EFFECTIVENESS OF INDUCTIVE THINKING MODEL FOR TEACHING SCIENCE TO SECONDARY SCHOOL STUDENTS IN TERMS OF ACHIEVEMENT IN SCIENCE CONCEPT FORMATION LOGICAL THINKING AND ATTITUDE TOWARDS SCIENCE

PRE-PRESENTATION SUMMARY SUBMITTED TO

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1.0.0   INTRODUCTION

The world has become a global village and in this age of globalization no country can live in isolation without seeking impact of global trends in national development. The age of globalization has a great impact on education. Education is very much intimate with individual's process of growth. It is a continuous recognition or reconstruction of individual's life experiences. The process of teaching and learning aims at transmission of knowledge, imparting skills and formulation of attitudes, values and behavior. Teaching is a complex activity, which is cluster of different roles and responsibilities, it may operate in different level and in different form. To provide an all round development we need to design a suitable instructional strategy, which helps our students grow emotionally, physically and intellectually. The present trend indicates that student should understand the structure of the body of knowledge rather than memorize actual information. Therefore it is a duty of a teacher to enhance teaching learning process by using various methods, strategies, techniques so that his teaching learning process may became effective and successful.

The Educationists and Psychologists are making efforts to evolve theories of teaching as a result for making teaching learning process effective and successful, so various teaching models has been developed to enhance teaching learning process. Teaching models are relatively a new paradigm which exerts measure theoretical influence on present education system. In the present study the researcher will selected **Inductive Thinking Model** of teaching, because it would improve approaches to information processing in schools and it will be effective in developing actual task in classroom situation.

1.1.0   MODELS OF TEACHING

Teaching model is an instructional plan or instructional pattern based on a specific learning theory, a teaching model is a theory of instruction which impart tactics, techniques and strategies to the students to learn. Teaching models are instructional designs they describe the process of specifying and producing particular environment, situation which causes the students to interact in such a way that specify changes occur in their behavior.

According to **N.K Jangira:-** "Model of teaching is a set of interrelated components arranged in sequence which provides guidelines to realize specific goal. It helps in designing instructional activities and environmental facilities, caring out these activities and realization of the stipulated objectives".

According to **Joyce and Weil**:- they have given three meanings of teaching models.

- "Teaching models are just instructional designs they describe the process of specifying and producing particular environmental situations which causes the students to interact in such a way that specify changes occur in their behavior 1972."

- "Teaching model is a pattern or plan which can be used to shape a curriculum or course, to select instructional material and to guide teacher's action 1972."

- "A model of teaching consists of guidelines for designing educational activities and environment, it specifies ways of teaching and learning that are intended to attain certain kind of goals". (1972)

1.1.1 FAMILIES OF TEACHING MODELS

Joyce and Weil 1972 classified models of teaching into four groups which are as follows:

- **Information Processing Family:** This family is concerned with organization, presentation of verbal and non verbal symbols in a way that helps in the formation of concept and solution of problem, development of social relationships, integrated personality and development of general intellectual ability.

- **Personal Family: -**This family is intended to develop unique personality of learner. These models pay more attention to the emotional life of the person and also focus on helping the individual to develop productive relationship with their environment.

- **Social Family: -**these models aim at the development of social relationships, democratic process and work productivity in the society. They are also concerned with development of mind and learning academic subject.

- **Behavior Process Family:-** The main thrust of these models is modification of visual or overt behavior of the learner. The main psychological basis of these models is stimulus control and reinforcement as put forward in B.F skinner theory of Operant Conditioning.

1.1.2 INDUCTIVE THINKING MODEL

Inductive Thinking Model is under Information Processing Family. Hilda Taba developed this model in her experimental studies. She popularized the term Inductive Thinking and prepare entire social curriculum based on **Inductive Thinking**. This Model is based on resent adaption's by Joyce and Calhoun 1996-98 in programmes designed to accelerate students ability to learn.

Taba concludes that thinking skills should be taught using specific teaching strategies, the main focus of the model is to develop the mental ability and give emphasis on **Concept Formation**. This involves the cognitive task in concept formation.

Hilda Taba believed the students make generalizations only after data are organized, she believed that students led towards making generalization through concept development and concept attainment strategies. Hilda Taba describes generalizing as a higher order of thinking when compared to forming concept.

The primary application of the model is develop thinking capacity. However, in the course of developing thinking capacity, the strategies obviously require students to develop and process large quantities of information. The model can be used in every curriculum area and from kinder garden to high school. This model develops creative thinking, convergent use of information to solve problems.

Inductive Thinking Model is one of the teaching model which develops concepts, thinking skill and mental abilities. It makes teaching learning process effective and successful. The Inductive Thinking Model is designed to instruct students in concept formation and simultaneously, to teach concepts and the application of concepts/ generalizations, mental processes and mental operations. It nurtures attention to logic, attention to language and attention to the nature of knowledge.

According to **Joyce and Weil** Hilda Taba utilize three main assumptions in developing her teaching model.

- Thinking can be taught

- Thinking is an active transition between individual and data.

- Process of thought evolves by sequence that is "lawful".

1.1.3 ELEMENTS OF INDUCTIVE THINKING MODEL

The elements of Inductive Thinking Model are as follows:

- **SYNTAX :-** The teaching organize nine phases and three strategies which are as follows:

  a) **Strategy one   - concept formation**

     Phase one: -   Enumeration and Listening.

     Phase two: -   Grouping.

     Phase three: -   Labeling and Categorizing.

  b) **Strategy two - Interpretation of data**

     Phase four:- Identifying Critical Relationships.

     Phase five:- Exploring Relationships.

     Phase six :- Making Interference.

  C) **Strategy three**: – **Application of principles**

     Phase seven:- Predicating Consequences, Explaining unfamiliar phenomenon hypothesis.

     Phase Eight :- Explaining and Supporting the Predictions and Hypothesis.

     Phase nine: - Verifying the Predictions.

- **Social System**: - In all the nine phases the classroom environment is cooperative the teacher is usually the imitator and controller of activities the teaching activities are arranged in logical sequence.

- **Principles of Reaction** :- Teacher matches tasks to students level of cognitive activity, determine students readiness

- **Support system:-**Teacher helps the students in dealing with the more complex data and information. The teacher encourages the students in processing the data and develops thinking capacity.

1.1.4 INSTRUCTIONAL AND NURTURANT EFFECTS

The Instructional and Nurturant effects are as follows:
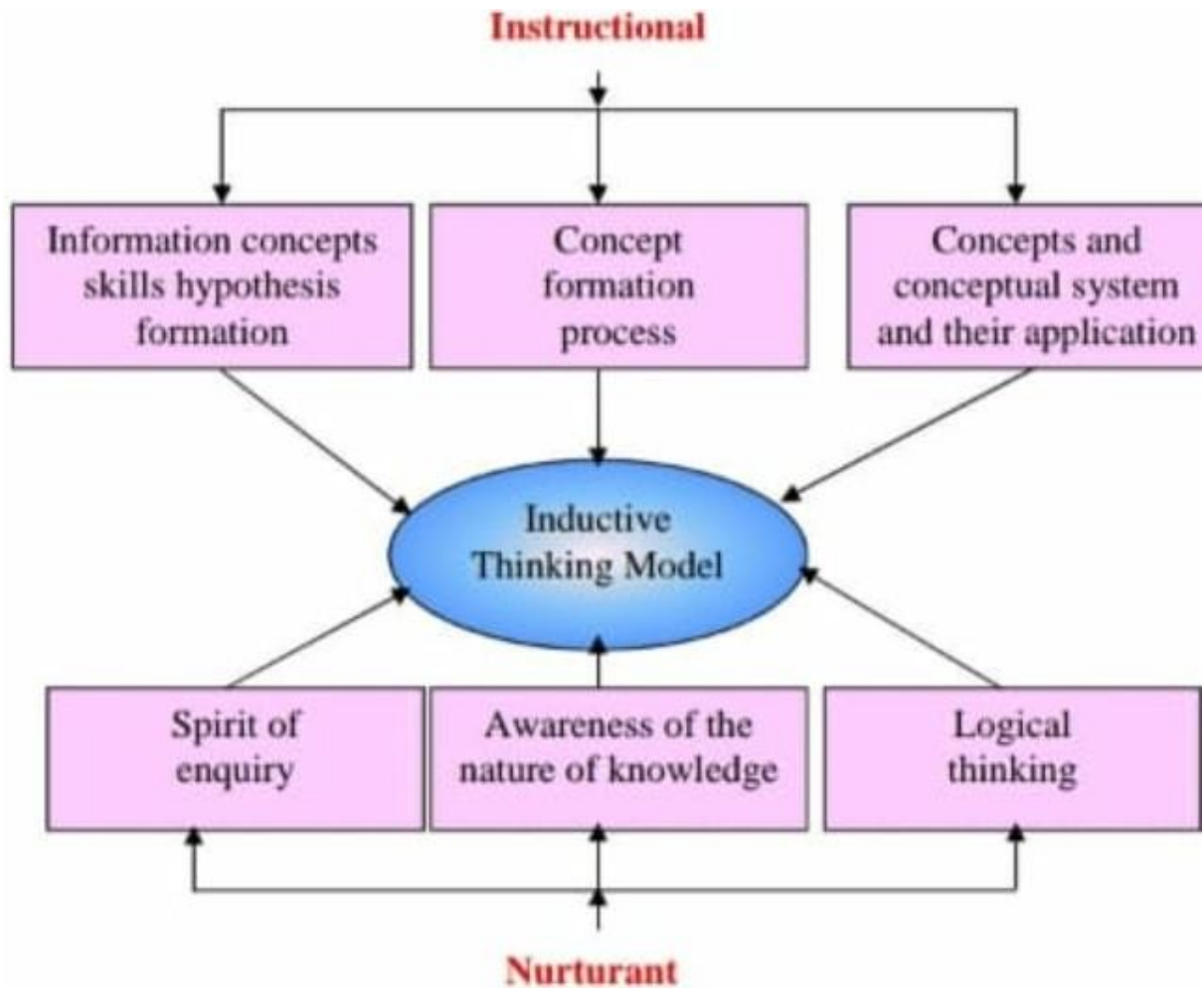
INSTRUCTIONAL EFFECTS

- Information, Concepts, Skills, Hypothesis formation.
- Concept Formation Processes.

- Concepts and Conceptual Systems and their Application

NURTURANT EFFECTS

- Sprit of inquiry

- Awareness of the nature of knowledge

- Logical thinking.

1.2.0 RATIONALE

Change is law of nature; everything changes in their own circumstances. The world of today is changing rapidly because of fast change in the field of science and technology. Thus teaching of science is compulsory subject in the schools has become the need of our as from Secondary Education Commission (1955) to National Educational Policy (1986). The emphasis should be laid on the basic principles, concepts and generalizations. To make science teaching in schools according to the needs of the 21th century, the whole thrust has to change from Memory based learning to Comprehensive based learning.

The research evidences indicate clearly that teaching objectives cannot be achieved if subject is taught by using Conventional Method of teaching. For this reason there is a need to adopt innovative methods and instructional strategies specially teaching a subject like science. Models of teaching are effective in teaching learning process. Inductive Thinking Model can prove instrumental in attaining micro as well as macro teaching objectives.

Various researches has been conducted in the field of Effectiveness Inductive Thinking Model like **Joseph 1979, Bhattacharaya 1984, Rojoria 1987, Sushma 1987, Kamalpreet 1989 Singh 1994, Ramakrishna 1996, Naik 1997, Mehra 2000, Verma 2001, Leuva 2002,**

Ramkumar 2003, Sanjiwani 2005, Indu 2005, Nimbalakar 2006, Wanjari 2008, Vogel 2011, Dorothy 2012, Harneet 2013, **Mahadeo (2014.** It is evident from the above studies that several studies has been conducted to compare the models of teaching like **Joseph, Vogel, Kamalpreet, Rojoria** they found that Inductive thinking model is effective and suitable for teaching various subjects like Geography, Economics, Biological Sciences.

As **Sanjiwani 2005** has conducted a study on Effectiveness of Inductive Thinking Model to develop Reasoning ability, scientific creativity and Attitude towards Science and found that Inductive Thinking Model is effective. But less researches have been conducted to study the relationship and effectiveness of Inductive Thinking Model in terms of Achievement in Science, Logical thinking, Concept formation, Scientific creativity, Intelligence.

Ramkumar 2003, Sanjiwani 2005, Indu 2005, found that Inductive Thinking Model of Teaching was effective in enhancing achievement in Science. Harneet 2013 found that Inductive Thinking Model was found to be effective in terms of Achievement in Commerce and Reactions of students towards Inductive Thinking Model. Also found that Inductive Thinking Model of Teaching was effective among Females than Males in terms of Attitude towards Science Due to inconsistency in the findings researcher took the achievement in science as one of the variables. Gangwar (2021) Inductive Thinking Model was found to be effective in terms of Achievement in Commerce and Reactions of students towards Inductive Thinking Model And ICT Based Teaching. Kardambhai 2022 found that significant difference was found between Inductive Thinking Model (ITM) and Traditional Teaching Method (TTM) group students. Mean score of Inductive Thinking Model (ITM) is more than Traditional Teaching Method. Hence Inductive Thinking Model (ITM) method is more effective than Traditional Teaching Method and Significant difference was found between Inductive Thinking

Model (ITM) and Traditional Teaching Method (TTM) group of urban area students. It is evident from the above researches that less number of researches has been conducted in the area of Inductive Thinking Model of Teaching on Concept Formation and Achievement in Science. Researcher decided to take IX class Students for study. Harneet 2013, Mahadeo (2014) found that Concept Attainment Model were effective in developing Reasoning Ability and Inductive Thinking Model were effective in developing Reasoning Ability, Scientific Creativity among 9th class Students in Science Subject so the researcher selected Science subject. Furthermore in the researches which were conducted on Inductive Thinking Model of Teaching the variables taken were different like Concept attainment, creativity, Mathematical Ability, Problem Solving etc with contradictory findings.

From the related literature it was found very few researches have been conducted by taking Achievement in Science but none of the study has been done to taken Concept Formation in science and logical thinking as a dependent variable. Concept formation is instructional effect and Logical Thinking is nurturant effect of Inductive Thinking Model, so researcher was curious to know the effect of these variables on science subject. The studies are also diverse in respect of sample, design, treatment, analysis and areas so that no generalizations could be made. Therefore a gap was found by the researcher and there was a need to conduct a study in "Effectiveness of Inductive thinking Model for teaching science to Secondary school students in terms of Achievement in Science, Concept formation Logical thinking And Attitude towards Science.

1.3.0 STATEMENT OF THE PROBLEM

EFFECTIVENESS OF INDUCTIVE THINKING MODEL FOR TEACHING SCIENCE TO SECONDARY SCHOOL STUDENTS IN TERMS OF ACHIEVEMENT IN SCIENCE CONCEPT FORMATION LOGICAL THINKING AND ATTITUDE TOWARDS SCIENCE

1.4.0 OPERATIONAL DEFINITIONS OF THE KEY TERMS

- ### INDUCTIVE THINKING MODEL

Inductive Thinking Model is a system of instruction which includes the strategies i.e concept formation, interpretation and application of rules. This Model can be used in every curriculum area and from kinder garden to high school. This model develops Creative thinking, Convergent use of information to solve problems.

- ### TRADITIONAL TEACHING

Traditional teaching is concerned with the teacher being the controller of the learning environment. Power and responsibilities are held by the teacher and they play the role of instructor and decision maker.

- ### ACHIEVEMENT IN SCIENCE

Achievement in Science refers to marks achieved by the students on some selected topics of science taught by the researcher.

- ### CONCEPT FORMATION

Concepts are the categorization of objects, events, and people share common properties. By using concepts we are able to organize complex notion into simple and mostly easily useable forms. Concept formation is the process by which we earn to form classes, things, events and people.

- **LOGICAL THINKING**

Logical thinking is the ability of an individual to think in a disciplined manner on the basis of facts and evidence. It is a process of thinking on the basis of knowledge what we know and what we can prove. Logical thinking means incorporating logic into ones thinking process and to find out a solution of problem.

- **ATTITUDE TOWARDS SCIENCE**

It indicates feelings of an individual or a group concerning science like faith in scientific method, opinion about scientific values of science, interaction of science with individual and society, opinion held about science related social issues.

- **REACTION SCALE**

The reaction scale refers to the opinion of the students about the treatment.

1.5.0 OBJECTIVES

The objectives of the study will be as follows:

1. To compare the adjusted mean scores of Achievement in Science of the student taught through Inductive Thinking Model and the students taught through Traditional Method by considering Pre Achievement in Science as covariate.

2. To compare the adjusted mean scores of Concept formation of the student taught through Inductive Thinking Model and the students taught through Traditional Method by considering Pre Concept formation as covariate.

3. To compare the adjusted mean scores of Logical thinking of the student taught through Inductive Thinking Model and the students taught through Traditional Method by considering Pre Logical thinking as covariate.

4. To compare the adjusted mean scores of Attitude towards Science of the student taught through Inductive Thinking Model and the students taught through Traditional Method by considering Pre Attitude towards Science as covariate.

5. To study the effect of Treatment, Intelligence and their interaction on Achievement in Science of students taught through Inductive Thinking Model and Traditional Method by taking Pre Achievement in Science as covariate.

6. To study the effect of Treatment, Intelligence and their interaction on Concept formation of students taught through Inductive Thinking Model and Traditional Method by taking Pre Concept formation as covariate.

7. To study the effect of Treatment, Intelligence and their interaction on Logical thinking of students taught through Inductive Thinking Model and Traditional Method by taking Pre Logical thinking as covariate.

8. To study the effect of Treatment, Intelligence and their interaction on Attitude towards Science of students taught through Inductive Thinking Model and Traditional Method by taking Pre Attitude towards Science as covariate.

9. To study the reaction of students of Experimental group towards Inductive Thinking Model.

1.6.0 HYPOTHESIS

The Hypothesis of the study will be as follows:

1   There is no significant difference in the mean scores of Achievement in Science of the student taught through Inductive Thinking Model and the students taught through Traditional Method by considering Pre Achievement in Science as covariate.

2   There is no significant difference in the mean scores of Concept formation of the student taught through Inductive Thinking Model and the students taught through Traditional Method by considering Pre Concept formation as covariate.

3   There is no significant difference in the mean scores of Logical thinking of the student taught through Inductive Thinking Model and the students taught through Traditional Method by considering Pre Logical thinking as covariate.

4   There is no significant difference in the mean scores of Attitude towards Science of the student taught through Inductive Thinking Model and the students taught through Traditional Method by considering Pre Attitude towards Science as covariate.

5   There is no significant effect of Treatment, Intelligence and their interaction on Achievement in Science of students taught through Inductive Thinking Model and Traditional Method by taking Pre Achievement in Science as covariate.

6   There is no significant effect of Treatment, Intelligence and their interaction on Concept formation of students taught through Inductive Thinking Model and Traditional Method by taking Pre Concept formation as covariate.

7   There is no significant effect of Treatment, Intelligence and their interaction on Logical thinking of students taught through Inductive Thinking Model and Traditional Method by taking Pre Logical thinking as covariate.

8 There is no significant effect of Treatment, Intelligence and their interaction on Attitude towards Science of students taught through Inductive Thinking Model and Traditional Method by taking Pre Attitude towards Science as covariate.

1.7.0 SAMPLE

The study was an experiment where schools in the Kanpur city were randomly selected using the Random Sampling Technique. A list cbsc board schools was created, and a chit system was used to select the sample. The eight C.B.S.E. board schools selected were:

1. Oxford Inter College

2. Millennium High School

3. Asian public school

4. Subhash public school

5. BKSD Global School

6. R K education centre

7. United public school

8. St. Vivekananda high school

Two schools were randomly chosen for a study: Subhash public school and R K education centre. Subhash public school was selected for the Experimental Group, where a new teaching method would be implemented. R K education centre was chosen for the control Group, where traditional teaching methods would be used. Subhash public School IX class with a total of 63 students in the Experimental Group. R K education centre class IX sections with a total of 57 students in the control Group.

1.8.0 EXPERIMENTAL DESIGN

The current study was experimental in nature and followed a Non-Equivalent Control Group Design. According to Campbell and Stanley (1963), the design layout is as follows:

$$O \qquad X \qquad O$$

- - - - - - - - - - - - - - - - - - - -

$$O \qquad\qquad\qquad O$$
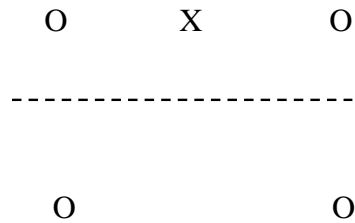
Where O= Observation of pretest and posttest

……. =Random assignment of the treatment

X =Treatment given to experimental group

1.9.0 TOOLS

In this study, data was collected on Achievement in Science, concept formation, logical thinking, and attitude towards science and Reaction towards inductive thinking Model of Teaching. Standardized tool was used to assess, logical thinking, attitude towards science while tools developed by the researcher were used to assess Achievement in Science, concept formation, and Reaction towards Inductive Thinking Model of Teaching. Details about the tools used for assessing these variables are provided below under different captions.

1.9.1 ACHIEVEMENT TEST IN SCIENCE

The researcher evaluated students' achievement in Science using an Achievement Test that was standardized by the researcher. The test consisted of 50 items, each worth one mark for a correct answer. Students had 60 minutes to complete the test.

1.9.2 CONCEPT FORMATION TEST

In this study, students aged 14-18 years who were studying in CBSC board were assessed using the concept formation test standardized by the researcher. This test consists of 40 items. In this test the researcher had formulated the items related to science concepts, each statement consists of four examples, three of the four examples comes under one group which are related with one concept students have to identify those examples and write the name of the concept and they have to justify why those examples are related to that concept. The students have to also tick (✓) the example which is different from the remaining four.

The test was scored according to the guidelines provided in the manual. The Split Half reliability of the Scale was .67 and the validity was .84. The time limit for completing the concept formation test was 60 minutes as specified in the test.

1.9.3 LOGICAL THINKING TEST

To assess the logical thinking of students researcher used the logical thinking test by Sujit Tiwari and Shikha Chaturvedi. The test consisted of 50 items with four options, all of which were correct. Students had to carefully read each statement and mark the most appropriate option on a response sheet provided by the researcher. The time limit for the test was 45 minutes, and scoring was done according to the manual. The test showed good reliability with a Pearson's Correlation Coefficient of .753 and a Cronbach's Alpha value of .731.

1.9.4 ATTITUDE TOWARDS SCIENCE

Researcher used science attitude scale by Avinash Greval. This scale consists of 20 statements; Each statement had a 5-point rating scale: Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree.

1.9.5 REACTION SCALE

In order to evaluate how students responded to Inductive thinking Model of Teaching, the researcher created a scale. This scale included 24 statements, with 12 being negative and 12 being positive. Each statement had a 5-point rating scale: Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree. Students were instructed to carefully read each statement and mark the alternative that best represented their reaction to the teaching model. Positive statements were weighted 5, 4, 3, 2, and 1, while negative statements were weighted 1, 2, 3, 4, and 5. The test had a time limit of 30 minutes.

1.10.0 PROCEDURE OF DATA COLLECTION

The process of collecting data began after obtaining permission from the Principals of selected schools. Shubhash Public School was chosen randomly to conduct an experiment on class IX students, while R K Education centre. In the Experimental Group were informed about the research objectives to establish a connection with them. Once rapport was established, an Achievement Test in Social Science was given to the Experimental Group. The same procedure was followed with the control Group, administering the same test. Over the next four days, both groups took a achievement test, concept formation test, logical thinking test and attitude toward science Scale. All these variables were measured in both groups. The Experimental Group was taught Science using the inductive thinking Model of Teaching, while the Traditional Group was taught using traditional methods. The treatment lasted for 40 working days, including pre and post tests lasting 45 minutes each. The same content was taught to the control Group in a traditional manner. At the end of the treatment, both groups were tested again on the same variables using the same tests. The Experimental Group also completed a reaction scale to assess their response to the inductive thinking Model of

Teaching. Scoring was done according to the manual. The treatment process is summarized in Table 4.

TABLE4: *THE SCHEMATIC REPRESENTATION OF TREATMENT*

Activity		*Process*		*Time*
Day1		Both the groups Experimental and control Group was oriented and objectives of research were discussed to build rapport with students		
		Control Group	Experimental Group	
Pre Testing of Dependent variables	Day2	Administration of Achievement Test	Administration of Achievement Test	45 minutes
		Administration of concept formation test	Administration of concept formation test	
	Day3	Administration of logical thinking test	Administration of logical thinking test.	
	Day4			
	Day5	Administration of attitude towards science scale	Administration of attitude towards science scale	
Day 6 to day 55		25 lessons were taught through traditional	25 lessons were taught through Inductive thinking	

Treatment		method of Teaching one Lesson	Model of Teaching one Lesson	45 Minutes
Post Testing of Dependent Variables	Day56	Administration of Achievement Test,	Administration of Achievement Test	45 minutes
	Day57	Administration of concept formation test	Administration of concept formation test	
	Day58	Administration of logical thinking test	Administration of logical thinking test	
	Day59	Administration of attitude towards science scale	\Administration of attitude towards science scale	
Day 60 Reaction Scale		-------------------	Administration of Reaction Scale towards Inductive thinking Model of Teaching.	30 Minutes

1.11.0 ANALYSIS OF DATA

Here is an analysis of the data based on different objectives:

1. One Way ANCOVA was used to compare the adjusted mean scores of Achievement in Science between a group taught through Inductive thinking Model and a group taught through the Traditional Method. Pre-Achievement in Science was considered as a covariate.

2. One Way ANCOVA was used to compare the adjusted mean scores of Concept Formation between a group taught through the Inductive Thinking Model and a group taught through the Traditional Method. Pre- Concept Formation was considered as a covariate

3. One Way ANCOVA was used to compare the adjusted mean scores of Logical Thinking between a group taught through the Inductive thinking model and taught through the Traditional Method. Pre- Logical Thinking was considered as a covariate.

4. One Way ANCOVA was used to compare the adjusted mean scores of attitude towards science between a group taught through the Inductive thinking model and a group taught through the Traditional Method. Pre attitude towards science was considered as a covariate

5. 2x2 Factorial Design ANCOVA was used to study the effect of Treatment, Intelligence and their interaction on Achievement in Science of students taught through Inductive Thinking Model by considering Pre Achievement in Science scores as covariate.

6. 2x2 Factorial Design ANCOVA was used to study the effect of Treatment, Intelligence and their interaction on Concept Formation of students taught through Inductive Thinking Model by considering Pre Concept Formation as covariate.

7. 2x2 Factorial Design ANCOVA was used to study the effect of Treatment, Intelligence and their interaction on Logical Thinking of students taught through Inductive Thinking Model by considering Pre Logical Thinking ascovariate.

8. 2x2 Factorial Design ANCOVA was used to study the effect of Treatment, Intelligence and their interaction on Attitude Towards Science of students taught through Inductive Thinking Model by considering Pre Attitude Towards Science as covariate.

9. Statement-wise analysis has been done. The data were analyzed by frequency, percentage and intensity index.

1.12.0 FINDINGS

The findings of the present study were as follows:

1. The Inductive Thinking Model was found to be significantly superior in comparison to the Traditional Method of Teaching for facilitating Achievement in Science when Pre-achievement is taken as a covariate.

2. The Inductive Thinking Model was found to be significantly superior in comparison to the Traditional Method of Teaching for improving Concept formation when Pre-Concept formation is taken as a covariate.

3. The Inductive Thinking Model was found to be significantly superior in comparison to the Traditional Method of Teaching for improving Logical Thinking when Pre-Logical Thinking is taken as a covariate.

4. The Inductive Thinking Model was found to be significantly superior in comparison to the Traditional Method of Teaching for improving Attitude towards Science when Pre-Attitude towards Science is taken as a covariate.

5. The Achievement in Science of the students was found to be significantly independent in terms of Intelligence when Pre-Achievement in Science is taken as covariate.

6. The Achievement in Science of the students was found to be significantly independent in terms of interaction between Treatment and Intelligence when Pre-Achievement in Science is taken as covariate.

7. The Concept Formation of the students was found to be significantly independent in terms of Intelligence when Pre-Concept Formation is taken as covariate.

8. The Concept Formation of the students was found to be significantly independent in terms of interaction between Treatment and Intelligence when Pre-Concept Formation is taken as covariate.

9. The above average Intelligence group was found to be significantly superior in comparison to the below average Intelligence group for improving Logical Thinking when Pre-Logical Thinking is taken as a covariate.

10. The Logical Thinking of the students was found to be significantly independent in terms of interaction between Treatment and Intelligence when Pre-Logical Thinking is taken as covariate.

11. The Attitude towards Science of the students was found to be significantly independent in terms of Intelligence when Pre-Attitude towards Science is taken as covariate.

12. The Attitude towards Science of the students was found to be significantly independent in terms of interaction between Treatment and Intelligence when Pre-Attitude towards Science is taken as covariate.

13. The reaction of the students of the experimental group was found to be favourable towards Inductive Thinking Model.

1.12.0 DELIMITATIONS

1 Only some selected topics of Science of 9th class students were selected.

2 Only Inductive Thinking Model of Teaching Were used for Experimental Group

3 The Sample for the present study was selected from Kanpur City.

4 Tests were developed in English language only.

1.13.0 EDUCATIONAL IMPLICATION OF THE STUDY

The implications which are drawn from the present study for teachers, students, teacher educators, administrators, text book writers and researchers for further study.

1.13.1 STUDENTS

In the present scenario overall teaching goals cannot be achieved through conventional method. The educational implications of inductive thinking are significant, as it fosters critical thinking, problem-solving skills, and creativity among students. Inductive thinking model promotes active learning, as students are required to actively engage with the material and draw conclusions based on evidence. This Model encourages students to think analytically and critically about the information presented to them. By engaging in inductive reasoning,

students can make connections between concepts and develop a deeper understanding of the subject matter.

Inductive thinking model encourages students to think creatively and outside the box. By allowing students to explore different possibilities and draw their own conclusions, ITM promotes divergent thinking and innovation. Students are encouraged to consider multiple perspectives and viewpoints, leading to a more holistic understanding of the Subject.

Inductive thinking model promotes problem-solving skills among students. By starting with specific examples and observations, students are able to identify patterns and formulate hypotheses to explain their observations. This process of trial and error helps students develop their problem-solving skills and think strategically about how to approach a given problem. Furthermore, the inductive thinking model promotes a deeper level of understanding and comprehension of the material. By requiring students to use their own observations and experiences to derive general principles, students are able to internalize the information in a more meaningful way. This approach aids in long-term retention of knowledge and enhances students' ability to apply what they have learned in new contexts.

ITM promoting critical thinking, problem-solving skills, creativity, and collaboration, this approach supports student learning and helps students develop the skills they need to succeed in today's complex and fast-paced world.

1.13.2 TEACHERS

The educational implication of utilizing the inductive thinking model for teachers is substantial, as it encourages critical thinking and problem-solving skills among students. By presenting real-world examples and allowing students to draw their own conclusions through observation and investigation, teachers can foster a deeper understanding of complex

concepts. This approach also promotes independent learning and helps students develop a sense of curiosity and initiative in their studies. Additionally, incorporating the inductive thinking model into classroom instruction can help teachers tailor their lessons to meet the diverse needs of learners, making education more inclusive and engaging for all students. Teachers can promote active learning in the classroom. Instead of passively absorbing information, students are encouraged to question, explore, and make sense of the material on their own. This approach helps students to develop a deeper understanding of the subject matter and fosters a sense of curiosity and independence in their learning process. By presenting students with concrete examples and allowing them to draw their own conclusions, teachers can empower students to take ownership of their education and become more self-directed learners.

Inductive thinking model can also help teachers to differentiate instruction and cater to the diverse learning styles of their students. By presenting information in a variety of ways and encouraging students to make connections on their own, teachers can support students with different strengths and weaknesses. Overall, the use of the inductive thinking model in education can help teachers cultivate a dynamic and engaging learning environment that fosters critical thinking skills and empowers students to become lifelong learners.

1.13.3 TEACHER EDUCATORS

The Education Commission (1964-66) stated that the destiny of its nation is being shaped in its class-rooms. These days people are not satisfied with the type of development taking place in the class-room. Most of the schools are having trained teachers. During the teachers-training, teacher educators play an important role. The teacher educators supposed to be up to date in new techniques and technologies of teaching-learning as well as the

training. In the present study, Inductive Thinking Model was used for teaching Science to Secondary school Students. On comparing Inductive ThinkingModel with traditional method of Teaching, Inductive Thinking Model was found to develop significantly Achievement in science, Concept Formation, Logical thinking, Science Attitude of the students. It indicates that the teacher educators should train the teachers in Inductive Thinking Model. Not only the pre-servicebut whenever in-service training is organized, the teachers should be trained in Inductive Thinking Model.

 Teacher Educators may train teachers to develop some interactive multimedia teaching package based on the phases of Inductive Thinking Model.

Educators should incorporate the inductive thinking model into their teaching practices to enhance student learning and foster a culture of intellectual curiosity and inquiry.

1.13.4 ADMINISTRATORS

Administrators are the key to the success of any organization, institution, and society also. Only, those administrators may perform it successfully who have the leadership quality and ability to make quick decisions in changing situations. Inductive reasoning, critical thinking, creative thinking, scientific attitude, better understanding ability, etc. are must have qualities for leadership. The findings of the present study indicate that these abilities could be developed significantly through the use of Inductive ThinkingModel. It is well known that the students of the present day may be the administrators of tomorrow. So, there is a need to change method of teaching, so that those abilities are developed in students which make them a useful citizen. The use of Inductive Thinking Model in classroom necessarily needs the support of administrators. Therefore, there are implications of this study to the administrators. The use of Inductive Thinking Model requires training of teachers, instructional

materials, flexibility in the timetable, freedom to change the setting of the classroom, etc. The administrator can also help in theimplementation of Inductive Thinking Model by way of motivating teachers and providing maximum possible help in the above mentioned areas.

1.13.5 TEXT-BOOK WRITERS

There are many books written by different authors on various subjects and at different levels. These books are typically written in traditional styles. However, students often struggle to understand the content and apply the information they learn from these books. Books are a valuable source of information and can greatly impact and shape a person's personality. With technological advancements, the way books are written has changed significantly.

A recent study suggests that authors can easily incorporate different phases of the Inductive Thinking Model into their books. By presenting content in a way that stimulates students' mental processes, authors can engage readers by including challenging questions and arguments at strategic points. This can lead to significant changes in the readers' thinking.

Authors who are proficient in language can effectively integrate various activities of the Inductive Thinking Model into their writing. Therefore, the results of this study have important implications for book writers.

1.13.6 SUGGESTIONS FOR FURTHER STUDY

Research is a creative work there is always a possibility to gain new knowledge from researches that has been done previously. From the present study there are following suggestions given below by the researcher.

- In the present study Science was taught through Inductive Thinking Model and Traditional method of Teaching. The other subjects may also be taught through Inductive Thinking Model and Traditional method of Teaching and their effectiveness may be determined using different criteria.

- ITM may also be used in combination with other method of teaching.

- Inductive Thinking Model may be used in combination with other Models of Teaching.

- Further researches may be taken up on the line of this present study by changing the samples as high school students or intermediate students.

- Effectiveness of ITM could be studied in terms of other variables.

- Researcher has taken sample from CBSC board. A similar study can be carried out with another board of school to study the effectiveness of ITM.

- Effectiveness of ITM can be studied by development of tool in concept formation and logical thinking on another subject.

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