Effectiveness of a Cartoon Based Programme to Teach Science in Standard VIII

A Dissertation Submitted to the Sardar Patel University,
Vallabh Vidyanagar in Partial Fulfillment of the
requirement for the degree of

Master of Education

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Certificate

This is to certify that the work incorporated in the dissertation bearing the title **"EFFECTIVENESS OF A CARTOON BASED PROGRAMME TO TEACH SCIENCE IN STANDARD VIII"** submitted by **Ms. Nikita Patel** comprises the result of independent and original investigations carried out. The materials that have been obtained (and used) from other sources have been acknowledged in the dissertation.

Vallabh Vidyanagar
March , 2013

Signature of the Researcher
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Certified that the work mentioned above is carried out under my guidance.

Vallabh Vidyanagar
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Certificate of Approval

This dissertation directed and supervised by the candidate's guide has been accepted by the Waymade College of Education, Sardar Patel University, Vallabh Vidyanagar in partial fulfillment of the requirement for the degree of

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Nikita Patel

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INTRODUCTION

1.1 INTRODUCTION

Man has been trying to understand the changes going around him and has been constantly receiving a great number of impressions through his various senses such as hearing, sight, smell, taste and touch. Making an effective use of his senses and his communicative ability has enabled him to accumulate information about his surroundings. This systematic store of human knowledge gained after generalizing and inter-relating the various isolated facts is known as Science.

Human mind has always been busy in pursuit of knowledge exploration. This search for knowledge has enabled human beings to arrive at facts, theories and assumptions via cause and effect relationships. This has led to the development of science. This store of knowledge can be inherited from generation to generation for preservation and progress of civilization and society. There are several perspectives to science. Some of them are discussed below.

- **Science as a body of knowledge:** This body of knowledge includes facts, concepts and theories that are subject to error and change. The scientific knowledge exists in the form of facts, concepts, principles, laws, hypotheses and theories. Science is dynamic in nature; scientific information is constantly being rearranged and reoriented in the light of new knowledge. Science never proves anything in an absolute sense. It accumulates data by observation. Measurement from an assemblage of such data the scientist constructs a hypothesis.

- **Science as a method of inquiry:** Science teachers should emphasize that scientists approach the solution of any specific problem in an organized manner with inspiration, imagination and insight. The steps defined by Karl Pearson for scientific method are helpful guidelines for solving a problem. The steps in scientific methods are mentioned below.

- Identification of the problem
- Gathering observation relevant to the problem on hand
- Statement of a hypothesis based on observations gathered
- Testable predictions of other related observable phenomena are developed from the hypothesis.
- The hypothesis is tested through observations.
- As a result of empirical observations the hypothesis is supported, rejected or modified

- **Science as a way of thinking:** The acquisition of scientific attitude is one of the most important outcomes of science. A person with a scientific attitude will have the following characteristics.
  - Open mindedness
  - Objectivity
  - Freedom from superstitions
  - Belief in cause-effect relationship
  - Accuracy and truthfulness in reporting observations
  - Methodical way of solving a up to dated problem

Science is a multi faceted enterprise as well as a complex abstraction. It is more than having a look at a plant or mixing chemicals in test tubes in the science laboratory. It is way that looking at things that which interconnects the answer to the problem through disciplined imagination. It is comparatively easier to experience science than define it. It can be defined as what scientists do.

It is very important to prepare and provide proper learning materials to students and to actively involve them in learning processes. The students need to think, solve, question, discuss, and write in classroom. This implies that a lot of materials need to be prepared for the learners. Since decades, Science educators have been experimenting with the different techniques and methods of learning. The focus of the present research is on one of the techniques, namely Concept Cartoons.
The following section discusses the same in brief.

Concept Cartoons

Concept Cartoons and analysis of Concept cartoons are a new approach to teaching, learning and assessing in science. Cartoon style drawing showing different characters arguing about an everyday situation are designed to intrigue, to provoke discussion and to stimulate scientific thinking and May not have a single right answer. A typical Concept Cartoon has the following features:

Visual representation of scientific ideas, minimal text in dialogue form, alternative view points on the situation. Scientific ideas are applied in everyday situations. A scientifically acceptable viewpoint is included in the alternatives; the alternatives are given equal status. Some of the characteristics of concept Cartoons are presented below.

Characteristics of Science Cartoons

- Science concepts are presented by linking them with every day events. In this way, students can see the relationship between science concepts and every-day life Science concepts can be applied to every age and every grade level.
- Alternative thinking ways and misconceptions presented in balloons in Concept Cartoons are chosen from research that investigates students thinking. This will increase validity and believability of alternative thinking.
- Scientific thinking methods are also presented in Concept Cartoons.
- Concepts presented in balloons are short and within the level of understanding for students. This is especially important for elementary students' reading and understanding ability of Concept Cartoons.
- Concepts presented in the balloons should have similarity in their meaning and are believable.

Teaching and learning through traditional methods was more teacher centred. Keogh and Naylor (2005) indicated that Concept Cartoon approach was introduced as a teaching and learning approach, which took account of constructivist views on learning various subjects. Researcher in past have also indicated that Concept Cartoons could be effective for elicitation of ideas and they tended to have a positive impact on learner motivation and involvement. (Keogh and Naylor, 1999).

Accordingly, an attempt is made in the present research to explore the potential of Concept Cartoons in teaching of science. An overview of the research methodology is depicted below.

1.2 Statement of the Problem

The title of the study can be stated as under.

'Effectiveness of a Cartoon Based Programme to Teach Science in Standard VIII.'

The important terms related to the research are operationalised below.

1.3 Operationalisation of Terms

The researcher has operationalised the term, Effectiveness and Cartoon Based Programme.

Effectiveness

Effectiveness means usefulness of the programme /output of the programme. This mainly refers to the improvement in achievement scores of the students in the pre test and post test.

Cartoon Based Programme

It is a set of lesson plans in which intensive use of cartoon based teaching technique and tasks is used.

The research was carried out with the following objectives in mind.

1.4 Objectives of the Study

The objectives of the study are mentioned below.

- To prepare a Cartoon Based Programme to teach Science.
  (1) To identify the concepts from textbook.
  (2) To prepare or construct Cartoon Based tasks to teach the Concepts.
- To implement the Cartoon Based Programme in the classroom.
- To evaluate the effectiveness of the Cartoon Based Programme to teach Science at Standard VIII.
- To study opinions of the teachers towards Cartoon Based Programme.

The hypotheses are mentioned below.

1.5 Hypotheses

A hypothesis is a guess or hunch. The researcher has framed a null hypotheses and made attempts to test the same in the present study.

(1) There will be no significant difference between mean achievement scores of pre test and post test of students in the control group.

(2) There will be no significant difference between mean achievement scores of pre test and post test of students in the experimental group.

(3) There will be no significant difference between mean achievement scores of post test of students in the control and experimental groups.

The variables of the study are mentioned below.

1.6 Identification of Variables

In any experimental research variables are very important.

In the present study, the academic achievement of students is taken as dependent variable and the cartoon based programme is the Independent variable.

1.7 Delimitation of the Study

The cartoon based programme was prepared for three chapters from the text book for standard VIII of Gujarat State Examination Board.

1.8 Significance of the Study

Science is a dynamic, expanding body of knowledge covering ever new domains of experience. Science has the potential to be beneficial or harmful, emancipative or oppressive. Science is a process for producing knowledge. The process depends both on making careful observations of phenomena and on inventing theories for making sense out of those observations. Change in knowledge is inevitable because new observations may challenge prevailing theories. No matter how well one theory explains a set of observations, it is possible that another theory may fit just as well or better, or may fit a still wider range of observations. In science, the testing and improving and occasional discarding of theories, whether new or old, go on all the time. Scientists assume that even if there is no way to secure complete and absolute truth, increasingly accurate approximations can be made to account for the world and how it works.

Understanding science concepts requires linear and logical thinking. Science is not just about being able to memorise the facts. The students need to be able to apply them, analyse and critique data. Learners face no of difficulties when they learn science. They experience lack of interest in the subject. Hence students find it difficult to remember formulae, theories, reactions, principles, laws, etc. For that teachers need to adopt various methods of teaching the subject to minimize the learning difficulty level of learner.

One of the traditional methods i.e. lecture method is generally followed in classrooms. It is one way process as students are not allowed to express their views and they become passive listeners. Other methods used in teaching are problem solving method, project method, discovery method, demonstration method and discussion method etc. Teaching learning process becomes monotonous when teachers follow a single method and technique and due to that active participation from the side of the learner as well as teacher is not seen. So there is a need for innovative techniques and methods which provide learning with joy, interest, curiosity and motivation. By adopting innovative methods, techniques and active participation the effective group dynamics and collaborative cum participatory learning among learner is seen. One of the innovative techniques of teaching science is cartoon based learning which can be used for making teaching learning process effective. In teaching learning process cartoon is a kind of stimulus for learners that allows them to brainstorm the things. So the learner thinks ‘out of box’. Cartoons enable learners to think critically and go beyond textual information; relate it with their day to day life experiences. A cartoon allows them to work on the situations in diverse way.

Concept cartoons may also be used as a starting point to encourage students during class discussions and identify their prior knowledge (Bing and Tam, 2003).

Kabapinar proposed that the phases of concept cartoon based teaching as “introduction of cartoons”, “discussion about cartoons”, “investigation about ideas in the cartoons” and “re-interpretation of the ideas in the cartoons by taking the investigation findings into account”.

Naylor and Keogh (1999) argued that constructivist approach brings a need for new teaching and learning methods and exhibit concerns about teachers' and students' possible resistance towards these innovations. They found concept cartoons useful in identifying students' prior knowledge.

The researchers found that Concept Cartoons (a) Help in eliciting student misconceptions in a short time (b) Provide participation of almost all students in class discussions, (c) Motivate and activate the students in order to advocate and support their arguments, and as a result (d) Eliminate their misconceptions (Keogh, Naylor & Wilson, 1998; Keogh & Naylor, 1999; Naylor, Keogh, DeBoo & Feasey, 2001; Stephenson & Warwick, 2002; as cited in Saka et al., 2006).

Researches in past found that concept cartoons increase student motivation, and provide constructivist learning environment where the students participate in classroom discussions comfortably and enjoyably. In addition, in science and technology courses, the concept cartoons, targeting active enrolment of students, provide them social environment to express their ideas freely (Saka et al., 2006)

Cartoons are tools that have been used successfully as a means of assessing students' learning in science. They can be used at the beginning, middle and end of a unit to assess students' prior knowledge and new knowledge.

The research undertaken by the researcher has contributed to the field of science education i.e. attempts were made to teach concepts of science in an innovative manner. The researcher prepared a Cartoon Based Programme to teach science in a joyful and experiential manner.
The chapters included in the report are depicted below.

1.9 Scheme of Chapterisation

Chapter 1 Introduction This present chapter begins with an introductory note and states the problem of the study with the operationalization of key terms. It also states the objectives of the study undertaken, hypotheses framed and Significance of the study as perceived by the researcher.

Chapter 2 Conceptual Framework This chapter focuses on the conceptual framework or theoretical background of the study undertaken.

Chapter 3 Review of Related Literature the chapter begins by stating the objectives with which review of related literature is done and then presents the different studies reviewed for the present work.

Chapter 4 Methodology of Investigation The chapter focuses on the methodology adopted in the present study. It describes in detail the research design selected for the present study, the tools used and the procedure adopted for data collection as well as data analysis.

Chapter 5 Data Analysis and Interpretation In this chapter the collected data have been analysed and presented in a tabular form. Interpretations based on the findings have been presented.

Chapter 6 Findings, Suggestions for further Study and Implications The last chapter of the dissertation deals with the conclusions drawn from the present study. It also presents some suggestions for the future studies that can be undertaken in the field.

The subsequent chapter focuses on the Conceptual Framework of the study.

Chapter 2
CONCEPTUAL FRAMEWORK

2.1 Introduction

'Science' has been derived from the Latin word 'Scientia' which means knowledge. Science is a systematic observation of natural events and conditions in order to discover facts about them and to formulate laws and principles based on these facts. Science is an intellectual activity carried out by humans that is designed to discover information about the natural world in which humans live and to discover the ways in which this information can be organized into meaningful patterns. Science is about gaining a deeper and often useful understanding of the world. Science is about the suspension of belief". Science is like a hungry furnace that must be fed logs from the forests of ignorance that surround us. The meaning of science was to know God better.

Science is the conscious disciplined, systematic and sustained endeavour to methodically discover the non - obvious truths of both nature and society. Science is knowledge gained by testing ideas against reality.

2.2 Definitions of Science

Science is an endless frontier. Various definitions of science are encountered in literature since it came to be studied as a formal discipline. Some of them are enumerated here.

Science is an ordered knowledge of various natural phenomena and a rational study of relationships existing between the concepts which define or express those phenomena. Science is a specific way of looking at the world. To many scientists, science is the systematic study of structure and behaviour of the physical and natural world through observations and experiments.

Science means the pursuit of knowledge but it has a wider connotation for our purpose and can be said to mean knowledge of nature in the widest possible form. This includes study of physics, astronomy, meteorology and much more. It is equally

important to look beyond mere precise definitions and see what science includes. The following aspects are of fundamental importance in the study of this subject.

1. Direct and Indirect observation
2. Scientific inquiry – asking questions
3. Drawing inferences from observations
4. Recording observations
5. Developing ways and means to find answers
6. Classification and checking evidence

There are a number of methods used to teach science across levels. The following section focuses on the same.

2.3 Methods of Teaching Science

The best method is that which establishes a rapport between teacher and taught vis-a-vis science content and its utility in day to day life.

(1) Lecture method

This is a method generally followed in higher classes. In this method, only the teacher talks and delivers content. The students are by and large passive listeners and they do not take any active part. This is purely a teacher centred method.

(2) Demonstration method

This method is based on the principle 'Truth is that which works.' This method is one of the best methods for teaching science to secondary classes. If the teacher feels that s/he will have to put in more work by rehearsing, arranging and then demonstrating, that is not case. Here, pupils do everything regarding arranging, rehearsing etc. The teacher always guides and facilitates the teaching learning sessions.

(3) Problem solving method

This method applied in the classroom or science laboratory helps in the development of scientific attitude and training in scientific method. The students are given situations and problems to solve, explore and thereby learn. This method is purely student oriented.

(4) Assignment method

This is one of the best suited methods because it involves a harmonious combination of training at the demonstration table and individual laboratory work. In an ideal method of science teaching, theory and practical work should go hand in hand. The students get the opportunities to work at their own pace and thereby learn. The method may include tasks that are student centred or guided by teachers.

(5) Project method

It is based on the philosophy of pragmatism. John Dewey wanted that education should be for life and through life. The gap between school life and home life should be bridged. This method is based on the principles of learning by doing, learning by living and co-operative learning. Projects are student oriented ways of learning that aims at providing first hand experience about life.

(6) Heuristic method

According to Prof. Armstrong, "The soul of the learning of science is exploration. The students should explore the facts and principles themselves". In this method the students learn by exploring. The teacher's role is that of the path setter who rectifies the faults at the proper time. As the children work and perform experiments they attain new knowledge. The student works as an explorer. She/he does not have knowledge of experiment in the beginning.

(7) Discussion method

In this method of teaching, students discuss a problem together. A topic is taken and the teacher encourages the students to discuss it. He develops the lesson with the help of the answers and reactions of the students. In this method students have freedom to express their views.

(8) Review method

According to Lawrance Urdang, "Review is the process of going over a subject in study or recitation in order to fix it in the memory or summarise the facts, criticism, imply carefully examining something making a judgement and putting the judgement into written form." The teacher prepares the lesson. Ponders over the important points and tries to locate topic which would be more useful for the students. Review also

helps the teacher find the shortcoming of his teaching and what he can do to remove them.

(9) Discovery Method

In this method the students discover new facts / knowledge in an original manner as per their mental level, age, class and other related facts. The facts are explained in a manner by which they give a sense of new facts. It makes students active and develops their power of reasoning and observation. The students can evaluate the differences between various facts and assumptions.

(10) Role Play Method

This is a role performing method related to development of knowledge and social dexterity. It may bring change in the taste, interest, inclination and attitudes of students. Imitation teaching is given importance in this method. The student enacts the role of both the teacher and the taught. One student poses as a teacher and the rest of them act as students. They express their feelings and experiences in a natural manner.

(12) Sensitivity training method

This is a method by which the relations among the students are developed, they are sensitized towards a problem. Their ego is aroused and they start working vigorously according to their capability.

(13) Laboratory Method

Laboratory method usually involves carrying out experiments by either individuals or in small groups. Students are encouraged to derive the laws and principals of science themselves by actually performing the experiments. The students are given all necessary materials and equipments in the laboratory along with proper instructions for carrying out their experiments with their own initiative and efforts. Then they carry on the experiments and record the observation and infer their own result. They learn by their own experience, observation, testing and verification. The teacher supervises their work and also guides them whenever needed.

(14) Tutorial Teaching Method

Tutorial method is that method of teaching which can be used individually or for groups also known as 'intensive instruction' method. Cognitive and affective objectives can be achieved through this method.

(15) Independent Study Method

It is a student centred method. The teacher tries to develop capability in the students, so as to enable them for self study or work independently to solve a problem. The students remain active and study by themselves to find solutions to a particular problem. Supervised study method is a form of independent study method.

(16) Lecture cum Demonstration Method

This method is economical both time and energy wise. The teacher explains the theoretical portion with the help of lecture method making use of diagram and statements. Then to make the theoretical portion more clear, he performs the experiment with the help of students. During the course of experimentation, he keeps asking questions to the students.

Teaching methods are determined by the teacher keeping in mind the capability of students and curriculum. In the absence of the correct direction or path, a person can't reach his destination. In the same way in the absence of a proper method the students can't be given correct knowledge.

Now days science teachers adopt different innovative and joyful ways of teaching science. The following section focuses on the same.

2.4 Innovative Ways of Teaching Science

There are a number of ways to teach science. Some of them are innovative and joyful like using puppets, storytelling, games and cyber fairs.

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A number of participatory approaches like interactive tasks based on the above tasks. Moreover, the use of experiments, scientific investigation promotes the concept mastery and skill development among students vis-a-vis. higher order thinking skills. The effectiveness of cartoons in classroom is depicted below.

2.5 Concept Cartoons

A cartoon is a pictorial caricature representation of a person, an idea or situation that is designed to influence public opinion. It is a pre-digested source of information with a strong visual impact. Cartoon may be a unit of pictures which can provide a whole and complete meaning related to an idea or situation. It requires very less background and foreground for understanding. Because of its uniqueness and simplicity it can be effectively used in appraising, interpreting and emphasizing any event, person or matter. Most commonly, cartoon is used in connection with fields such as politics, geography, economics and sociology. But increasingly, it is being utilized in commerce, science, literature, mathematics. Educational cartoons are used in the educational books and magazines for educational purpose. It is used for learners of all age and all levels.

2.5.1 Significant Features of Concept Cartoons

- They are based on everyday situations that don't appear to be scientific. So students lacking in confidence are less likely to be intimidated by science and more likely to engage with them. These everyday situations appear to be effective across geographical and cultural boundaries, enabling Concept Cartoons to be used successfully in a wide range of countries.
- They present alternative viewpoints on the situation, including the scientifically acceptable viewpoint(s). Most of the Concept Cartoons embed scientific ideas in everyday contexts, and the contextual features can influence how the problem is interpreted, so that in many cases there can be more than one scientifically acceptable alternative. This presents an additional level of challenge to learners, especially to high achieving students.
- They have a blank speech bubble, to give a clear statement that there may be more ideas that are not yet included in the dialogue so that learners are encouraged to explore alternative ideas.
- The background text is written in students' language. So they can be used independently by learners if the teacher feels that this is appropriate. This extends the range of ways that teachers can choose to use Concept Cartoons in their classrooms.
- All the alternative viewpoints have equal status. When the teacher presents a

set of alternative viewpoints in a Concept Cartoon, all of these viewpoints are seen as legitimate. This gives less confident students support in voicing what they think, because someone else has already articulated their ideas. If their ideas are incorrect then they can put the blame on the Concept Cartoon character. Keogh and Naylor's early research indicated the need to minimize any contextual clues, such as those given by facial expressions or wording of statements, so that students cannot use these to attempt to work out their answer.

- The speech bubbles include common misconceptions, so these can be recognised and addressed directly in the lesson. Some teachers are concerned that raising misconceptions may make students more likely to believe these, but research indicates that this does not happen in practice and that Concept Cartoons can be a very effective way to challenge misconceptions.
- They present plausible alternatives that are based on research evidence about students' ideas at different ages.

2.6 Role of Concept Cartoons in Teaching Science

Cartoons are used in the classroom mainly because of the following.

* **Effective and easy medium of communication -** Cartoons are potential medium for communicating ideas and concepts in all levels effectively and easily. It has proved to communicate social economic and political message effectively and comprehensively with minimum language and space.

* **Greater sources of motivation -** By its nature an effective cartoon readily attracts attention and arouses interest of the viewer. This suggests that appropriate cartoon materials can be useful motivation devises in the classroom.

* **Helpful in illustration** - Illustration is the major ingredient of cartoons. A major portion of the message is communicated to the viewers and readers only with the help of illustration.

* **Scope for imagination and creativity -** Cartoons are the product of the creative imagination skill and individuality of the cartoonist. It can be used to increase the imagination and creativity of children. Cartoon reading helps children to create their imaginary ideal world and to follow the rules, discipline and regulation of that world.

*** Scope of interest –** Cartoons can sustain the students' attention and interest for a

longer time.

* **Provides information along with fun and pleasure -** It is very easy to pass information to the students with the help of cartoons information of boring and dull nature can also transfer immediately with this medium. The desire and interest for fun and pleasure can also help learners to get abstract information and help in making it concrete.

* **A language free, culture free and religion free medium** - Though cartoons have message, it can communicate message to the learners of different language, culture and religion. So if prepared carefully it can be used in a multilingual, multi religious and multi cultural country like ours in the best possible way.

Cartoon can be a wonderful and versatile medium in enhancing teaching and training teachers. According to Keogh and Naylor the following are the roles of Concept Cartoons in teaching Science.

Adjudication - When learners use Concept Cartoons they find themselves in the role of adjudicator – that is, they make judgments about the ideas that other people hold. This is an unusual role for learners and a reversal of the more typical situation where the teacher acts as adjudicator for their ideas. One of the consequences of teachers making judgments about learners' ideas is that learners tend to avoid taking the risk of being wrong (Dweck, 2000). Less confident and low achieving learners are often unwilling to put forward their own ideas in case they are wrong. Taking on the role of adjudicator can be empowering for learners, since they are doing the judging rather than having their ideas judged by the teacher. This enables less confident learners to engage in argumentation and put forward their ideas more readily (Solomon, 1999).

Argumentation - Concept Cartoons act as an effective stimulus for argumentation, including enabling students to co-construct arguments. They enable argumentation to take place without the need for any formal structure, specific vocabulary, or teacher intervention in managing the process of argumentation. Concept Cartoons focus on scientific issues, in contrast with much of the research on argumentation where the focus is on socio-scientific issues. Research into argumentation using Concept Cartoons raises questions about the value and applicability of the commonly-used Toulmin model for analysing argumentation (Naylor, Downing and Keogh, 2001; Naylor, Keogh & Downing, 2007). The complexity of the model and the language

used appear to make it unsuitable for use with younger learners in primary schools or students with a restricted language register.

Subject knowledge - There is a requirement for student teachers' subject knowledge to be audited, in order to ensure that they have sufficient relevant subject knowledge for entering the profession. Concept Cartoons have been used as an effective means of auditing student teachers' subject knowledge, so enabling them to identify where they need to develop their ideas further. In some cases the use of Concept Cartoons acts as an effective stimulus for student teachers to engage in further research to develop their own understanding, coupling together assessment and continued learning in an integrated process (Naylor, Keogh, de Boo and Feasey, 2000).

Cognitive conflict - Learners find themselves in a position of having to give serious consideration to these plausible alternatives, many of which they may never have thought of before, and this makes them effective at generating cognitive conflict. For more confident, higher achieving learners this can be an important step in getting them to think more deeply about scientific concepts (Keogh and Naylor, 1999). Not having an obvious right answer, or not having a single right answer, makes cognitive conflict more likely.

Formative assessment - It has been evident since Concept Cartoons were first developed that they can integrate formative assessment and learning in a single activity (Keogh & Naylor, 1999). Even when they are used for summative assessment they can help to integrate assessment and learning (Naylor, Keogh, de Boo and Feasey, 2000). In addition, Millar and Murdoch (2002) suggest that Concept Cartoons compare favourably with other formative assessment strategies in their impact on learners. Chin and Teou (2009, 2010) found that Concept Cartoons can be used for both self and peer assessment as part of formative assessment, and that they provide valuable diagnostic feedback to teachers about students' misconceptions, so enabling the teacher to be more effective in promoting conceptual change.

Higher order thinking skills - The dialogic approach encouraged by Concept Cartoons is empowering for learners and helps them to move away from a passive approach to thinking and learning, so that they probe more deeply into their

understanding of the topic and become more independent of the teacher (Foley, Boylan and McTearnan, 2011). Thus concept cartoons focus on developing thinking skills of students.

Informal learning settings - The nature of Concept Cartoons means that they are not identified exclusively with formal learning settings. They can bridge the gap between formal and informal learning settings because they are based around everyday situations that appear to involve ordinary characters doing ordinary things. They have been used successfully in a range of informal learning settings, such as corridor displays in school, thinking homework that involve family members in thinking about scientific problems, parents' open evenings at school and exhibits at science exploration centres.

Language skills - Pictorial representation of ideas, coupled with the minimal text, makes it relatively easy for learners to engage with Concept Cartoons in a language that is not their home language. It is widely recognized that language can be an important barrier to learning in science. With their relatively simple representation of concepts that learners are likely to recognize, Concept Cartoons can provide an accessible entry point for language learning and can help learners to develop their language skills (de Lange, 2009). In some countries (e.g. Norway), the English versions of Concept Cartoons have been used for many years as a way of consolidating English language learning in addition to learning about science.

Misconceptions - In looking for evidence and constructing suitable arguments to justify their ideas, learners often come to recognize for themselves that their understanding is limited and that there are more productive ways of understanding the situation. Since Keogh and Naylor first noted this (1999), several studies have confirmed how Concept Cartoons help to not only challenge students' misconceptions but can also go on to help remedy these misconceptions (Chin and Teou, 2010; Dolasir, 2007; Ekici, Ekici and Aydin, 2007; Kabapinar, 2005; Rahmat, 2009; Stephenson and Warwick, 2002).

Motivation and engagement - Concept Cartoons have been found to be highly motivating for groups of learners of all ages and backgrounds and in a variety of

circumstances, including those students who have emotional and behavioral difficulties. Learners tend to spend longer on task, to sustain their levels of interest and to interact confidently with their peers. It is suggested that for less confident students, having voices speaking for them gives them the confidence to discuss their ideas (Keogh and Naylor, 1999). Repeated use of the Concept Cartoon strategy does not appear to reduce the level of engagement of learners (Keogh and Naylor, 1999). Birisci, Metin & Karakas carried out a study with student teachers and found a similar impact on their motivation to use Concept Cartoons, quoting one student teacher as saying that Concept Cartoons *rescue students from boring traditional teaching* (Birisci, Metin & Karakas, 2010).

Thus, from the above it is evident and clear that Cartoons have huge potential in classroom.

Conclusion

From the above discussion it is evident that Cartoons have the fun and elavative element of learning and can enhance academic performance of the students. A number of researchers have explored the potentials of comics, cartoons and pictures in teaching. The subsequent chapter focuses on Review of Related literature.

Chapter 3
REVIEW OF RELATED LITERATURE

3.1 Introduction

The following sections presents the reviews related to books and researchers in the area of science education. The reviews include researches in the field of methodology of teaching science as well as cartoon concepts in specific.

3.2 Review of Related Literature

The review of related literature is an exerting task calling for a deep insight and clear cut perspective of the overcall field. It is a crucial step which invariably minimizes the risk of the dead ends, rejected topics, rejected studies, finding based on a faulty research design. The review of literature also promotes greater understanding of the problem and its crucial aspects and ensures the avoidance of unnecessary duplication.

Survey of related literature provides valuable help in the development of knowledge in research work. It helps the investigator to gain insight into various aspects of the problem area that is in formulating a framework for the study, developing the methodology, constructing the tool for data collection and planning the analysis of data.

The subsequent section focuses on theoretical reviews from books and articles.

3.3 Theoretical Review

Vaidya, N. (2003) in the book 'Science Teaching for the 21st century' indicates that teaching and learning always go hand in hand. Where there is a capable well prepared teacher and a motivated student learning occurs. This book on science methods provides valuable resource that can help prepare the science teachers of the future anywhere. In this book total 14 chapters are included. Author mentions that it is very important for science teachers to have some practical knowledge about the varied ways children learn science, and then there are many factors which influence learning in one way or another, i.e. Motivation, interest and attitudes, difficulty of teaching materials, poor communication and class size and lack of physical facilities in the classroom.

Joshi, S.R. (2007) mentions in the book, aims and objectives of teaching science. The objectives of teaching science have undergone an immense change during the last few decades. Science was recognized as one of the subjects in the school curriculum. Society is new exerting pressures, demanding conceptual change in science teaching. Science teaching should be directed towards living in a modern technologically oriented society. The knowledge and skills of the Science subject is helpful in selecting the appropriate raw material and devising ways and means for the improvement of processes and products science teacher must also take care of all the occasions and opportunities where he can make his students conscious and aware with the application of scientific facts and principles in gaining useful experiences and skills related with various work experiences.

Mohan, R. (2007) in the book 'Innovative Science Teaching' mentions that construction as a process in which learners construct new ideas or concepts based on their current and past knowledge. Constructivism focuses on knowledge construction while in tradition education the role of teacher is seen as that of a transmitter of knowledge in the constructivist classroom a teacher's role changes significantly. The teacher in the constructivist classroom is to act as a guide. The teacher's job is to provide opportunities for learners to expand knowledge in an active and engaged format. Bringing constructivist principles into classroom have implications for the learning environment.

Ward, Judith, Hewlett, and Foreman (2008) in the book 'Teaching Science in the Primary Classroom' mentions that science education is important because it produce well balanced individual members of society. The author states that Science has had two aspects first a body of knowledge and second way of working. One of the principle aims of science education has been to develop pupils understanding through the use of scientific approaches. The challenge for today's primary teacher is to break from the traditional mould and to teach science in a creative way making it more relevant to the future generation of could be scientists. In science from stories mention that stories provides a vehicle to link previously learnt concepts with new ideas. Good stories have the potential to motivate pupils by making them feel involved through the linking of their own understanding of the world. Science from games indicates that playing games of different types provides a wealth of learning opportunities. Play is

known to be a powerful mediator for learning throughout a person's life. Games can be good for helping learners with the hard to learn facts.

Bhatnagar, A.B.(2012) in the book 'Teaching of Science' expresses that science and technology are playing important role in our lives. They have become an integral part of our social and cultural life. Various activities are controlled and governed by science. It has helped man to acquire supremacy over nature. The Author mentions definitions of science given by different scientists. According to Tennyson 'science moves but slowly, steadily, creeping on from one point to another but actually the progress has been rapid". The teaching methods are determined by the teacher keeping in mind the capabilities of students and curriculum. The teaching methods tell him how he/she should teach his/her students. Programmed learning is one of the newer techniques of effective science teaching. It is based on the principles of reinforcement. The programmes may be in the form of books, cards and machines. Module based learning can be different forms. They can be written form or in form of slides, tapes, pictures. Modular approach is an effective and economical way of developing specific knowledge and skills with the minimum of teacher's direction and supervision.

Implication of the above Researches to the Present Study

From the above reviews of books, it is evident that Science is an important subject and is an important part of the curriculum at all levels. Moreover, the review of related literature from books suggested a range of teaching learning methodologies used to teach Science. Most of the methods are found to be advantageous for student centred methods. Most of the authors suggested scope for innovative teaching learning methodologies in Science and also expressed that the complicated facts, concepts and theories can be made easy by relating the knowledge of Science to life.

The following section focuses on the research based reviews related to the present research.

3.4 Research Based Review

3.4.1 Reviews Based on Methodology of Teaching Science

Phutola, R.L. (1991) studied the effects of comics and comic television serials on children. The objectives of the study were (1) To survey various types of available comic books and comic television serials and (2) To study their likes and dislikes as regards comic books/serials. Findings of the study indicated that students like stories on magic, most of teachers felt that comics are useful in many ways cartoon television serials, the percentage of preferences are higher. Parents liked these serials as these provided entertainment, adventure recreation and children learnt new things and got entertained.

Inel and Balim, (2010) studied the effects of using problem based learning in science and technology teaching upon student's academic achievement and levels of structuring concepts. The study employed a non equivalent pre test- post test control group design as an experimental research method. Continuous four weeks experimental application process was given and the experimental group was taught by using problem solving method and controlled group was taught on the basis of the science and technology curriculum. Four modules were used in experimental design. In each module, real life problems were included in concepts about digestive system, Nervous, Endocrine and Excretory system. Data was collected by using academic achievement test on the unit 'systems in our body' and open ended interviews. Data analysed by using Whitney U test non statistical technique. Findings of study revealed that there was no significant difference between the groups means academic achievement scores before the experimental application, a significant difference was found between the groups academic achievement after the application in favour of the experimental group. Author argued that the use of the problem based learning method in science and technology; teaching is more effective in enhancing students' academic achievement than simply using the science and technology curriculum.

Bhatia, M. (2010) studied the effectiveness of teaching general science to the student's teachers through holistic approach. The objectives of the study were (1) To study the effectiveness of holistic approach of teaching science in terms of holistic development of student teachers. (2) To study the reactions of the student teachers on

holistic approach of teaching. Sample of the study constituted 24 science method student teachers of B.Ed of Navarachana College of education. Tool were used cognitive achievement test, spiritual domain test and reaction scale. Data was analysed by using content analysis. Finding of the study said that the teaching of the general science to the student teachers through holistic approach has been found to be effective.

3.4.2 Reviews Based on Concept Cartoons

Keogh, B. and Naylor, S. (1997) stated that Concept Cartoon was used in teaching, learning and evaluation. Researchers have used concept cartoons within a normal teaching sequence. Data collection was done through questionnaires from primary, higher secondary level. Interviews conducted at the end of the research period. Data also collected through observation. This study indicated a number of ways in which the use of concept cartoons has been found to be valuable in typical classroom teaching sessions. Finding of the study revealed that the concept cartoons provide open discussion for many learners and appear to encourage reluctant learners to engage in debate.

Rule and Auge (2005) used humorous Cartoons to teach mineral and rock concepts in six grade science class. It hypothesized that students taught science concepts through viewing, critiquing, improving, completing and creating humorous Cartoons were able to retain the information better than students taught by using traditional methods. Data collection was done by random sampling method. Study was experimental in nature. Researchers implemented module on two groups, one experimental and other control group. Pre test – Post test design as an experimental design. Data analysis was done by using ANOVA variance. Pre test score of the experimental groups was 0.4 and pre test score of control group was 0.3. Most students enjoyed learning science in the new method of using cartoons evidenced by their enthusiasm in class. Student in the control group were disappointed that they were not shown the cartoon slide shows.

Kabapinar (2005) introduced Concept Cartoon approach as a teaching and learning approach which took account of constructivist views on learning science. Also, a number of Concept Cartoons were created and used in various primary science classes

in an attempt to find out the potential benefits of teaching via concept cartoons. First, a number of case studies were conducted in different primary science classes (4th and 5th grades) to study Concept Cartoons' effectiveness. Students' ideas were determined both individually via written probes and during classroom interactions. The results of the case studies indicate that the Concept Cartoons were effective for finding out students' ideas without being affected by the ideas of others. Secondly, a number of case studies were conducted to determine the effectiveness of Concept Cartoon teaching. Results showed that Concept Cartoon teaching was effective in creating focused discussions where reasoning behind students' misconceptions could be uncovered, especially via teachers' thought-provoking questions. It was also found that the method was effective in providing a purpose for investigation as long as the context lies itself for an investigation. Lastly, two experiments were designed to answer the question of how effective Concept Cartoon teaching for students. For this reason, students' ideas were determined before and after the teaching. The results of these experiments indicated that teaching via Concept Cartoons was effective in remedying the misconceptions. It needs to be emphasized that the success of teaching does not only stem from the Concept Cartoons itself as a teaching material but it also stems from the quality of classroom interactions during the discussion and investigation phases of the teaching.

Siew (2007) used Concept Cartoons to develop conceptual understanding of light in primary pupils. Sample included 35 pupils and plan conducted over a period of 5 weeks. Pre and post test achievement test and interviews were conducted with the pupils. Study indicated that majority of the pupils had misconceptions about light. Achievement scores of post test obtained by the pupils were higher than pre test scores. Finding of the study showed that Concept Cartoon is one of the effective techniques in developing Pupils conceptual understanding of light.

Ekici, F., Ekici, E. and Aydin, F. (2007) in a research article 'Effectiveness of Concept Cartoons in Diagnosing and Overcoming Students' misconceptions related to photosynthesis', the authors stated that the purpose of the study was to present the effectiveness of Concept Cartoons in diagnosing elementary student misconceptions in the subject of photosynthesis. Objectives of the study were (1) to examine the role of Concept Cartoons in the elimination of identified misconceptions. (2) To explore

student views about Concept Cartoon based teaching method. First the researcher has been thoroughly examined the literature and misconception about photosynthesis had listed and then grouped the students. Cartoon related to Concept had prepared and in order to identify their misconceptions. Then new Concept Cartoon addressing to elimination of these misconceptions prepared and used in class discussions. Comparison of finding of the study and misconceptions about photosynthesis in the literature shows that Concept Cartoons may be utilized in the identification and elimination of misconceptions. Another Finding of the study was that it can be utilized in science education due to its compatibility to constructivist approach.

Wen-Cheng Chen and Chih- Hsiung Ku, (2008) studied the effects of Concept Cartoon argument instruction on the student argumentation. The one group pre test-post test design adopted in this research. The samples were 21 upper graders in a remote elementary school. The Cartoon Concept argument instruction provided for six weeks. Achievement test were used to collection of data. Data analyzed by using dependent sample t-test and ANCOVA. The finding of the study the analyzed results indicated that the mean post test scores were higher than pre-test. There was significant difference between pre and post test in all six sessions and the effect size ranged between 0.62 and 0.99. Findings of the study indicate that applying the Concept Cartoon strategy to argument instruction could enhance the student argumentation ability. Students in the high and mid score group outperformed students than the students in the lower score group with increase of familiarity with the instruction, all the three groups showed decreasing difference in their post test performance.

Emanuel and Gandhi. (2012), in a research article 'Continuous and Comprehensive Evaluation through Cartoons conducted an action research to evaluate students' understanding of environmental Concepts through Cartoons. The objectives of the study were (1) to find out the opinions of the learners towards the cartoon analysis task (2) to find the effectiveness of Cartoon analysis as a technique for monitoring learners understanding. Data collection was done by using group discussion and response sheet. Data analysis was done through content analysis and percentage analysis. The major findings of the study were (1) 40% of the learners found it difficult to analyse the Cartoon independently after seeking guidance from the

teachers the learners made attempt to express their views about the concepts. (2) 33% learners managed to explain the concept partially, 60% learners were able to express points about all the concepts and sub concepts depicted in the Cartoons. 7% did not attempt the task at all. (3) Learners were motivated to think, discuss and question during the session and there by remained active and attentive in class. (4) The task gave the students opportunities to think open-mindedly and creatively. (5) The interaction with the learners signified that the use of Cartoon analysis task enabled learners to think out of box, beyond textual information.

Keogh and Naylor (2008) explored that Concept Cartoon was used as a tool for assessment of student teachers understanding regarding science. Data collection was done via questionnaire, interview and informal feedback during teaching sessions. Findings of the study said that 47% had negative feelings about the idea of being assessed at their beginning of course. 89% have positive feelings about this approach. (1) 81% of the student teachers felts that assessment at the beginning of the course would be valuable in principle. (2) 69% of student teachers thought that using the Concept Cartoons helped them to think differently about the situations and to begin the process of restructuring their understanding. (3) 97% of student teachers had positive views about the value of the Concept Cartoon as a teaching approach.

Balim, Didem and Fvreki (2008) conducted a study on the effect of Concept Cartoons which is used in science education on Students academic achievement and enquiry learning skill perceptions. In these study pre test-post test quasi experimental design were used to determine the difference between experimental and control groups enquiry learning skills perception points and post test only design were used to determine the difference between control and experimental groups academic achievement points. Data collection was done by preparing achievement test and perception scale. Data analysis was done by using **t** tests for independent and dependent groups. Findings of the study said that there is no difference between the experimental and control group with respect to the Students academic achievement. There is meaningful difference in favour of the experimental group with respect to the Students enquiry learning skill perceptions. There is no meaningful difference between control groups pre and post test in students enquiry learning skill perceptions.

There is no meaningful correlation between groups post test enquiry learning skill perception and academic achievement.

Kabapinar (2009) wrote a research article 'What Makes Concept Cartoons More Effective?' Using Research to Inform Practice states that the purpose of the study is to propose several ways of making Concept Cartoons more effective and to find out their effectiveness of Concept Cartoons on learning. Both case study and pre - post experimental research designs were used. The main data sources were written feedback form collected from the learners, field notes concerning classroom observations and videotape recordings of the instruction. Findings of the study indicated that Concept Cartoons in form of worksheets are as effective as posters in remedying students' misconceptions and helping them to understand scientific ideas. They also indicated that Cartoon characters do not cause change in students' response pattern while minimizing classroom management problems during whole class reflection activity.

Ellez and Guzin (2009) explored the effects of computer aided Concept Cartoons on learning outcomes in science and technology education. Study was experimental in nature where experimental and control group were selected randomly. Achievement tests were applied to both groups. Data collection was done through conducting interviews. Data analysis was done by content analysis. Finding of the study revealed that Concept Cartoons based on learning atmosphere affected students achievement positively.

Dalacosta, Kamariotaki and Palyvos, (2009) studied multimedia application with animated Cartoons for teaching science in elementary education. In this study 18 different public schools were randomly selected from metropolitan area. Students of different intellectual ability, gender, and economic status, constituting one whole classroom from each school took part in the two samples. The first group followed the classic instruction method. Teacher used the usual methodology, theoretical explanation of the concept in class with qualitative and quantitative examples. For the second group the animated Cartoons multimedia application were used only. Data collection was done by using questionnaire. In the post tests multiple choice questions were used for assessment. The principal finding of study indicated that student's

knowledge and understanding upgraded through the differentiation of the concepts with the use of animated Cartoons. Students' correct answer reached 80.3 % in the case with the Cartoons application and 61.3 % in the classic method.

Birici, Melin and Karakas, (2010) conducted a study 'Pre service Teachers' Views on Concept Cartoons' by using mixed research method. Sample was 40 students enrolled in elementary teaching department. Data were gathered in 6 weeks. Data collection was done by using questionnaire and interviews. Data analysed by frequency and percentage analysis. Study indicated that using Concept Cartoons in instruction rescue students from boring traditional lecturing helps teachers to improve their instruction approaches. Concept Cartoon create discussion environment where students can improve their critical thinking skill and influence in positive way student attitude towards the lesson.

Birici and Metin (2010) developed an instruction material using a Concept Cartoon to teach soil erosion through the 5E model. In the study an instructional material was designed for Earth's crust composed of what? Cartoons were designed in MS Power point software. Researcher starts the lecture by asking students their thoughts on the topic appearing on the screen. Student's prior knowledge of the topic can be examined. Opinionnaire and feedback form were used to collect data. In the study, instrument design Concept Cartoon description adapted with 5E model. (a) Enter phase – First an intriguing short story that is related to soil pollution was introduced to students. After reading the passage asked the questions related story. (2) Explore – In this phase, researcher must perform these given instructions with the student group in the class room. In terms of the experiment results, students should guess which type of erosion is shown. (3) Explain – this phase provides an opportunity for teachers to directly introduce new concepts, processes or skills. (4) Elaborate – The teacher fosters students to apply their understanding and skills to additional activities.(5) evaluate – in this phase, assess what students have learned and how much they have increased their knowledge about erosion in previous phases.

Cepni and Ipek (2010) studied teaching floating and sinking concepts with different teaching methods and techniques based on the 5E instructional model. The aims of the study were to test the influences of prepared instructional material based on the 5E

instructional model combined with Concept Cartoon, animation worksheets. In the study the quasi experimental design consisting of an experimental group and control group is used. Each group is given a pre and post test. In the study a delayed post test was implemented to both CG and EG students in addition to pre test and post test. The same science teacher taught in both groups. The experimental group taught with learning materials based on 5E model, prepared for elementary school's 8^{th} grade. Teaching material enriched with CCT, CC and animations. The CG is taught with the existing textbook materials developed by 5E model of the constructivist theory. Samples were 48 students where in 25 students in control group and 23 students in experimental group from the 8^{th} grade Students were selected according to their achievement scores. Findings of the study indicates that there is no significant difference between experimental and control group according to pre test. After implementation of material when the post test results were examined significant difference was found in favour of Experimental group.

White, (2010) used Concept Cartoon as a formative and summative assessment in biology. Sample were size of 76 biology students, Male 55 % and female 45%. Researcher constructed Concept Cartoon were used as formative probes to lead students through two steps of the conceptual change model. Introductory and feedback surveys, group interview and pre – post test data were also analysed to determine the effectiveness of using the visual approach as a formative and summative assessment. Finding of the study said that 18.5% increase in average unit test scores from biochemistry unit to cells and genetics units when Concept Cartoon probes used. Student's responses on the final feed- back survey showed that they found the Concept Cartoon misconception probes to be useful and helpful learning activities.

Ormanci and Sasmazoren (2010) conducted study on the use of Concept Cartoon for assessment purposes aimed to present exemplary applications about developing a Concept Cartoon test. Cartoon Concept test developed including six Concept Cartoon questions about photosynthesis and respiration in plants. Samples were 192 science teacher candidates. Data analysis was done using scoring key. The study implied that Concept Cartoon are applicable as alternative assessment evaluation tools and analysis method performed in the study through the scoring criteria and scoring process of the Cartoons are systematic and easy.

Emanuel, S. (2011) in Spark international Online Journal presented research article on a Cartoon Analysis: A technique for Classroom Interaction. The objectives were to find out the opinions of the students towards the Cartoon analysis task and to find the effectiveness of Cartoon analysis as a model for assessment as well as teaching and learning in the classroom. Data collected by using group discussion, opinnionaire and response sheet of students. Data analysis carried out by content analysis and percentage analysis. Findings of the study indicate that 98% of the student teachers found it difficult to analyse the Cartoon independently. The study signifies that the use of Cartoon analysis task enabled the student learners to think beyond the textual information. 95% of the student teachers thought that using the Concept Cartoons helped them to think differently about the situations. The task gave the students opportunities to think open- minded and creatively. All the student teachers held positive views about the value of concept cartoons as a teaching approach. The cartoon analysis technique appears to be potentially valuable in both summative as well as formative assessments.

Balim, et al. (2011) examined the views of Science and Technology Teachers towards Concept Cartoons integrated to problem based learning (PBL). In this context, teacher's views were reviewed to compare before and after the experimental treatment of a project. Data gathered with qualitative research method. In first step of study, a 30 hour workshop including theoretical subjects, applications and experimental treatments about Concept Cartoons presented to teachers. Then teachers (n:9) were interviewed by a semi-structured interview form. In following of this workshop, all applications and experimental treatments towards the project consisting of this workshop was requested to teachers to apply for developing of students. After the experimental applications and treatments towards this project, the same teachers were again interviewed by the semi-structured interview form used in parallel to previous interviews. The semi-structured interview forms were developed by researchers in the project. The semi-structured interview form consisting of five question items was used in before experimental applications and treatments and then the same form was developed to get teachers' insights adding different two question items to them. Data was analyzed by the content analysis method. Findings of the study indicated that problem based learning modules improves student's critical thinking, inquiry teaching skills and help students to relate their information with daily life. During study

teachers said that they had problems while student's group work, problem determination, research phase. After the study they indicated that sometimes problem based learning sessions take longer time than courses, activities were pushing students and these were parts of limitations of PBL. What is more, when interviews before and after experimental applications and treatments was compared, it may be said that teachers focused on similar properties about Concept Cartoons. Teachers said that Concept Cartoons are interesting, includes visual elements, encourages to participate in course, provides permanent learning and these are positive parts of Concept Cartoons.

Balim, et al. (2011) tried to find out the effects of using Concept Cartoons and mind maps on students' achievements, motivations, attitudes, and perceptions of inquiry learning skills. One group pre-test post test design was used. The single-group pre test post test design was used as a pre-experimental design and the measurements were evaluated on a single group in consideration of the pre test and post test scores. The sample group consisted of a total of 16 students (11 males, 5 females) studying in the sixth grade in an elementary school. The data collection instruments employed in the study include an academic achievement test about the unit "Matter and Heat", the questionnaire for motivation toward science learning , the enquiry learning skills perceptions scale, and the attitude scale towards science and technology. Findings of the study mention that, a significant difference were found in students' achievements and motivations, however; there was no significant differences in students' attitudes, and perceptions of inquiry learning skills. When the analysis related to attitudes and perceptions of inquiry learning skills was examined, the analysis related to attitudes and inquiry learning skill perceptions, post test measurement was found higher than pre-test measurement. The analysis showed that there were no significant differences between groups concerning their achievement, attitude, motivation and inquiry learning skills perceptions.

Patricia, et.al. (June 2012) conducted a study on getting children to design experiments through Concept Cartoons. Three different Cartoons were used in heterogeneous grade 5 class with 29 children. The children had no experience in inquiry based learning and doing experiments. Researcher planned six lessons in which 3 concept cartoons were introduced. For each Cartoon there were two lessons

and steps followed in the lessons were as follows. (1) The researcher handed out the Cartoons with short introduction to make sure the children understood the Concept and Cartoon. (2) Children individually were asked to write down their own opinion about which Cartoon character was right. (3) They were asked to design an experiment to test one of the statements in the Cartoon. The group was asked to describe a worksheet. The author selected the Cartoons (1) condensation on the outside of glass with cold water (2) shadows is a double shadow darker than a single one.

Burhan, et al. (2012) examined the effectiveness of an intervention based on a series of laboratory activities enhanced with Concept Cartoons. The purpose of the intervention was to enhance students' understanding of acid-base chemistry for eight grade students' from two classes in a Turkish primary school. A pre test- post test non-equivalent groups design and one experimental group (EG; N =19) and one comparison group (CG; N = 17) were used in the study. While the comparison group taught with laboratory activities-based instruction, the experimental group received concept cartoon enhanced laboratory activities-based instruction. *Acid-Base Achievement Test (ABAT)* consisting of 25 multiple-choice questions administered in the form of a pre-test/post test research design. Besides, pre-interview were used for collecting data. Alternative conceptions identified in the pre-test and pre-interviews were incorporated into the intervention, which thereby sought to move students toward views more in accord with scientific views for the concepts. The results of the study indicated that while there is no statistically significant difference between groups in pre test, performance of EG students is greater than the CG ones in post test. Besides, the EG students are better in remediating their alternative conceptions related to concepts of acid-base chemistry. The findings shows that laboratory activities enhanced with concept cartoons help student improve their understanding and reduce their alternative conceptions.

Pillai, L. (2012) studied the teaching of environment science to primary school children through Cartoon based learning material. The objectives of the study were (a) to prepare a Cartoon based learning material to teach environment science to primary school children (2) to implement the Cartoon based learning material in ES on primary

school children. (3) To see the effectiveness of Cartoon based learning material in terms of achievement of primary school children in ES. (4) To see the effectiveness of Cartoon based learning material in terms of reaction of primary school children. The sample of the study constituted of 28 students from the university experimental school in experimental group and 28 students from the Don Bosco School in control group. Data collected through the achievement test and reaction scale. Data analysed through non parametric statistics, Mann- Whitney U-test. The findings of the study revealed that the achievement of the students in environmental science taught through Cartoon based learning material was found significantly higher than that of the students taught through traditional text book. Hence it can be said that teaching environmental science through Cartoon based learning material is comparatively better than teaching through traditional text book in terms of the achievement of the students. Cartoon based learning material also found to be effective in terms of the reaction of students towards the components and implementation of Cartoon based learning material. As most of the students show favourable reaction towards most of the components of Cartoon based learning material.

3.5 Implications the Review of Related Literature to the Present Study

There are a lot of studies in the literature investigating Concept Cartoons' effect on science education. Balim, Inel and Evrekli found that Concept Cartoons help students question their prior knowledge with the new knowledge they encounter. Similar results are found in studies by Keogh, Naylor and Wilson, Keogh and Naylor, Ekici, Ekici and Aydin, Kabapinar found that Concept Cartoons help create discussion environment in the classroom that reveal students misconceptions. However, there are very few studies conducted in India about Concept Cartoon.

By reviewing the literature it was found that Questionnaire, interview, observation and feedback form as tools were used in survey study. However achievement test, reaction scale, response sheet, attitude scale, group discussion and oppionnaire (tool) were used in experimental study. Researchers need to be further conducted study on concept cartoons. From the overall findings of study the researcher found that concept cartoon was effective to provides open discussion for learners, and help to retain information better, develop pupils' conceptual understanding, enhance student

argumentation ability, minimize classroom management, upgrade student's knowledge and understanding, improve critical thinking skill, encourage student's participation, provide tool for formative and summative assessments, help for identification, remedying and elimination of misconception. The aim of this research is (to contribute to these few studies and more specifically) to investigate effectiveness of Cartoon Based Programme to science education. The subsequent chapter focuses on methodology of the research.

Chapter 4

METHODOLOGY OF INVESTIGATION

4.1 Introduction

Methodology is one of the most important aspects in any research work. It gives one an idea about how the study would be conducted. The methodology of any research work needs proper attention and care for its planning and execution, if in appropriate methodology is used or if appropriate methodology is used poorly, the results of the study could be misleading. Thus, it is essential to have a rigorous methodology to improve the quality and authenticity of and research study. The present study is an experimental study. There are four main components of the research methodology: design, sampling, data collection and data analysis. This chapter deals with the design of the study sample, tools and techniques used and the procedure of the data collection.

4.2 Research Design and Research Type

The present study was experimental in nature. It followed the two group pre test –post test design. Attempts were made by the researcher to prepare a programme using the concept cartoons and the same was tried out on a group of students.

X	O1 x O2	O1O3 = pre tests
C	O3 x O4	O2O4 = post tests
		X = Experimental Group.
		C = Control Group.

The study was both qualitative and quantitative in nature.

4.3 Population

Population is said to be the scope of the study i.e. the unit where generalizations with respect to the findings of the study can be made. Population of the present study consisted of all the students studying in English medium schools of Anand district following syllabus prescribed by the Gujarat State Board.

4.4 Sample and Sampling Procedure

Sample for the present study was selected conveniently. For this, the investigator selected experimental group and control group from the C. J. Patel English Medium School, Karamsad. The sample consisted of 20 students in experimental group and 20 students in control group. There were total 40 students in standard VIII of C. J. Patel English Medium School.

4.5 Tools and Techniques

Tool enables the researcher to interact with the subjects and get their responses. In the present study the researcher used an achievement test for collecting the quantitative data for the research.

The tools used in the present study are as follows.

Cartoon Based Programme (CBP)

A CBP was prepared by the investigator to teach the students of the experimental Group. A range of concept cartoon based tasks were prepared to teach the topics. i.e., Micro-organism, Sources of energy, Diseases and Environmental issues.

Achievement test

An achievement test was constructed by the investigator based on the science content of standard VIII. The achievement test included only objective type questions covering three units of text book i.e. micro-organisms, common diseases and sources of energy. The achievement test consisted of 20 objective type questions having one mark each. This test was used for pre test and post test of both experimental and control groups. Marks scored by the students in this test were considered as the achievement of the students.

Opinionnaire

An opinionnaire was prepared by the investigator to know the subject teacher's views about cartoon based programme. An opinionnaire was developed with 12 statements those representing different components like uses of cartoons at different level and for different subject. The five point Likert type scale, ranging from strongly agrees to strongly disagree was constructed.

Feedback form

A feedback form was developed by the investigator and administered to the control group and experimental group after concluding the experiment. The feedback form was developed in order to know their views regarding the cartoon based learning. It included three open ended questions related to their learning experience during the sessions. The feedback form was prepared that is attached in the appendix.

4.6 Data Collection and Procedure

The entire study was conducted in three phases. The phase wise procedure has been described below.

The required data were collected with the help of pre test, post test and opinionnaire which were constructed by the investigator implemented the programme for a period of seven days on the experimental group and control group was taught the same topics by researcher through the text book prescribed by the Gujarat state government. After implementation of cartoon based programme to the experimental group and lecture method to the control group investigator administered the post test and opinionnaire towards the programme were also taken. The data were collected in three phases. Details of that are given below.

Phases of data collection

The entire experiment was conducted in three phases

(1) **Pre testing**

The investigator took the permission from the experimental and control group for experimentation and collection of data. The investigator administered the achievement test for science as the pre test on the experimental and control group students. The test included the questions related to the four topics viz. Micro organisms, common diseases, sources of energy and environmental problems. There were 20 objective type questions.

(2) **Implementation of cartoon based programme**

After the pre testing the cartoon based programme was implemented on the experimental group and control group was taught through lecture method. The investigator taught four topics to the experimental group students for seven days, 1

hour 45 minutes per day. The same four topics were taught to the control through the traditional way.

(3) **Administration of post test and opinionnaire**

After providing the treatment, the investigator administered post test on the experimental group and control group.

The investigator administered the opinionnaire on the science teachers.

Table 1 Implementation of the designed tasks (day wise)

Date	Time hour	Focus of session	Description of task and activities
Day 1 8/12/12	½ hour	The investigator conducted a session from 8 to 8.30 am. The focus of session was to administer the pre test on the students of std VIII to find basic information they have about environmental issues, diseases and sources of energy.	Pre test
10/12/12	1½ hour	Investigator conducted a session from 10.30 to12 pm. The focus of session was to teach about causes and effect of green house effect and deforestation.	Concept Cartoon based on green house effect, ice melting, flood and polar region were given to students. Researcher divided students into groups. Then they gave cartoons in each group. Time period and instruction related to the tasks were given to each group provided by researcher. Each group worked together and discussed the concepts. Finally each group presented their views on cartoons. Researcher prepared power point presentation on deforestation using different cartoons and the same were discussed.
10/12/12	1½ hour	Researcher conducted a session from 12 to 1.30a.m. Focus of the session was to explain the concept of acid	Researcher divided students into two groups: group A and Group B and concept cartoons that included observation and discussion tasks were

		rain and causes, effects of acid rain, ozone layer depletion causes and effects.	given to students.
11/12/12	½ hours	The investigator conducted a session from 11 to 11.30.and focused of the session was to revised the content. Investigator gave them task sheet.	Task sheet 1 and 2 were given to the students.
11/12/12	2 hours	The investigator conducted a session from 2.00 to3.00 pm. focus of the session was to teach the communicable diseases i.e. tuberculosis and chicken pox The investigator conducted session from 3.00 to 4.00 pm. Focus of the session was to teach the communicable diseases i.e. rabies and typhoid.	Cartoons based on symptoms and control, transmission of TB, etc were discussed at length through a PPT based on Concept Cartoons. Cartoon based task sheets were given to students on topics, transmission and symptoms of rabies. The students worked in groups and presented their views. (Tasksheet 2)
12/12/12	1½ hour	Investigator conducted a session from 10.55 to 12.40 am. Focus of the session was to teach the content of micro-organism i.e bacteria and fungus.	Researcher prepared worksheet in which different situations were given. Students identified it and tried to relate it with their day to day life experiences. Students gave different examples based on it. And finally discussion was carried out in the classroom. (Tasksheet 4) Cartoon based on yeast, and mushroom, and Penicillium. Researcher showed cartoons using power point presentation and discussed the content in classroom.
13/12/12	1½ hour	Investigator conducted a session from 2.20 to 3.40 am. Focus of the session was to teach the renewable energy sources	Researcher gave cartoon based pictures to students in pairs. Researcher asked questions based on it. And helped the students brainstorm on the topic.

14/12/12	2 hour	Investigator conducted a session for two hours. The focus of the session was to teach the non renewable energy sources.	Researcher divided students into groups and tasks based on topic types of energy were given. Task sheets were used to check the effectiveness of the 7th session (Task sheet 5)
15/12/12	½ hour	The investigator conducted a session from 8 to 8.30 am. The focus of session was to administer the post test on the students of std VIII.	Post test

4.7 Data analysis

Data collected was analysed qualitatively and quantitatively. Content analysis and percentage analysis were used for analysing the data of opinionnaire and feedback form. For testing hypothesis t test was applied. The subsequent chapter focuses on data analysis and interpretation.

Chapter -5

DATA ANALYSIS AND INTERPRETATION

5.1 INTRODUCTION

Data analysis is considered to be important step and heart of the research. After collection of data with the help of relevant tools and techniques, the next Logical step is to analyze and interpret data with a view to arriving at empirical solution to the problem. The data analysis for the present research was done quantitatively with the help of both descriptive statistics and inferential statistics. The descriptive statistical techniques like mean, standard deviation and for the inferential statistics t test were used during data analysis. For the analysis of opinnionnaire was done through percentage analysis.

5.2 Analysis and Interpretation of Pre test and Post test scores

The scores of the pre test and post test are depicted in the table below. The pre test and post test scores were statistically tested using t test.

5.2.1 Analysis and Interpretation of Test Scores

Table 2 Pre test and post test scores of Control group

Roll no	Pre test scores	Post test scores
1	9	12
3	11	12
5	12	14
7	11	14
9	11	14
11	6	13
13	11	13
17	8	12
19	10	12
21	11	13
23	12	14
27	9	12
29	10	16
31	12	13
33	10	14
35	8	10
37	6	10
39	6	8
41	9	13
13	13	14

Table 3 Pre test and post test scores of Experimental group

Roll no	Pre test scores	Post test scores
2	01	14
4	10	15
6	9	16
8	11	18
10	11	16
12	7	14
14	10	17
16	10	16
18	4	16
20	12	15
22	12	15
24	10	13
28	9	17
30	9	17
32	12	17
34	11	16
36	12	15
38	10	16
40	15	16
42	9	15

pre test and post test of the students in the control group" is rejected at the 0.01 level of significance. It means that there is a significant difference between the achievements of the control group in achievement test. It can be mentioned that the traditional way of teaching method has effect on the performance of the students of control group.

Mean value for post test (12.7) is higher than pre test scores (9.85) therefore it is Concluded that student's performance is better in the post test.

Ho2 There will be no significant difference between the mean achievement scores of pre test and post test of the students in the experimental group

This hypothesis was tested by applying "t' test.

Table 5 Difference between pre test and post test scores of the experimental Group

Group	**Mean**	**SD**	**SDM**	**DF**	**'t' value (cal)**	**'t' value (table)**
Experimental group Pre test	**9.65**	**3.06**	**0.68**			
Experimental group Post test	**15.55**	**1.25**	**0.27**	**19**	**7.86**	**2.86**

** Significance 0.01 level

Table value is less than calculated value. Hence the hypothesis stating "There will no significant difference between the mean achievement scores of pre test and post test of the students in the experimental group" is rejected at the 0.01 level of significance. So there is a significant difference between the mean achievement scores. It can be mentioned that teaching through cartoon based learning was effective and enabled students to score better.

Mean value for post test (15.5) is higher than pre test scores (9.65) therefore it is concluded that students' performance has improved.

Ho3 There will be no significant difference between the mean achievement scores of post test of the student in the experimental group and control group

This hypothesis was tested by applying "t' test statistics.

Table 6 Difference between performance of control and experimental group

Group	Mean	SD	SDM	DF	't' value Cal	't' value Table
Control group Post test	**12.7**	**1.82**	**0.48**	**19**	**6.1**	**2.87**
Experimental group Post test	**15.55**	**1.25**	**0.27**			

** Significance 0.01 level

Table value is less than calculated value. Hence the hypothesis stating "There will no significant difference between the mean achievement scores of post test of the student in the experimental group and control group" is rejected at the 0.01 level of significance. So there is a significant difference between the performance of students of control and experimental group. The mean of experimental group and control group are also shown in the graph 4 for better comprehension.

Interpretation - The mean pre test score are 9.65 and 9.85 for the experimental and control groups respectively. The mean post test scores are 15.55 and 12.7 for experimental group and control group respectively. This shows that mean of experimental group is significantly higher than mean of control group. The obtained difference between mean scores for experimental and control groups was found to be 6.1, which was found to be significant at 0.01 level of significance. It showed that the experimental group scored higher than the control group in the post test which may be due to the effect of CBP. As the Hypothesis-3 was rejected, it can be concluded that the mean achievement of experimental group (that were taught through CBP) is significantly higher than that of the control group (that were taught through Lecture method).

20% teachers were undecided, 40% teachers agreed, 20% disagreed with the statement and 20% teachers strongly agreed with the statement. From this, it can be concluded that the teachers found that the use of cartoons does distract the students and lead to a noisy class.

Statement 3. Cartoons can be used for very simple topics in science.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
- 0.00%	4 80%	1 20%	- 0.00%	- 0.00%

80% teachers agreed and 20% were undecided with this statement. For this it can be concluded that majority of teachers found that Cartoons can used for very simple topics in science.

Statement 4. Teacher can relate science concept to day to day life with the help of cartoons.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
3 40%	1 20%	1 20%	- 0.00%	- 0.00%

40% teachers strongly agreed with the statement, 20% agreed with the statement and 20% teachers said that were undecided. Thus, most of the teachers agreed and said that cartoons enable students to relate concepts with day to day life.

Statement 5. I strongly recommend the use of cartoons in teaching science.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
- 0.00%	4 80%	1 20%	- 0.00%	- 0.00%

80% teachers agreed with the statement, 20% teachers agreed with the statement and 20% teachers said that they were undecided. Thus most of the teachers agreed with the statement.

Statement 6. Cartoons can make learning a joyful process.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
1 20%	3 60%	1 20%	- 0.00%	- 0.00%

60% teachers agreed with the above statement, 20% strongly disagreed with the statement and 20% were undecided. Thus 80% teachers said that Cartoons make learning a joyful process.

Statement 7. Cartoons can be used to teach physics.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
- 0.00%	1 20%	2 40%	1 20%	1 20%

40% teachers said that they were undecided, 20% agreed with the statement, 20% disagreed and 20% strongly disagreed with the statement. Thus only few teachers opined that Cartoons can be used to teach physics.

Statement 8. Cartoons can be used to teach chemistry.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
- 0.00%	2 40%	2 40%	1 20%	- 0.00%

40% agreed with the statement, 20% disagreed with the statement and 40% were undecided. Thus 40% teachers expressed that concept cartoons can be used to teach Science.

Statement 9. Cartoons can be used to teach Biology.

Strongly agree	agree	Undecided	disagree	Strongly disagree
- 0.00%	3 60%	1 20%	1 20%	- 0.00%

60% teachers agreed with the statement and 20% disagreed with statement. Thus teachers did express that Concept Cartoons can be used to teach Biology.

Statement 10. Cartoon can be used to teach science at primary level.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
4 80%	1 20%	- 0.00%	- 0.00%	- 0.00%

80% teachers strongly agreed with the statement and 20% were undecided with statement. Thus all the teachers felt that Concept Cartoons can be used to teach at the primary level.

Statement 11. Cartoon can be used to teach science at secondary level.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
- 0.00%	1 20%	3 60%	1 20%	- 0.00%

20% teachers strongly agreed with the statement, 60% were undecided and 20% disagreed with statement. Thus most of the teachers felt that Concept Cartoons can be used to teach at the secondary level.

Statement 12. Cartoon can be used to teach science at higher secondary level.

Strongly agree	Agree	Undecided	Disagree	Strongly disagree
- 0.00%	- 0.00%	2 20%	2 40%	1 40%

From the above analysis, it can be concluded that all the teachers felt that Concept Cartoons cannot be used to teach at the higher secondary level.

Interpretation

Teachers felt that cartoons can be used to teach science (biology, chemistry and physics). Cartoons can be used at primary and secondary levels. Cartoons provide fun to learner and enable them to relate concepts with day to day life experiences. Mostly Cartoons are used to teach science for simple topics.

The following section focuses the analysis of data collected through the feedback form.

5.4 Data Analysis and Interpretation of Feedback obtained from the Students.

The students were asked to describe their experience about the task. The researcher analysed the feedback qualitatively to find, triangulate and confirm the effectiveness of the module. The responses obtained from the students are analysed and depicted in the table below.

Q.1 Describe your experiences of learning with cartoons during the sessions?

Table-7 Response on feedback form question 1.

Sr No	Responses of students	Percentage
1	Learning experience was good	70%
2	I enjoyed all the sessions of teacher	60%
3	Cartoon based learning increased my interest in the subject	55%
4	It provided joyful learning	80%
5	It provided excitement	20%

Chapter 6

Findings, Suggestions and Implications

This chapter includes findings, suggestions and implications of the study. The chapter presents the outcome of the study and also the scope for future researches.

6.1 Findings of the Study

The findings of the study are depicted below.

1. Cartoon Based Programme was effective as compared to the traditional method of teaching.
2. Cartoon based tasks induced elated learning in the classrooms.
3. Concept Cartoons are a potential source of learning because they enable the learners to comprehend the concepts easily as well as retain them.
4. 100% students expressed that they enjoyed learning Science through cartoons.
5. Cartoon Based Programme had a positive impact on the students' achievement scores as well as their attitude towards learning science.
6. The element on Concept Cartoons made the class lively and also generated ideas and discussion in the classroom.
7. Learners were motivated to think, discuss and question during the sessions in the experimental group.
8. Concept Cartoon increased the attention span of the learners in experimental group.
9. 80% of the Science teachers expressed that cartoons can be used to teach Science. 40% expressed that teaching through cartoons might also lead to a noisy class.
10. 80% Science teachers said that cartoons can be used to teach simple topics in science and it makes the learning environment joyful.
11. Only 20% science teachers said that cartoons can be used to teach Physics, 40% said that it can be used to teach Chemistry and 60% said that it can be used to teach Biology.
12. 90% science teachers opined that cartoon based teaching was effective at primary classes, 20% said that it can be used at secondary levels whereas 0%

(zero percent) said that it cannot be used to teach science at higher secondary levels.

6.2 Educational Implications of the Present Study

The teacher and teaching should be changed as per the context, need of the learner and with the passage of time. Education should not become burden for the students; learner should enjoy and involve themselves while learning, then its effect will be long lasting. The experiment was just an attempt to find out an innovative ways of teaching science using cartoon based programme and to see its effectiveness. The following are some of the implications of the present study on the basis of major findings.

(1) To increase the effectiveness of teaching science in standard VIII the teachers should teach in a joyful way where the Cartoon Based Programme can be one of the ways of the teaching so that the students get interest and enjoy teaching. The Cartoon Based Programme can be developed in the subject of science taking all the units of the subject.

(2) The Cartoon Based Programme has the potential to enhance the achievement and making the learning joyful mainly due to the introduction of an interesting medium i.e. cartoon. The same medium can be used for the other subjects in school.

(3) At least, cartoons can have a place in the traditional text books. The concepts that can be taught in a humorous manner can have cartoons in the books.

(4) Cartoon Based Programme enhances self learning. It also makes teaching learning process more fruitful and interesting. Apart the text book, CBP could be prepared for the students. Text book producers could be encouraged in this line.

6.3 Suggestions for further study

Since the present study had delimitation, the investigator would like to suggest the following points for further research**.**

- CBP could be developed in all the topics of science of standard VIII and that could be implemented for the whole year and the effectiveness could be tested by further researches.
- CBP could be developed for the other subjects for Standard VIII and for other standards and the effectiveness of those programme could be tested by further researchers.

- Similar study can be conducted for the students of other boards like CBSE and ICSE.
- Cartoon can be mixed up with comics and materials could be developed, tested in different subjects and standards.
- True experiment design can be considered if feasible for the better generalization of the result.

6.4 Conclusion

The Cartoon Based Programme prepared and tried out by the investigator was found to be effective in terms of the students' achievement, in comparison to teaching through traditional method. Cartoon Based Programme has enhanced the learning of the students. Teachers can use it innovatively by providing them materials for self learning and keeping only discussion in the classroom. This kind of teaching can involve the students in discussion which make learning participatory, joyful and interesting. Findings of the study suggest that Cartoon Based Programme can be used for self learning so that students can learn at their own pace, convenience and interest.

Bibliography

Balım, A.G., İnel, D., & Evrekli, E. (2008) The effects of using the Concept Cartoons in science education on students' academic achievements and enquiry learning skill perceptions.

Birisci P., Metin M. and Karakas M. (2010) Pre-service elementary teachers' views on Concept Cartoons: a sample from Turkey. *Middle East Journal of Scientific Research.*

Chin C. and Teou L.Y. (2009) Using Concept Cartoons in formative assessment: scaffolding students' argumentation. *International Journal of Science Education.*

Chin C. and Teou L.Y. (2010) Formative assessment: using Concept Cartoons, pupils' drawings and group discussions to tackle children's ideas about biological inheritance. *Journal of Biological Education.*

Dr.A.B.Bhatnagar (2010) Teaching of science, Vinay radheja Merut edition.

Emanuel, S. (2007) Preparing Scientists in Classroom, A teacher's manuel. Vallabh Vidyanagar. Waymade College of education.

Ekici F., Ekici E. and Aydin F. (2007) Utility of Concept Cartoons in diagnosing and overcoming misconceptions related to photosynthesis. *International Journal of Environmental & Science Education.*

Joshi S.R.(2007) Teaching of science, APH publishing corporation New Delhi.

Kabapinar F. (2005) Effectiveness of teaching via Concept Cartoons from the point of view of constructivist approach. *Educational Sciences: Theory and Practice.*

Keogh B. and Naylor S. (1996) *Teaching and learning in science: a new perspective.* Paper presented at the BERA Conference, Lancaster, UK.

Keogh B. and Naylor S. (1999) Concept Cartoons, teaching and learning in science: an evaluation. *International Journal of Science Education.*

Narendera vaidya.(2003), Science teaching for the 21st century, deep and deep publication pvt.Ltd.

Naylor,S., Keogh, B. (2012). Concept Cartoons, what have we learnt? Paper presented at the Fibonacci Conference, Leicester,

Radha, M. (2007) Innovative science teaching for physical science teachers, hall of India private Ltd. New Delhi.

Stephenson P. and Warwick P.(2002), Using Concept Cartoons to support progression in students' understanding of light. *Physics Education.*

Text Book of Science Std. VIII (GSEB)

Text Book of Science Std. VIII (CBSE)

Webliography

www.conceptcartoons.com/index _ *flash.html*

http://www.academia.edu/1323201/Effectiveness_of_Teaching_via_Conce - 71k

http://www.merga.net.au/publications/counter.php?pub=pub_conf&i –

http://www.southalabama.edu/coe/bset/dempsey/isd613/stuproj/summer0

http://www.tandfonline.com/doi/abs/10.1080/095006999290642

http://www.ipn.uni-kiel.de/projekte/esera/book/b053-keo.pdf

http://www.ied.edu.hk/apfslt/download/v11_issue1_files/birisci.pdf

http://www1.rdoffice.ndhu.edu.tw/exchange/abroad/abroad98/10_paper.

http://www.eric.ed.gov/ERICWebPortal/recordDetail?accno=EJ901275 - 44k

http://www.jsse.org/2011/2011-3/pdf/fenske-et-al-jsse-3-2011.pdf

http://www.nef.balikesir.edu.tr/~dergi/makaleler/yayinda/11/EFMED_F

http://www.idosi.org/mejsr/mejsr5(2)/7.pdf

http://www.ijese.com/V2 N4_Ekicietal.pdf

http://cimm.ucr.ac.cr/ojs/index.php/eudoxus/article/view/136/137

http://www.leeds.ac.uk/educol/documents/000000115.htm

http://www.millgatehouse.co.uk/research/concept-cartoonsresearch

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Appendix 1

TOOL

Pre test

Name of the Student: **Date:**
Name of the School: **Marks: 20**
Roll No:
Standard:

*** Read the following sentence and select the most appropriate response from the options given below.**

1. The disease caused by the bite of a dog _____ .
A Tuberculosis B Cholera C Rabies D Malaria

2. The disease caused by the bacteria_____.
A Chicken pox B None of this C Typhoid D Polio

3. _____Method of making the body immune to a particular disease.
A Antibodies B None C Inoculation D Vaccination

4. Chicken pox is _____disease.
A Transmitted B Intrinsic C None D Communicable

5. The Cholera is caused by _____
A Vibrio cholerae B Virus C Protozoa D None

6. Biomass is a _____ source of energy.
A gaseous B anaerobic C renewable D None

7. _____ is a non renewable energy source.
A fossil fuel B None C sun D wood

8. _____ is a device based on solar energy used for cooking food.
A petrol B solar cooker C none D Both (A&B)

9. _____ is the major atmospheric greenhouse gas.
A N B Argon B Co2 D O2

10. The chemical formula _____ that represents that of ozone.
A O2 B O3 C O D None

11. _____ is the natural ozone layer destroying product.
A CO2 B volcanic dust C Argon D Salt spray

12. Acid deposition is produced by the release of SO2 and _____ into air.
A CO2 B NO C Ozone D Sulphur per chlorate

13. _____could causes an increase in the number of people with skin cancer.
A Acid rain B Global warming
C Ozone depletion D Deforestation

14. _____could led to the death of fish in a lake.
A Acid rain B Ozone depletion C Deforestation D None

15. Deforestation is most likely a result of the following _____
A Cleaning massive area of trees to plant crops B Land slides
C Global warming D Flooding

16. _____ process will increase the chance of erosion in an area.
A Urbanization B Deforestation C Toxification D Desertification

17. Microorganisms can be seen with the help of _____
A Lamp B Microscope C Mirror D None

18. Mushroom is edible _____
A Fungi B Bacteria C Algae D Virus

19. _____ That helps in the curding of milk.
A Lactobacillus B Coccus
C Vibrio D None

20. The fungus that grows on bread is _____
A Mucor B Aspergillus C Yeast D None

Post test

Name of the Student:
Date: **Name of the School:**
Marks: 20 **Roll No:**
Standard:

Q.1 Write true or false in front of the statements given below.

Statements	True/False
(1) Lungs are affected in tuberculosis.	
(2) Chicken pox is caused by bacterium.	
(3) Hydrophobia is a symptom noticed in tuberculosis.	
(4) Vaccination is a process of injecting a vaccine into healthy person in order to develop immunity to a disease.	
(5) CNG is liquefied natural gas.	
(6) Acid rain is caused by carbon dioxide and carbon monoxide.	
(7) Green house effect can be used in keeping rooms warm.	
(8) Symbiotic bacteria convert atmospheric nitrogen into useful soluble compounds of nitrogen.	
(9) Biogas can be used for running tube wells.	

Q.2 Match the statements in column A with those in column B.

Column A	Column B
(1) Source of energy which can be regenerated.	Coal
(2) The process of burning of fuels with the liberation of heat energy.	Renewable energy source
(3) A solid fuel formed by the carbonisation of wood.	Deforestation
(4) Disease causing organism.	Hydroelectric energy
(5) Removal or cutting of the trees.	Combustion
(6) The electric energy produced by flowing water	pathogen

Q.3 Fill in the blanks.

(1) A _____ used in the preparation of antibiotics.
(2) _____ Depletion caused Skin cancer.
(3) _____acid responsible for acid rain.
(4) Yeast is used for _____ process.
(5) Micro organisms can be seen with the help of a _____.

Feedback

Name of the Student **Name of the School:**

Roll No:

Standard:

Instruction – Read the Following Questions and Gives Answers in Space Provided.

(1) Describe your experience of learning with cartoons during the sessions.

(2) Do you think you could learn better with Cartoon s? Why?

(3) Would you like to learn any science concept through cartoons in future? Please share your views about the same.

Feedback

Name of the Student: **Date:**
Name of the School:
Roll No:
Standard:

Instruction – Read the Following Questions and Gives Answers in Space Provided.

(1) Describe your experience of learning during the sessions.

(2) Which is the other methods use for teaching science?

Opinnionnaire for Teachers

Name of Teacher: Date:
Name of School:
Standard**:**

No	Statements	Strongly agree	Agree	Undecided	Disagree	Strongly Disagree
1	Cartoons can used to teach science.					
2	Students will make noise and get distracted if cartoon are used for teaching.					
3	Cartoons can be used for very simple topics in science.					
4	Teacher can relate science concept to day-day life with the help of cartoons.					
5	I strongly recommend the use of cartoons in teaching science.					
6	Cartoons can make learning a joyful process.					
7	Cartoons can be used to teach physics.					
8	Cartoons can be used to teach chemistry.					
9	Cartoons can be used to teach biology.					
10	Cartoon can be used to teach science at primary level.					
11	Cartoon can be used to teach science at secondary level.					
12	Cartoon can be used to teach science at higher secondary level.					

Sign

_____

Dear teachers,

This opinnionnaire is a part of my M.Ed dissertation work titled ‘Effectiveness of a Cartoon Based Programme to Teach Science in Standard VIII’. The information that you give will be used purely for academic purpose.

Thank you for your support.
NIKITA PATEL

Appendix 2

Module

Session 1

Hour	Focus of session	Objectives	Content	Learner activity	Facilitator activities
1Hr	Focus of the session will know about the acid rain and learn about the causes of acid rain, also discuss different effects of acid rain	To know about acid rain To understand about the causes of acid rain. To understand the effects of acid rain on ecosystem.	Rain which has been made more acidic than the normal rain due to the dissolved pollutants such as so2 and NO2 is called acid rain. Causes – All fossil fuels contain sulphur, on burning, s produces SO2. Petroleum refineries emit large amount of these gases. During volcanic emissions large amounts of SO2 and NO2 are injected into the air. Internal combustion engines of the motor vehicles make small amount of N and O react together and form Nitric acid. Damaged caused by acid rain (1) Acid rain causes extensive damage to the soil and the forests. It damages the forests by damaging their leaves, which turn yellow. (2) Contaminated streams and rivers with the result certain fish die. (3) It corrodes building and statues, especially those made from marble or sand stone.	Student will first observe the cartoons based worksheet. Student will write one or two sentence about each cartoon. Student will understand the concept through cartoons.	Teacher will give cartoon based worksheet to the students. Teacher will discuss content by showing cartoons

Session 2

Hour	Focus of session	Objectives	Content	Learner activities	Facilitator activities
2 Hr	Focus of session will discuss about the environmental issues.	To knows about green house effect. To understand concept of deforestation. To knows about ozone hole. To discuss the effect of ozone layer depletion	The trapping of solar heat energy in earth's atmosphere is called **green house effect.** Harmful effect – Increased the amount of CO2 in the atmosphere, As a result temperature of earth has gone up. As a result ice in the polar region will start to melt. Water level in sea will increase. Useful applications of green house effect. Growing vegetables and flowers in snow bound regions. Use of glass in keeping homes warm. **Deforestation** Causes – urbanization forest converted into agriculture land. Industrialization Remedies – grow more trees. Reduce use of forest products. Use biogas. **Ozone hole** Causes – CFCs, ozone depleting substances, fumigants and propellants. Effect – skin cancer eye cancer, low sexual rate; reduce fertility, loss pigmentation in plant.	Students will work together in groups and will discuss on each cartoon. Finally each group members present their views about concept.	Teacher will divide class in small groups and will give cartoons in each group.

Session 3

Hour	Focus of the session	Objectives	content	Learner activities	Facillitator activities
1½ Hr	Focus of session will learn about the communicable diseases. Focus of session will identify the symptoms, causal organism. Focus of session will teach about vaccine.	To knows about the causal organism and the symptoms of the disease. To knows remedial measures of tuberculosis. To understand the symptoms of the disease. To suggest remedies measure and how to control/prevent chicken pox.	**TB** – chronic bacterial infection. Causal organism – Mycobacterium tuberculosis Symptoms – fever evening rise temperature and chest pain, Cough, blood in the sputum. Loss of Appetite, weight loss and weakness. one pain, seizures and diarrhoea. Lymph node swelling in neck. Transmission – air and spitting and sneezing. Prevention and control Patients should be given complete rest nourishing diet and drugs. The patient while coughing should cover his /her mouth with a piece of cloth. Vaccine which provides protection against the disease. **Chicken pox** Causal organism – Varicella zoster virus. Symptoms – low grade fewer, Skin rashes forming crusts. First appear on trunk and then comes on face. Pain in the back. Shivering. Transmission – contact with infected person. Use of personal articles of infected person. Prevention and control- Isolating the patient from healthy persons, Vaccination, Calamite lotion may be applied on the rashes.	Student will observe it. Students will understand question and will give answer according to their understanding.	Teachers will show cartoons through PowerPoint presentation. Teacher will ask questions based on cartoons.

Session 4

Hour	Focus of session	objectives	content	Learner activities	Facilitator activities
1½ Hr	Focus of session will learn about the communicable diseases. Focus of session will identify the symptoms, causal organism. Focus of session will teach about vaccine.	To list out the symptoms of the rabies. To take action against rabies. To explain the symptoms of disease. To know about disease transmission	**Rabies** Causal organism- Lyssavirus. Symptoms – Fever, headache, malaise and muscle pain, Sore throat, pain at the site of bite, Fear of air, water. Transmission – Disease is spread to man by the bite of dog. Control – The wound should be scrubbed with soap and then washed with plenty of water. Active immunisation with vaccine (antirabies). **Typhoid** Causal organism – Salmonella Symptoms – step like increase temperature, Headache	Student will observe it. Students will understand question and will give answer according to their understanding.	Teachers will show cartoons through PowerPoint presentation. Teacher will ask questions based on cartoons.

Session 5

Hour	Focus of session	objectives	content	Learner activity	Facilitator activities
1½ Hr	Focus of session Will understand the importance of microorganism and will discuss the harmful effect of organism	To understands the importance of bacteria in our daily life. To knows about harmful effect of some bacteria. To classify organisms according to their mode of nutrition. To knows about harmful and useful effect of fungi,	**Bacteria** – unicellular microscopic organism. Nutrition – Autotrophs /Heterotrophs Harmful bacteria – bacteria cause diseases in people and animals. Cholera tetanus and tuberculosis, Food is spoiled by bacteria. Useful bacteria – bacteria cause the decay of dead plants and animals both on land and water. Bacteria in agriculture- root nodules nitrogen fixing bacteria fix atmospheric nitrogen into solid state. Bacteria in industry – fermentation, production of vinegar. **Fungi** as plants but fungi differ from plants in many ways lack chloroplast. Saprophytic/ parasitic Harmful fungi- damage food products cause diseases in crops. Useful fungi – mushrooms eaten raw or cooked. Produce antibiotics that are used to treat infections and diseases. Fermentation yeast Decomposition	Students will observe and express their views. Students will write one or two sentences about each cartoon pictures.	Teacher will show powerpoint presentation in the calssroom. Teacher will give task sheet to the students.

Session 6

Hour	Focus of the session	Objectives	Content	Learner activity	Facilitator activities
1½ Hr	Focus of session will to teach sources of energy	To knows about the sources of energy. To classifies the sources of energy into renewable and non renewable sources. To understands the importance of solar energy in comparison to the other sources of energy.	Sources of energy **Renewable energy source –** energy sources which is once used can be again obtained immediately or after some time. Solar energy – sun is the source of solar energy. Green vegetation uses solar energy directly for preparation of food through photosynthesis. In this process solar energy converted into chemical energy. Solar energy converted into electrical energy i.e. solar cells. Solar energy converted into heat energy i.e. solar cooker. Hydroelectric energy- Energy is also available in the water mass stored in a dam, can be tapped when this water flows to lower height, or as waterfalls. The kinetic energy of this flowing water can be used to drive a turbine and generate electricity. Such power generating stations are called Biogas /biomass – biomass consists of dried leaves, cow dung or any other non usable product of animal or vegetable life. The biomass converted into combustible gases, such as methane, in the gobar gas plants. Wind energy – energy available in the form of kinetic energy of flowing air called wind is known as wind energy. A wind mill can be used to run a pump set for drawing water and operate a mechanical grinding mill to crush grains. Electricity can be generated by connecting a wind mill to electric generator.	Students will see the cartoons and relate it with their day to day life experiences and will give the different examples	Teacher will show the cartoons through projector. And ask some questions. What artist wants to say in these cartoons?

Session 7

Hour	Focus of session	Objectives	Content	Learner activity	Facilitator activities
1½ Hr	Focus of session will to teach sources of energy	To knows about the thoughtful use of non renewable energy sources	**Non renewable energy sources.** Energy cannot be replenished. Petroleum and coal- are formed in prehistoric times when large parts of forests got buried under the surface of the earth. These forests changed into coal or petroleum, over millions of years, due to slow action of the heat and pressure of the earth.	Students will see the cartoons and relate it with their day to day life experiences and will give the different examples.	Teacher will show the cartoons through projector. And ask some questions.

Appendix 3

TASKSHEET

Appendix 4

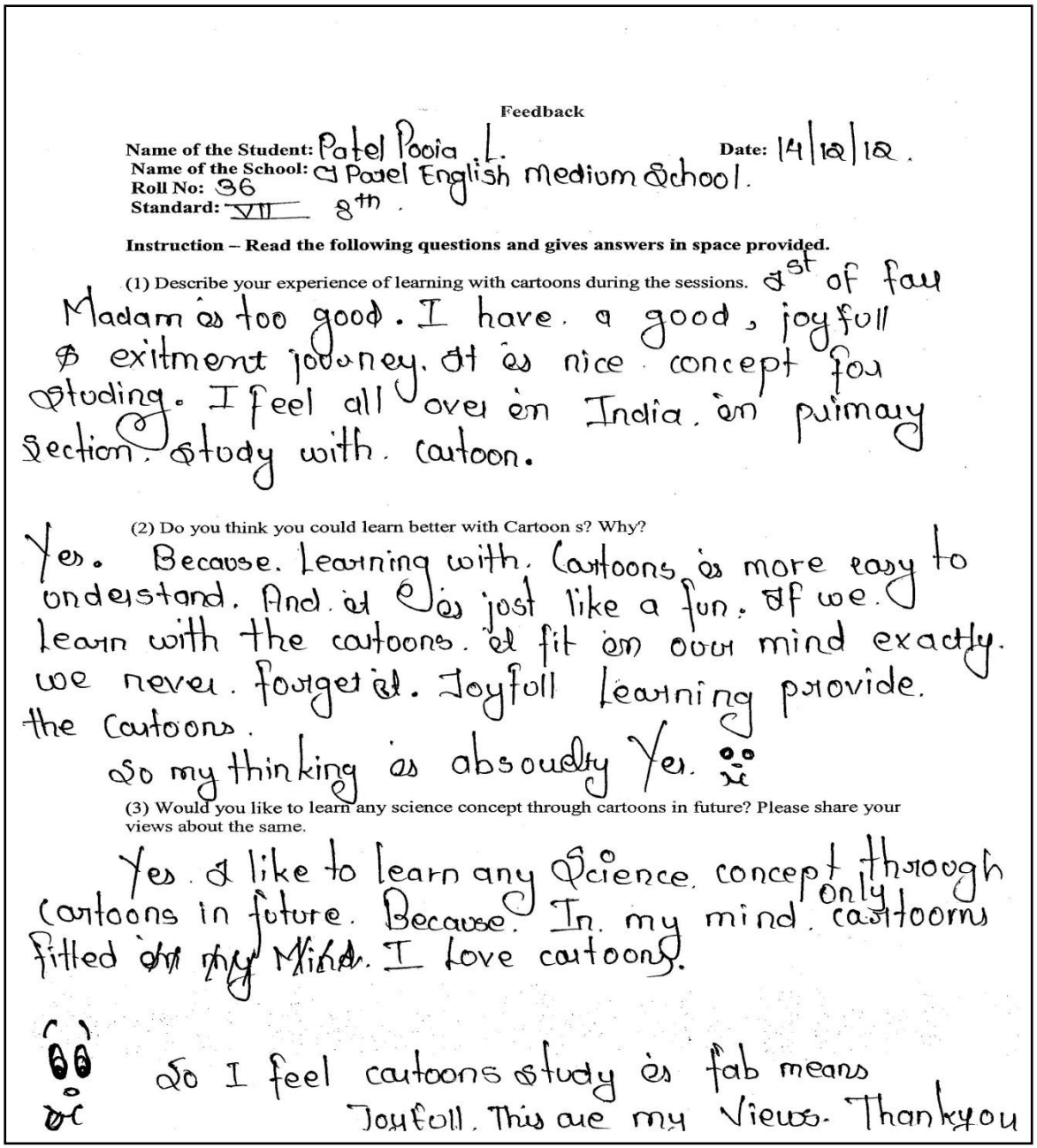
CARTOON PICTURES

Appendix 5

FEEDBACK

Scanned Feedback given by the students about tasks

Feedback 1



Feedback

Name of the Student: Patel Pooja L. **Date:** 14/12/12.
Name of the School: Patel English Medium School.
Roll No: 36
Standard: VII 8th.

Instruction – Read the following questions and gives answers in space provided.

(1) Describe your experience of learning with cartoons during the sessions. 1st of fau Madam is too good. I have a good, joyfull & exitment jouney. It is nice concept for studing. I feel all over in India. in puimary section. study with. cartoon.

(2) Do you think you could learn better with Cartoon s? Why?

Yes. Because. Learning with. Cartoons is more easy to understand. And it is just like a fun. If we. learn with the cartoons. it fit in our mind exactly. we never. forget it. Joyfull learning provide. the Cartoons.

So my thinking is absoudly Yes.

(3) Would you like to learn any science concept through cartoons in future? Please share your views about the same.

Yes. I like to learn any Science. concept through only cartoons in future. Because. In. my mind. cartoons fitted in my Mind. I love cartoons.

So I feel cartoons study is fab means Joyfoll. This are my Views. Thankyou

Feedback 2

Feedback

Name of the Student: khushi **Date:**
Name of the School: Smt C-J Patel English medium school.
Roll No: 35
Standard: 8th

Instruction – Read the following questions and gives answers in space provided.

(1) Describe your experience of learning during the sessions.

when first time the sessions start I thing it was too boring but after the teacher teaches us the we understand that it is not boring it is interesting and we explain all that things which teacher ~~study for~~ explain the topic. and it is very enjoyable sessions. ---.

(2) Which is the other methods use for teaching science?

the other methods use for teaching science is when teacher explain any topic in between ~~of~~ teacher have to say some new jokes and see picture of that topic but in science class there is no enjoyment so ~~for~~ that movement it is very boring. etc. ---

Appendix 7

PHOTOS OF DATA COLLECTION