Review of related literature:-

So far only few researches and some online articles have been conducted in India and abroad related to the present research topic, which have a significant bearing on the present research.

Research conducted in India and Abroad:-

Dr. Sibil and Dr. Kalpana K. (2004) conducted a study on "looking for an alternative strategy for teaching and testing: - An experiment with concept mapping in an inclusive science classroom"

Elizabeth Lilija Newlin (2002) - She suggested for the student, concept mapping gives new meaning to learning as they organize in their own way. Student can link this new knowledge to the existing concept

John Margeram (1991) - In this paper suggested that concept mapping is useful tool in school subject. He also suggested many website and summary of concept mapping for history subject along with some examples.

Shuzo - Katsu - This paper is design to provide an audience with no prior research knowledge with basic ideas of concept mapping. For the purpose of simplicity and clarity, the text is presented in Q &A form. This tutorial can be followed from beginning to end.

Joseph, D. Novak, J.D, Alberto J. Cannas, J.D. (2004) - This paper describes briefly the theoretical foundations for Novak’s research program at Cornell University that led to the development of the concept mapping tool, and the range of applications for this tool. In the history of science, there are many examples where the necessity to develop new tools to observe events or objects led to the development of new technologies. For Novak’s research program, the necessity to find a better way to represent children’s conceptual understandings and to be able to observe explicit changes in the concept and propositional structures that construct those understanding led to the development of the tool we call a concept map. This tool has now become a powerful knowledge representation tool useful not only in education but in virtually every sector of human activity. We begin with a brief historical sketch of problems and issues addressed in the research program, and proceed to describe how the integration of concept mapping with new technologies have enabled the development of software programs that greatly enhance the capabilities of the tool.


Objective of the study:-
To develop and implement concept mapping as a strategy in the selected few units of science for VIII standard students and study its effect on the achievement, concept attainment, and the process skills of students belonging to different intelligence groups.

To study the attitude of students towards concept mapping in science.

To study the gender differences in science achievement, process skills and attitude towards concept mapping.

**Major Findings of the study**

1) The analysis of data revealed that the experimental group students had performed better when compared to the control group on the achievement test process skills and concept attainment test on the post test occasion. This was evidence through the “t” values obtained for achievement test (9.66); process skills (6.34) and the concept attainment test (4.40).

   The analysis of students (experimental) attitude towards concept mapping revealed that almost 90% of them had a very positive attitude.

2) The F values obtained (5.921) showed that there is difference between and within the different intelligence groups of the experimental group in their post achievement test implying that the concept mapping strategy has had a differential effect on students belonging to different intelligence groups. Similarly, the F value obtained for concept attainment test was found significant implying that there is a difference within and between the students of different intelligence in their concept attainment ability. But there was no difference found either between or within the different grades of students in their performance of process skills.

3) There was no difference observed between girls and boys in their achievement, process skills, concept mapping.

   Based on the results of this study, it is concluded that there is need to include concept mapping with the constructivist basis as one of the major approaches to teach science in schools and provide workable strategies to help students “learn how to learn”.

**Chui-Chang Chou (2008) - The effect of concept mapping on students learning achievement and interests**

The study described in this paper has examined whether concept mapping can be used to help students to improve their learning achievement and interests. The participants were 124 students from two classes enrolled in an advanced accounting course at the school of management of a university.
in Taiwan. The experimental data revealed two important results. First adopting a concept mapping strategy can significantly improve students’ learning achievement compared to using a traditional expository teaching method. Second; most of the students were satisfied with using concept mapping in an advanced accounting course. They indicated that concept mapping can help them to understand, integrate and clarify accounting concepts and also enhance their interest in learning accounting. They also thought that concept mapping could be usefully used in other curriculum areas.

**Aimee A. Bancroft - The effect of concept mapping on student achievement in Tenth grade biology students**  
The purpose of this research project is to determine the effects of incorporating concept mapping on achievement of tenth grade Biology I students at a Catholic high school with approximately three hundred students located in southern Louisiana. The students will be tested with researcher – constructed pre-and post tests containing objective questions with ten randomly placed subjective questions. The students in the treatment and control groups will be exposed to the same teaching techniques covering a unit on photosynthesis and cellular respiration. They will be given the same pretest after the initial lessons. However, after the pretest the control group will be given a traditional oral review of the material and the experimental group will be exposed to the concept map centered review. After these reviews are completed, the students will complete the post test. Test scores will be analyzed for any statistically significantly difference in the scores on the material present on the tests using an ANCOVA.

**Mena Kharatmal and Nagarjuna G - Refined Concept Maps for Science Education: A Feasibility Study**  
In this paper, the study conducted to test the ease and feasibility of RCM by comparing it with other modes of representation. A homogeneous sample of school students was assigned the same task from a specific domain. The analysis shows that it was easy and feasible to use RCM by the school students. The fixed set of relation names, does not affect the expression of knowledge. The constraints in the RCM served as an anchoring and a facilitator for representing scientific knowledge.

**Machi and McEvoy (2008)** present two mapping approaches; mapping by core ideas or ‘descriptors’, developed from keywords in research topics, and mapping by author, which identifies key experts in the field and may incorporate the use of quotations and the referencing and citing of others (see citation mapping). These maps can be subdivided by categorisation processes based on theories, definitions or chronology, and cross referencing can be employed between two types of mapping.
Crandell, Naomi, & Souderton (1996) – According to them concept mapping is a organizing specific topics within a broad category in order to show the relationship of one to another. The maps depict hierarchal relationships in a manner of organizing the broadest information “at the top of a tree-like figure” and branching of two more specific information; each branch links a more general concept to more specific concept. For example, a broad concept would be education, the next branch may be science, and the next could be life science, which may lead us to biology. This shows how information can be linked but the specific differences in the information are also demonstrated (Gahr, 2003)

Heinrich (2001) advises students to use mind maps as a process of deduction, mapping specific to general concepts (resulting in an upright triangle shape), or a process of induction, mapping general to specific concepts (resulting in an inverted triangle shape).

Kamler and Thomson (2006) emphasize the positional aspect of mapping, in which the learner seeks to identify where she ‘fits’ within the field. They describe one student who adopted a ‘dinner party metaphor’ to visualize her epistemological position in relation to scholars in her field. Maps based on a single article will inevitably adopt the argument process of the author’s perspective.

Adman & Egan, (1998) - found that the idea of using concept mapping demonstrated that the knowledge retained by students was “accurate and meaningful”. Concept mapping has also demonstrated as a tool to enhance reading comprehension.

Chang, Sung, and Chen (2002) - found that incorporating concept mapping helps to improve text comprehension in fifth grade students. It has been stressed that for concept maps to be effective learning or reading comprehension tools, the process of creating these maps must be taught to the students in a manner that they can repeat the process on their own. It is important for students to understand the purpose of using concept maps to bolster the learning experience. If the students are unaware of the various methods or of the goal of this learning technique, then the experience of using them is lost on the untrained mind.

Gold and Chaffee (1998) - found that the use of concept maps can be spread across a variety of situations, but all uses contribute to learner comprehension. They also found that there are several “understandings “that must be put into place before success will be achieved. First, the concept map must allow for the identification and presentation of key ideas and concepts relating to the subject matter while it disregards superfluous material. Second the students must be able to gain and understanding of the process of concept mapping through picture modeling, but to truly become
proficient in concept mapping they must be allowed to apply the process in their own manner. Lastly the students must be forewarned of the pertinent information and goal of the task in order to direct themselves in the same path that the teacher desires.

**Asking Asan (1998)** - Concept Mapping in Science Class: A Case Study of fifth grade students. - Purpose of this research project was to determine the effect of incorporating concept mapping on the achievement of fifth grade students in science class. The study was conducted with twenty three students at Ata elementary school, Trabzon, Turkey. The students were tested teacher-constructed pre and post tests containing 20 multiple choice questions. The pupils in the experimental and control groups were exposed to the same teaching techniques covering a unit on heat and temperature. They were given the same pretest, the control group was given a traditional oral review of the material and the experimental group was exposed to the review by the use of inspiration, which is computer based concept mapping tool. After these reviews, the student on both groups was given the posttest. Test scores were analyzed for any statistically significantly difference in the scores on the test. The results from present study indicate that concept mapping has a noticeable impact on student in science classes.

**Ritchie and volley (2000)** found that having 6th grade science student create concept map before working on lab activities produce better “Long term retention” than using the concept map after the completion of the exercise. This research leads one to believe that by making important connections prior to actually doing any activity will lead to more complete understanding of the material. Thus the student will have really learn the concepts rather memorizing them. In addition to this, it has also been determine that concept mapping aides both teacher and student and converting scientific concept into a framework for arranging test book content in a manner that is visual and graphic. By incorporating this process into lessons plan the teacher enables student to both “remember and categorize information”. Teacher are better prepared to make connections between difficult scientific concept that are understood by students as concept maps.

**Wilkes, Copper, Levin and Betts (1999)**. This paper studies that concept mapping has been demonstrated to help student make cross-curriculum to better enable them to understanding their main field of learning. It was found that perceiving a RN bachelor degree in Australia had better knowledge of nursing field after incorporating concept mapping into curriculum to enable them to link concept science with concept in nursing. This connections allowed the student nurses to gain fuller understanding of how the two field intertwine. By incorporating this learning procedure, the nurses where better able to educate their patient about their various conditions. These demonstrate how concept mapping can be effective
tool for the student as a learning enhancement and for teacher as a tool for explanation and to promote understanding.

**Patil, A .S (2008)**- effect of concept mapping in science on achievement in physics for 11\(^{th}\) standard student- a study

**Objectives**-

1. To analyze the 11\(^{th}\) standard text book and select physics content for concept mapping
2. To study the effect of concept mapping achievement in physics.
3. To develop concept mapping strategy from physics textbook.

**Conclusion**-

1. Experimental and control group are same because both group is studying in higher secondary school.
2. Concept mapping strategy is very useful than traditional method
3. Student achievement in physics is very high because use of concept mapping

**Surve, Meena. V. (2010)** To study of development of teaching strategy for 9\(^{th}\) standard history student

**Hart (1998)** stresses mapping is not only an organizational tool but a reflexive one. This requires students understanding the mapping process itself and, as various mapping forms and processes can be employed, students need to make explicit their mapping methodology. Hart distinguishes between declarative knowledge demonstrated by identifying key concepts, ideas and methods, and procedural knowledge demonstrated through the classifying of those key concepts and forming links or relationships between them. Kalmar and Thomson (2006) describe the use of mapping in workshops and advocate joint construction of maps with supervisors:

**Mache and McIvor (2008)** present two mapping approaches; mapping by core ideas or ‘descriptors’, developed from keywords in research topics, and mapping by author, which identifies key experts in the field and may incorporate the use of quotations and the referencing and citing of others (see citation mapping). These maps can be subdivided by categorization processes based on theories, definitions or chronology, and cross referencing can be employed between two types of mapping.
Heinrich (2001) advises students to use mind maps as a process of deduction, mapping specific to general concepts (resulting in an upright triangle shape), or a process of induction, mapping general to specific concepts (resulting in an inverted triangle shape).

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Renders, A. B, Fonseca, M, Pinto. (2006)- Towards meaningful learning in under graduate medical education using concept mapping in PBL Path physiology Force”-Problem based learning is now an established method in under graduate education that aims to develop skill based on clinical problems. More recently the use of concept mapping in medical education aims to improve meaning learning at the new university of Lisbon. They have been using PBL as major education method in Path physiology course. In 2003 and 2004 they started the use of inspiration, a computer based concept mapping tool with a single tutorial PBL group. A total of 36 map where constructed related to short cases, already use in the PBL course in which certain number of key nodes were hidden to allow the students to fill in the gap. The result obtain appear to indicate that the use of concept maps stimulated meaningful learning within a PBL course.