thinking personal understanding. The studies of Akanwa, M., Alphonsus, J., and Ovute, M. (2014) have proved the significance of constructivist approach was found to be effective teaching in studies. Research findings also revealed that constructivist approach, activity based method developed science process skills in children. Many other Studies have been done on constructivist paradigm of learning also in science teaching, and in Physics. However, as far as the researcher has reviewed the researches, no research has been reported in physics teaching at the

diploma engineering level employing constructivist approach. Hence the researcher has attempted to employ constructivist approach to teach physics at Diploma Engineering students ascertain its effectiveness as a teaching learning approach.