MULTIPLE INTELLIGENCE APPROACH TO CURRICULUM TRANSACTION AND ACHIEVEMENT OF EDUCATIONAL OBJECTIVES AT SECONDARY SCHOOL LEVEL

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CERTIFICATE
STATEMENT BY THE STUDENT

As required by the University Ordinance 770, I wish to state that the work embodied in this thesis "Multiple Intelligence Approach to Curriculum Transaction and Achievement of Educational Objectives at Secondary School Level" forms my own contribution to the research work carried out under the guidance of Dr. Vasundhara Padmanabhan at the K.J.Somaiya College of Education, Training and Research, Vidhyavihar. This work has not been submitted for any other degree of this or any other University. Whenever references have been made to previous works of others, it has been clearly indicated as such and included in the bibliography.

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LIST OF ABBREVIATIONS

TA: Traditional Approach
MIA: Multiple Intelligence Approach
TAS: Traditional Approach Scores
MIAS: Multiple Intelligence Approach Scores
RBT: Revised Bloom's Taxonomy
LOA: Levels of Achievement
A: Average
AA: Above Average
BA: Below Average

CHAPTER 1

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The illiterate of the 21st century, according to futurist (Alvin Toffler, 1970), "will not be those who cannot read and write, but those who cannot learn, unlearn and relearn"

Learning is not a spectator sport. Learning happens in a variety of ways – from conversations, life experiences, personal thoughts, educational courses or working on some projects. There is not much difference between living and learning. Learning is a never ending cyclic process where paradise can be created. The environment which we are immersed has changed drastically thereby engaging in active learning. Lack of attention to the nature of learning inevitably leads to an impoverishment of education. An exciting learning experience is a real and relevant context for learning through which young learners recognize for themselves the importance of learning in their lives, both now and in the future. Learning becomes fascinating when young people take an active engagement with and responsibility for their own learning, increasing the impact and potential for future development. It has to be a rich engagement of the learner as per his needs. Learning is to incorporate new information or skills into the learner's existing knowledge structure and to make that knowledge accessible. Learning begins with the need for some motivation, an intention to learn. The learner must then concentrate attention on the important aspects of what is to be learned and differentiate them from noise in the environment. Learning should not be the lifeless, sterile, futile, quickly forgotten matter that is crammed into the mind of the poor helpless individuals tied to his seat by bonds of conformity.

Teaching is not Telling and Learning is not Listening. Students do not learn much by just sitting in class, listening to teachers, memorizing assignments and giving out answers. A regular classroom set up in schools displays students seated in systematic and synchronized manner in benches and desks arranged one behind the other allowing least mobility among themselves and also for the teachers towards the latter

section of the class. The participation of the students is often restricted to answering questions rarely asked by the teacher. Non-interactive, chalk-talk method used in overcrowded classrooms end up producing children who are able to replicate but not create knowledge. In lots of teaching situations we focus on the right and wrong answers to things, instead we need to pay heed to a less structured, curiosity-driven paradigm which focuses not on what is absolutely right or wrong, but instead on what is surprising.

Today learning has to be fun oriented, (W. *James, 2009)* in his article '*Children's Learning should be Fun*' has mentioned the results of various researches conducted on memory, the types of things we remember and that we do not remember. It concluded that we remember things learned in pleasant situations and forget things learnt in unpleasant situations thereby retaining and imprinting information in the brain at a higher rate when the person is relaxed and enjoying the experience. Traditional learning is indicative of the learning fields' reluctance to change. Various approaches towards the conventional system engulf the learning community in the chains of lack of interest and motivation towards learning. Also it has been deficient in catering to individual differences among the student community. Effective learning can originate from classroom as evidenced by effective use of alternative teaching - learning models.

Learning can be and should be fun has a scientific aspect too (*Tom, 2009*) a chemical messenger dopamine is revived with the learning experience; hence proper learning should be enjoyable. Learning without fun instead should be well blended with fun. Learning should free students from any bondage that would curb excitement and curiosity.

In an educational process old ideas have led to stagnation paving its way through innovations and continuous reconstruction of experiences thereby taking a new meaning of education in the present times. This significantly emphasizes a quest for quality and focusing on certain key areas in the realm of education. In a truly transition phase, we come across an educational set up where the old is becoming obsolete and the new is in the process of emergence and acceptance. Today education depends on quality of people produced and hence has the onus of producing knowledge based society rather than literacy based society and for this education can no longer remain conventional. Today schools have to come out of the normal set of

boundaries and have to become multidimensional, thus meeting the needs of quality, catering to individual differences and practice an inclusive setup. The 1964-66 Kothari Commission stated that destiny of India is being shaped in classrooms which in today's context extend further, to the horizon of thoughts filled with activities in the learning process.

Education should model good practices for students, reinvent the pedagogical aspects, revolutionize the curriculum, create a positive attitude towards teaching–learning and adhere to a transparent assessment system. Education must be student centric and establish a safe environment for students to collaborate, discuss, reflect, provide and receive feedback for further progress. Education today has assumed a bigger challenge towards several dimensions of student participation surpassing the four walls of the institution to the dynamic learning community. "We need kids who don't just do what they are told but who are self-directed" (KenKay, 2009)

1.1.2 Rationale of the Study

Education must develop in youth the capabilities for engaging in intense concentrated involvement in an activity. (James.C, 1977).

A child's personality is shaped and sharpened at school where the students get connected to the world of knowledge and hence it becomes important for the teachers to satisfy the students' needs by playing diverse roles. The recent global and technological revolution has created a scenario that is "powered by technology, fuelled by information and driven by knowledge" thereby promoting "learning to learn". Initiating the use of learner-centered activities in the teaching learning environment makes learning more individualized and kindles the flames of a motivating teacher - student interaction. Students should be made to learn differently in a classroom rather than passively listening to the teachers' lecture and receiving information. Different activities can be a vital door to learning, which stimulate their interests and cater to the various intelligences as propounded by Professor Howard Gardner in his theory of Multiple Intelligences. The Multiple Intelligence Approach reaches out to children with different interests, likes and capacities. It caters to all the children not just emphasizing the verbal and mathematical intelligence. The Multiple Intelligence Approach also helps the students to get an in-depth understanding of a concept through activities and tasks that enhance comprehension, understanding, and creativity thereby being able to achieve the educational objectives as given by

Revised Bloom's Taxonomy. Recent trends in instructional design place more and more emphasis on **learner centered classroom environment**. It caters to **individualizing instruction** by applying learning theories and principles to instruction so as to **enable each and every child to realize one's fullest potentials,** thereby engaging him in active learning. The recent constructivist learning theories, too, recommend this kind of active learning to cater to **different learning styles** of the learners. The National Curriculum Framework (2005) accepts active learning as a strategy for inclusion, as it is the best means of enabling each and every child to realize his fullest potentials. As National Curriculum Framework rightly remarks, *"Each new generation inherits the storehouse of culture and knowledge in society by integrating into one's own web of activities and understanding, and realizing its fruitfulness in creating afresh"(NCF, 2005)*

If we can organize the spectrum of human abilities, we could improve the self esteem of the students thus making them feel more engaged, participative and responsible for their learning contributing immensely to the society at large. The following text gives us a glimpse of the above trends.

1.1.2.1 Constructivist Learning

Only by wrestling with the conditions of the problem at hand, seeking and finding his own solution (not in isolation but in correspondence with the teacher and other pupils) does one learn. (John Dewey 1910).

Constructivism as a philosophy of learning can be traced since the eighteenth century and views that human can understand when they have themselves constructed. Constructivism is basically a theory -- based on observation and scientific study -- about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. Our experiences to something new has to be merged with our previous ideas and experience, it maybe changing what we believe, or discarding the new information as irrelevant, by asking questions, exploring and assessing thereby empowering us as active creators of our own knowledge.

Jean Piaget and John Dewey develops a clear idea and shed light on constructivism and its vital contributions to learning, it also takes an interdisciplinary perspective, as it draws on a diversity of psychological, sociological, philosophical, and critical

educational theories. In view of this, constructivism is an overarching theory that does not intend to demolish but to reconstruct past and present teaching and learning theories, its concern lies in focussing on the learner as an important agent in the learning process, rather than resting the power on the teacher.

Knowledge emerges only from situations in which learners have to draw it out of meaningful experiences (Bruce, 2009). Further, these situations have to be embedded in a social context, such as a classroom, where students can take part in manipulating materials thus, forming a community of learners who construct their knowledge together. Students cannot learn by means of rote memorisation; they need to learn by experiences whereby concrete activities are combined with theory. The implication of Dewey's theory is that students must be engaged in meaningful activities that induce them to apply the concepts they are trying to learn.

Piaget's constructivism is premised on the psychological development of children, where the basis of learning is discovery. To understand is to discover, or reconstruct by rediscovery and such a situation would enable us to produce the future individuals who are capable of production through creativity not through repetition but active participation and involvement (Clark. D.R, 1995)

Learning is a social process (Smith, 2002) where students construct new concepts based on current knowledge. The student selects information, constructs hypotheses, and makes decisions, with the aim of integrating new experiences into the existing mental constructs. It is cognitive structures that provide meaning and organization of experiences and allows learners to transcend the boundaries of the information which fosters the heart of effective education. In short we could analyse Bruner' view towards education as -

- ➢ Instruction must be corresponding with the experiences that make the student willing and able to learn (readiness).

- ➢ Instruction must be structured so that it can be easily understood by the student (spiral organization).

- ➢ Instruction should be designed to facilitate exploration (going beyond the information given).

Vygotsky's social constructivism (Galloway, 2001) emphasizes on the *zone of proximal development*. It encourages students to solve problems beyond their actual

developmental level under adult guidance or in collaboration with more capable peers. Constructivism emphasizes the importance of the world of knowledge, beliefs, and skills an individual brings to bear on learning. The new knowledge is a combination of prior learning matched with new information, and readiness to learn, and it opens up new perspectives, leading individuals to informed choices and to accept and fit it into their existing schema of knowledge.

Recapitulating on the main principles of constructivism, we could say that it emphasises learning and not teaching, encourages learner autonomy and personal involvement in learning, fosters learners' natural curiosity, and also takes account of learners' interests in terms of their beliefs, attitudes, and motivation. Thus emphasizing on experiential learning that is conducive to personal change and growth, it also helps in the learning process in its nature, direction and direct interaction with practical, social and personal issues, thereby helping in self evaluation, assessing progress and success. In addition, the constructivist theory renders meaningful and relevant situations that provide learners with the opportunity to construct new knowledge from authentic experience.

From the theoretical and psychological background, we could highlight that the constructivist classroom exhibits numerous discernable qualities different from a traditional classroom. A constructivist classroom depicts variety of teaching practices that encourages students to use active and integrative techniques to create more knowledge, reflect on it and talk about it. The students are encouraged to use prior experiences to help them form and reform interpretations. In the constructivist classroom, both teacher and students think of knowledge not as tablets of knowledge that need to be memorized, but as a dynamic, ever changing view of the world to explore it better. The teacher has to understand the students' pre- existing concepts and guide the activities to address them and build on them. The teachers promote students to become expert learners and create a planned classroom environment encouraging the students learn how to learn. The focus tends to shift from the teacher to the students.

A constructivist teacher flexibly and creatively incorporates ongoing experiences in the classroom and construction of lessons with small groups and individuals. The environment is democratic, the activities are interactive and student centered, and the students are empowered by a teacher who operates as a facilitator/consultant. The

independent learner is intrinsically motivated to generate, discover, build and enlarge his/ her own framework of knowledge. Thus it emphasizes on concrete learning design where teachers develop a situation for students to explain, select a process for grouping of materials and students, build a bridge between what students already know and what they want them to learn, encourage students to exhibit a record of their thinking by sharing it with others, and solicit students' reflections about their learning. Constructivist approach is used most of the times through various techniques in the teaching-learning process (Chandhok. Lynn. Susan, 2004):

- prompt students to formulate their own questions (inquiry);

- allow multiple interpretations and expressions of learning (multiple intelligences);

- encourage group work and the use of peers as resources (collaborative learning).

In a total contrast to this is our traditional classroom where knowledge is seen as inert. Teachers disseminate information to students who are the recipients of knowledge. Learning is based on repetition, students primarily work alone most of the times with materials such as the textbooks and notebooks. Teachers' role is directive and authoritative and strict adherence to fixed curriculum is highly valued where the motive of assessment is limited only with testing to seek correct answers.

In a traditional classroom, an invisible and imposing, at times, impenetrable, barrier between student and teacher exists through power and practice. In a constructivist classroom, by contrast, the teacher and the student share responsibility and decision making and demonstrate mutual respect. The democratic and interactive process of a constructivist classroom allows students to be active and autonomous learners. Using constructivist strategies, teachers are more effective. They are able to promote communication and create flexibility so that the needs of all students can be met. The learning relationship in a constructivist classroom is mutually beneficial to both students and teachers.

Impact of Constructivist theory on Education: Constructivist approach to learning has a great impact on the following:

Curriculum: Educators must emphasize on concepts related to life wherein the students can construct their own knowledge that would make students active and

responsible for their learning, enhance reflective thinking exploring the world and its challenges and encouraging collaborative approach of learning.

Instruction: Teachers should design their instruction methods to encourage students to question, participate in hands on experiments, investigate on a topic, and use variety of resources to find solutions and answers, reflecting on their learning either in group or as individuals.

Assessment: Teachers should include in assessment the work done by students, observation and point of view given by students in performing various activities as well some tests. Thus it gives importance to process and the product.

As long as there were people asking each other questions, we have had constructivist classrooms. Constructivism, the study of learning, is about how we all make sense of our world, and that really hasn't changed (Martin. G.B, Jacqueline G. B, 1999)

Students today represent a rich array of different backgrounds and ways of thinking and feelings. If the classroom can become a neutral zone where students can exchange their personal views and critically evaluate with others, thus enabling each student build understanding based on observed evidence. After all, classrooms are, and should be open to and sensitive to a whole lot of approaches to teaching and learning thereby catering to multiple intelligences of students and catering to their emerging and advancing thinking levels.

1.1.2.2 Learning Styles

Instruction begins when you, the teacher, learn from the learner. Put yourself in his place so that you may understand what he learns and the way he understands it. (Kierkegaard, 1843).

Learning styles are characteristic cognitive, affective, and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. To put it simply, one's learning style or learning preference is the way one tends to learn best. It involves one's preferred method of taking in, organizing, and making sense of information. One learning style is neither superior nor inferior to another, but is simply different, with different characteristic strengths and weaknesses. Students preferentially take in and process information in

different ways by seeing, hearing, reflecting and acting, reasoning logically, analyzing and visualizing.

Teachers must provide a variety of learning approaches to successfully lead our students through the task of learning so that these differences can be recognized and provided for in every classroom, this could be through lectures, demonstration, or leading students to self discovery. Understanding the different ways that children learn, interact with and process information can help us modify the way we teach so that all students have an equal opportunity to succeed. When a mismatch exist between learning styles of most students and the teaching styles of teachers the students become bored and inattentive in class, score poorly on tests and get discouraged. The goal of instruction should be to shrink the difference and cater to students' multiple needs.

Students have different levels of motivation, different attitudes about teaching learning and different responses to specific classroom environment in instructional practices (Kathy, 2003), the categories of diversity have important implications for teaching and learning : differences in students' learning styles (characteristic ways of taking in and processing information), approaches to learning (surface, deep and strategic), psychological bases (concrete and abstract perceivers, and active and reflective processors).

Students are inclined towards different approaches to learning (Kathy, 2003).

> Students with a *reproducing orientation* tend to adopt the *surface approach* of learning that relies on rote memorization and mechanical formula substitution and making little or no effort to understand the material being taught.

> Students with a *meaning orientation* tend to adopt a *deep approach* of learning through probing, questioning and exploring the limits of applicability of new material

> Students with an *achieving orientation* tend to use a *strategic approach* of learning, and tend to go deeper in analyzing the material, evaluating it.

The concept of learning styles in its psychological aspect emphasizes the result of heredity, upbringing and current environmental demand etc impacts on different individual's tendency to perceive and process information differently. The different ways of doing so are generally classified as:

➢ ***Concrete*** and ***abstract*** *perceivers*–Concrete perceivers absorb information through direct experience, by doing, acting, sensing, and feeling. Abstract perceivers take in information through analysis, observation, and thinking.

➢ ***Active*** and ***reflective*** *processors*–Active processors make sense of an experience by immediately using the new information. Reflective processors make sense of an experience by reflecting on and thinking about it.

➢ Learning is a cyclic process wherein the learner goes through the cycle of experiencing, reflecting, thinking and acting. Immediate or concrete experiences lead to observations and reflections (Kolb, 1984). These reflections are then absorbed and translated into abstract concepts with implications for action, which the person can actively test and experiment with, which in turn enable the creation of new experiences.

The best way a student can learn depends on him/her, and there are different learning styles that work best for them. The teacher has to cater to a variety of activities in the teaching learning process to ensure maximum participation from the students'. Below mentioned are the different types of learners (Miriam. M, 2007)

Auditory Learners : Students with this style are able to recall what they hear and prefer oral instructions. They learn by listening and speaking, enjoy talking and interviewing. They are phonetic readers who enjoy oral reading, choral reading, and listening to recorded books. They learn best by interviewing, debating, participating on a panel, giving oral reports or participating in oral discussions of written material.

Visual Learners : Students with this style are able to recall what they see and prefer written instructions. These students are sight readers who enjoy reading silently. They learn by observing and enjoy working with maps, graphs, posters, diagrams, text with pictures.

Kinesthetic Learners : Students with this style learn best by touching. They understand directions that they write, act out and through manipulations. They learn by drawing, making models, following instructions to make something.

Global Learners : Students with this style are spontaneous and insightful. Information needs to be presented in an interesting manner using attractive materials. Cooperative learning strategies and holistic reading methods work well with these learners. They learn through story writing, games, and group activities.

Analytic Learners : Students with this style plan and organize their work. They focus on details and are logical. They are phonetic readers and prefer to work individually on activity sheets. They learn by sequential presentation of information, structured and teacher directed lessons, clarity in goals.

Learning Styles (Edward de Bono,1976) by the concept of lateral thinking means *Vertical thinking is digging the same hole deeper. Lateral thinking is trying again elsewhere.* Lateral thinking offers scope for developing creativity of the learners and come in handy to achieve the highest objective of Revised Bloom's Taxonomy "creating".

Impact of Learning Styles Theory on Education: Learning styles impact education in the following areas:

Curriculum– Educators must place emphasis on intuition, feeling, sensing, and imagination, in addition to the traditional skills of analysis, reason, and sequential problem solving.

Instruction– Teachers should design their instruction methods to connect with all the learning styles, using various combinations of experience, reflection, conceptualization, and experimentation. Instructors can introduce a wide variety of experiential elements into the classroom, such as sound, music, visuals, movement, experience, and even talking.

Assessment– Teachers should employ a variety of assessment techniques, focusing on the development of "whole brain" capacity and each of the different learning styles.

Learners differ and teachers' need to address these differences by catering to the different learning styles through an array of activities that no longer consider students as a featureless mass, but kindles the flame of active, integrative and reflective learning to make learning enjoyable and meaningful. Multiple Intelligence Approach offers solution by enabling teachers to devise learning activities to cater to Multiple Intelligences, thereby catering to multiple learning styles.

1.1.2.3 Revised Bloom's Taxonomy

The learning process takes a new dimension as the students grow and become mature, they need to embrace more challenging tasks that will make them think more about the things that they see, hear, say and do. Children now recall and provide explanations that make connections between old learning and new learning. Students engaged in lower-order thinking, only receive, or recite, or participate in routine practice, no activities are involved for a major part of the lesson that go beyond simple reproduction of knowledge. Teachers need to develop higher order thinking skills among the mature students who have unquenchable thirst for knowledge. In higher-order thinking, students are involved with the transformation of information and ideas which is a result of the combination of facts and ideas that are synthesised, generalised, explained, to arrive at some conclusion and discover new meaning and products of knowledge. For this, the teacher's main instructional task is to create activities or environments that allow them opportunities to engage in higher-order thinking. Bloom's taxonomy of cognitive objectives (Bloom. B. S, 1956) qualitatively expressed different kinds of thinking. It was adapted as a vital planning tool for classroom practices. It provides a direction to organize thinking skills into six levels from the most basic to the higher order levels of thinking. Knowledge (recalling information) represents the lowest level in Bloom's taxonomy. It is "low" only in the sense that it comes first - it provides the basis for all "higher" cognitive activity. Only after a learner is able to recall information it is possible to move on to comprehension (giving meaning to information). The third level is application, which refers to using knowledge or principles in new or real-life situations. The learner at this level solves practical problems by applying information comprehended at the previous level. The

fourth level is analysis - breaking down complex information into simpler parts. The simpler parts, learned at earlier levels of the taxonomy. The fifth level, synthesis, consists of creating something that did not exist before by integrating information that had been learned at lower levels of the hierarchy. Evaluation is the highest level of Bloom's hierarchy. (Clark, D. R, 1999) consists of making judgments based on previous levels of learning to compare a product of some kind against a designated standard.
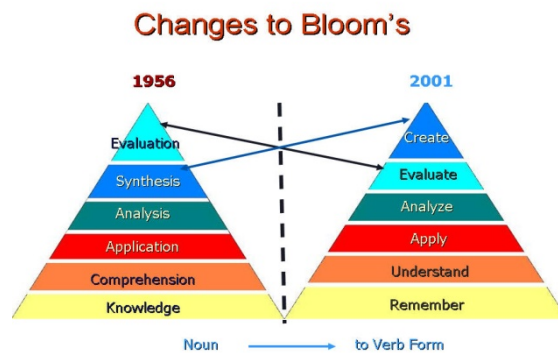
Loris Anderson (2001) reviewed the Bloom's taxonomy and incorporated few changes, the names of six major categories were changed from noun to the verb forms, as it reflects different forms of thinking and thinking is an active process, so the verb terminology was found to be more accurate (Forehand. M, 2005). The verbs are critical in organizing the hierarchy of domains and determining activities to facilitate learning through the integration of varied resources and activities. Knowledge category was replaced as Remembering, since knowledge is a product of thinking and it was inappropriate to describe a category of thinking. Likewise *Comprehension* came to be known as *Understanding* and *Synthesis* was replaced with *Creating* to reflect the nature of thinking in a better manner. The Revised Bloom's Taxonomy laid more emphasis on curriculum planning, instructional delivery and assessment. Its' scope was broader to meet the needs of larger student community of all levels of schooling. The Revised Bloom's Taxonomy across the spectrum of six categories is as follows:

In **Remembering,** the learner recalls, restates and remembers learned information by listing, memorizing, locating, reading, writing, choosing, selecting etc through various activities. A well defined teacher role consists of directing, telling, showing, questioning and evaluating the students' performance and their roles such as

responding, absorbing, remembering, defining and describing. Here the learner is a passive recipient.

In *Understanding*, the learner takes the information ahead by being an active recipient and grasps the meaning of information by interpreting and translating that has been learned by interpreting, inferring, summarizing, comparing, explaining with a definite teachers' role of demonstrating, listening, questioning and contrasting.

In *Applying,* the learner being an active recipient makes use of the information in a context different from the one in which it was learned by implementing, carrying out, using and executing, constructing, calculating with the teachers' involvement through showing, facilitating, evaluating, organizing and questioning.

In *Analysing,* the learner breaks the learned information into its parts to understand that information in the best way by comparing, organizing, deconstructing, integrating supported by the teacher through probing, guiding, evaluating, acting as a resource, dissecting enabling the student to discuss, debate, argue, uncover the facts, think deeply, investigate and be an active participant.

In *Evaluating*, the learner makes decisions based on in-depth reflection, criticism and assessment by checking, hypothesizing, judging, critiquing, experimenting, monitoring with constant guidance by the teacher through clarifying and accepting thereby being an active participant through comparing, critiquing, judging, deciding, justifying.

In *Creating,* the learner creates new ideas and information using what has been previously learned through designing, devising, planning, constructing, producing, inventing extending teachers' role by facilitating, reflecting, analyzing, evaluating for the students' to plan, design, take risk, modify, create and propose thereby being active in the learning process.

The levels of Revised Bloom's Taxonomy discussed above highlight the potentials to meet the growing needs of the student community and therefore, has be used for the entire class and also can lay emphasis on certain levels for different children. It is a vital feature that extends children's thinking skills through emphasis on higher levels of the taxonomy ie. analysis, evaluation and creation. The teachers could plan the possible line of action for the class by making all the children work through remembering and understanding stages and then select at least one activity from each

other level or ask some children to work at lower level while others to work at higher levels, at the same time some activities could be "essential" while others "optional", by involving students to work in small groups through comparing or on individual level through deep thinking. Some children work through the lower levels and then design their own activities at the higher levels.

Impact of Revised Bloom's Taxonomy in Education: Education has derived its importance by catering to the levels of objectives as given by RBT.

Curriculum–Educators must place emphasis on levels of thinking, lay emphasis on evaluation, analysis and develop creativity among the students.

Instruction–Teachers should conduct the teaching – learning process to meet the needs of all the learners through activities catering to the hierarchy of thinking levels and provide ample scope for judging, critiquing, accepting, discussing, comparing and creating.

Assessment–Teachers should assess the students while they are working; evaluate the work and efforts involved on it. The assessment should not be an end but a means to a creative end.

Thus we can conclude that Revised Bloom's Taxonomy is a classification of thinking organised by level of complexity that gives teachers and students an opportunity to learn and practice a range of thinking and provide simple structures for many different kinds of questions and thinking that purposefully sought to achieve well defined goals. It can be used as an integrated approach across six levels of thinking and eight different ways of knowing and understanding the world through Prof. H.Gardner's Multiple Intelligences Approach. This assists in achieving a balanced programme of activities that cater for all students' abilities and interests through a comprehensive planning.

1.1.2.4 Multiple Intelligences (MI)

"It's not how smart you are that matters, what really count is *how* you are smart."(*Gardner ,1983)*

Traditionally schools and education have been cognitively based relying on verbal and logical mathematical intelligences and students' who are not good at it, go unnoticed and untapped. Prof. Howard Gardner (1983) in his Multiple Intelligence theory propagates that individual differs in their abilities, learning styles and interests

and these differences need to be acknowledged and nurtured in schools. An action towards this would necessitate the need of a different scenario for learning. The educational benchmark need not be lowered but altered to include assessment for a broader spectrum of learners. Multiple Intelligence theory acts as a tool in the hands of a teacher to restructure the teaching- learning process that will make students active participants in learning by virtue of appropriate activities that do not thrive in the traditional school setup.

Gardner's pluralistic view of intelligence suggests that all people possess at least eight different intelligences that operate in varying degrees depending upon each individual. Students come to the class with different sets of intelligences comprising of intellectual strengths and weaknesses. Prof. Howard Gardner defines Intelligence "as the ability to solve problems or to create products that are valued within one or more cultural settings."(H. Gardner, 1983) Teachers develop strategies that allow the students to demonstrate multiple ways of understanding and show value for their uniqueness (individuality).

The Multiple Intelligence theory's eight accepted intelligences are (Susan. B, Julie. V, Barbara. S, 2005):
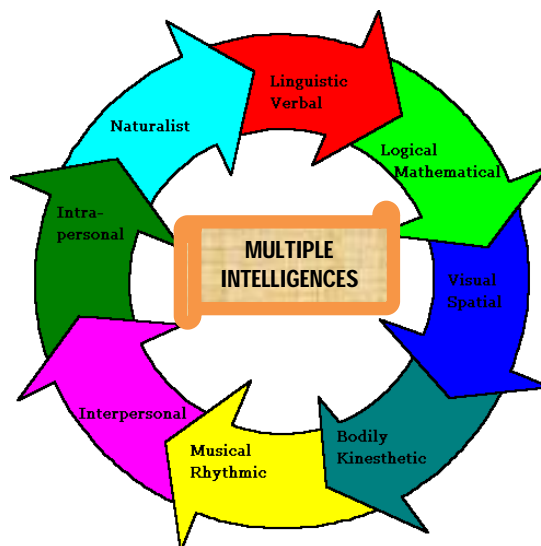
- Spatial

- Linguistic

- Logical-mathematical

- Bodily-kinesthetic

- Musical

- Interpersonal

- Intrapersonal

- Naturalistic

Spatial: This area deals with spatial judgment and the ability to visualize with the mind's eye. Careers which suit those with this type of intelligence include artists, designers and architects. A spatial person is also good with puzzles.

Key Abilities:

- Involves perceiving and transforming visual or three- dimensional information in one's mind.

- Allows for re-creation of images from memory.

Sub-Abilities:

- Understanding casual or functional relationships through observation.

- Use of spatial information to navigate through space.

- Sensitive perception or observation of visual world and arts

- Production of visual information or works of art.

Linguistic: This area has to do with words, spoken or written. People with high verbal-linguistic intelligence display a facility with words and languages. They are typically good at reading, writing, telling stories and memorizing words along with dates. They tend to learn best by reading, taking notes, listening to lectures, and discussion and debate. Those with verbal-linguistic intelligence learn foreign languages very easily as they have high verbal memory and recall, and an ability to understand and manipulate syntax and structure. Careers that suit those with this intelligence include writers, lawyers, policemen, philosophers, journalists, politicians, poets, and teachers.

Key Abilities:

- Involves perceiving or generating spoken or written language.
- Allows communication and sense making through language.
- Includes sensitivity to subtle meanings in language.

Sub-Abilities:

- Expressive language
- Invented narrative or storytelling
- Descriptive/ instructional language
- Reporting
- Poetic use of language
- Wordplay

Logical-mathematical: This area has to do with logic, abstractions, reasoning, and numbers. While it is often assumed that those with this intelligence naturally excel in mathematics, chess, computer programming and other logical or numerical activities, a more accurate definition places less emphasis on traditional mathematical ability and more on reasoning capabilities, abstract patterns of recognition, scientific thinking and investigation, and the ability to perform complex calculations. It correlates strongly with traditional concepts of "intelligence" or IQ. Careers which suit those with this intelligence include scientists, physicists, mathematicians, logicians, engineers, doctors, economists and philosophers.

Key Abilities:

- Enables individuals to use and appreciate abstract relations.

- Includes facility in the use of numbers and logical thinking.

Sub-Abilities:

- Numerical reasoning – calculations, estimation, quantification

- Logical problem solving – focusing on overall structures and relationships, making logical inferences.

Bodily-kinesthetic: The core elements of the bodily-kinesthetic intelligence are control of one's bodily motions and the capacity to handle objects skillfully. Gardner elaborates to say that this intelligence also includes a sense of timing, a clear sense of the goal of a physical action, along with the ability to train responses so they become like reflexes.

In theory, people who have bodily-kinesthetic intelligence should learn better by involving muscular movement e.g. getting up and moving around into the learning experience, and are generally good at physical activities such as sports or dance. They may enjoy acting or performing, and in general they are good at building and making

things. They often learn best by doing something physically, rather than by reading or hearing about it. Those with strong bodily-kinesthetic intelligence seem to use what might be termed muscle memory. Careers that suit those with this intelligence include: athletes, dancers, musicians, actors, surgeons, doctors, builders, police officers, and soldiers. Although these careers can be duplicated through virtual simulation, they will not produce the actual physical learning that is needed in this intelligence.

Key Abilities:

- Allows use of one's body to create products or solve problems.
- Refers to the ability to control all or isolated parts of one's body.

Sub-Abilities:

- Athletic movement
- Creative movement- including responsiveness to music
- Body control and fine motor abilities.
- Generating movement ideas.

Musical: This area has to do with sensitivity to sounds, rhythms, tones, and music. People with a high musical intelligence normally have good pitch and may even have absolute pitch, and are able to sing, play musical instruments, and compose music. Since there is a strong auditory component to this intelligence, those who are strongest in it may learn best via lecture. Language skills are typically highly developed in those whose base intelligence is musical. In addition, they will sometimes use songs or rhythms to learn. They have sensitivity to rhythm, pitch, meter, tone, melody. Careers that suit those with this intelligence include instrumentalists, singers, conductors, disc-jockeys, orators, writers and composers.

Key Abilities:

- Involves perceiving and understanding patterns of sound.
- Includes creating and communicating meaning from sound.

Sub-Abilities:

- Music perception
- Music production
- Composition or notation

Interpersonal: This area has to do with interaction with others. In theory, people who have a high interpersonal intelligence tend to be extroverts, characterized by their sensitivity to others' moods, feelings, temperaments and motivations, and their ability to cooperate in order to work as part of a group. They communicate effectively and empathize easily with others, and may be either leaders or followers. They typically learn best by working with others and often enjoy discussion and debate. Careers that suit those with this intelligence include sales, politicians, managers, teachers, and social workers.

Key Abilities:

- Is sensitivity to the feelings, beliefs, moods and intentions of other people.

- Involves the use of that understanding to work effectively with others.

- Includes capitalizing on interpersonal skills in pursuit of one's own ends.

Sub-Abilities:

- Assumptions of distinctive social roles.

- Ability to reflect analytically on the social environment or other people.

- Taking action.

Intrapersonal: This area has to do with introspective and self-reflective capacities. People with intrapersonal intelligence are intuitive and typically introverted. They are skillful at deciphering their own feelings and motivations. This refers to having a deep understanding of the self; what are your strengths/ weaknesses, what makes you unique, you can predict your own reactions/ emotions. Careers which suit those with this intelligence include philosophers, psychologists, theologians, lawyers, and writers. People with intrapersonal intelligence also prefer to work alone.

Key Abilities:

- Enables individuals to form a mental model of themselves.

- Involves drawing on the model to make decisions about viable courses of action.

- Includes the ability to distinguish one's feelings, moods and intention and to anticipate one's reactions to future courses of action.

Sub-Abilities:

- Self- understanding.

- The ability to self-reflect analytically.

- Articulating that understanding through other types of expression or intelligences

- Using that self- knowledge well toward personal or community goals.

Naturalistic: This area has to do with nature, nurturing and relating information to one's natural surroundings. Careers which suit those with this intelligence include naturalists, farmers and gardeners.

Key abilities:

- Includes the ability to understand the natural world well and to work in it effectively.

- Allows people to distinguish among and use features of the environment.

- Is also applied to patterning abilities.

Sub-Abilities:

- Observational skills.

- Pattern recognition and classification.

- Knowledge of the natural world.

- Employing that knowledge to solve problems and fashion products.

All these eight intelligences are independent and they develop at different times to different degrees in different individuals. However, they are closely related, and when a student becomes more proficient in one area, the whole constellation of intelligence is enhanced, hence it is important to encourage children to explore and exercise all of their intelligences. Creating a rich, nurturing, and stimulating environment filled with interesting materials, games, and books lays the foundation for healthier, happier, brighter children. Students with these kinds of experiences can learn almost anything. Schools predominantly emphasize two of the eight intelligences cited by H. Gardner - the Linguistic and Logical-Mathematical and students strong in these two intelligences perform well in tests conducted in class, because the tests are usually on

the matter taken from text books that are taught to students mainly through lecture method. Thus affecting students' who are not proficient in these two intelligences. Gardner's theory and its implications within the realm of education certainly explain the fact that some people are indeed better at certain things than others.

Advantages of MI Approach

1. Through the MI approach teachers can offer different pathways for students to learn rather than just filtering all information and learning through the "scholastic intelligences" thus empowering more students to succeed in school. MI approach is "child-centered" and enables teachers to visualize the students' learning, instruction and assessment. Thus we see MI as a tool to reach more kids, and way to become better educators.

2. MI transforms the role of the teacher. In traditional schools the teachers rely more on textbooks and adopt a lecture method with very few opportunities of activity based learning.

3. Through an MI approach students learn through numerous ways, that enhances their interest, caters to individual differences and thus making learning meaningful.

4. An MI teacher contrasts sharply with a teacher in a traditional classroom, who lectures while standing at the front of the class, writes on the blackboard, asks questions about the assigned reading or handouts and waits while students finish their written work. In contrast to this is the MI classroom, where the teacher continually shifts her method of presentation from linguistic to spatial to musical and so on, often combining intelligences in creative ways.

5. In an MI setup, not only are students more likely to learn and teachers more likely to bring their creativity to the fore, other opportunities are also presented keeping in mind that intelligences are multidimensional and students have the potential to change.

Multiple Intelligence Approach to Education: The Multiple Intelligence Approach to education has a great impact on the following:

Curriculum–Educators must provide the space to develop each of the intelligences so that the students are not deprived and can learn better with their interest levels.

Instruction–Teachers should plan lessons with a variety of activities addressing all the eight intelligences at some point or the other, so that no child is left behind.

Assessment–Teachers assessment involves with utilizing the resources provided to the students in the best possible way and deriving success in the task assigned to them. This assessment should be such that all the children should succeed.

Children's ways of learning are as different as the colors of the rainbow. Learning is a matter of making connections between previous experiences and new abstract knowledge thereby building strong connections in the form of concrete experiences. Multiple intelligences approach facilitates ways for students by ensuring that curriculum and instruction validate the strengths and build on the assets that students possess and value them. Teachers encourage students to be independent thinkers and learners, and provide different types of learning experiences so that students discover meaning in content and engage in active learning through a wide range of activities by expanding the gamut of techniques, tools and strategies beyond the typical and predominant ones that are used.

1.1.2.5 Inclusive Education

Inclusive education implies a radical shift in attitudes and a willingness on the part of schools to transform practices in pupil grouping, assessment and curriculum. The notion of inclusion does not set boundaries around particular kinds of learning difficulties, but instead, focuses on the ability of the school itself to accommodate diversity of students' needs. **Inclusion** in the context of education is about the child's right to participate in all the educational activities and the school's duty to accept the child (UNESCO, 2005).

Inclusive education and *student diversity* are common concepts in educational discourse. Cheng (2000) emphasizes the social, rather than isolated, nature of learning. The developing philosophy of inclusion is about identifying diverse groups of learners in a class and working towards an equitable, social acceptance. All educators need to be prepared to recognize and respect the unique attributes of every learner. As mirror of inclusion, our classrooms should reflect high expectation, high achievement and the full participation of all learners and teachers must redefine their roles towards this. Teachers need to shift their pedagogical focus from testing and reporting on outcomes to supporting and improving outcomes from schooling. The

development of positive and self-fulfilling values within all students' in education depends on building learner confidence within a supportive learning environment.

Students are often engulfed with barriers in education, either as a hindrance with the curriculum inside the classrooms or the teaching methodology, even with the examination systems that determine their success level. (Jha, 2002). At times, they are assessed, labeled and finally isolated within schools, or even classrooms, to receive discriminatory methods of learning. Curriculum that are content based are learnt through rote memorization by children. Linguistics and logical-mathematical areas of learning are overemphasized, while other areas of intelligence remain unexplored. The range activities are geared only to the level of few questions that address to the needs of only a handful, leaving the rest travel in the ocean of knowledge without a sailor, thus hampering their interest and creativity.

In an MI approach towards inclusion the schools follow flexible curricula that would respond to the diverse needs of children offering child-centered pedagogy. The application of H. Gardner's Multiple Intelligence (MI) theory showcases a major departure of the stringent practices in traditional schools where the emphasis was catering only the two intelligences i.e., linguistic and logical-mathematical. Schools in the MI approach encourage application of the eight intelligences using a variety of innovative practices to get children involved and participate in learning processes. Some of the inclusion strategies in the MI approach are through cooperative/collaborative learning, peer tutoring/child-to-child learning, activity based learning, teamwork/problem solving.

Today, students at school explore social and academic engagement; and also offer a unique set of measures that allows schools to begin understanding students' experiences of engagement in learning through the newer concept of intellectual engagement. Social Engagement brings in a sense of belonging and participation in school life while the Academic Engagement participates in the formal requirements of schooling. The emerging concept of intellectual engagement promotes a serious emotional and cognitive investment in learning, using higher order thinking skills (such as analysis and evaluation) to increase understanding, solve complex problems, or construct new knowledge (Doughlas. J, Sharon. F, Penny. M, 2009) The approach of intellectual engagement fosters among the students and teachers the need for diverse teaching- learning techniques that enables construction of knowledge as per

the emerging academic demands of the society through teaching practices that enable all students to achieve high levels, focus on certain teaching practices and learning processes that engage students in deeper and more sustained learning, applying effective teaching practices that narrow the achievement gap which, in turn, delivers students with a better educational experience when teachers and students actively collaborate in the process of improvement.

Impact of Inclusive Approach on Education: Inclusive Learning environment has a great impact on education in the following areas:

Curriculum–Educators must keep in mind the diversity and diverse needs of the student community, and develop opportunities that empower the child to deal with it in a smooth manner and be successful

Instruction–Teachers should plan which cater to all the students' and help them overcome the weaknesses and motivate their strengths. Activity based learning would be desirable for student progression.

Assessment–Teachers should assess the students as per their individual differences and motivate them to achieve higher levels though practice.

After reviewing the relevant literature as above, the researcher strongly felt that the ***MI approach to the teaching learning process offers the benefit of all the approaches-constructivism, catering to different learning styles, fostering an inclusive set up and catering to the development of higher order thinking.***

While the prevalent Traditional Approach tries to address the linguistic and mathematical intelligence to a large extent, and at times visual spatial, still it remains predominantly verbal and teacher centered.

The MI Approach used in the instructional module incorporates the advantages of all the above approaches as follows:

- The learning activities in the MI approach expects the students to construct their own knowledge through the use of various intelligences and hence, is a constructivist approach;

- The learning activities are so devised as to cater to various intelligences as given by Prof. H. Gardner and therefore cater to the various learning styles of the students;

- Since all the different types of intelligences and the learning styles are incorporated in the activities, the learning environment thus created is naturally inclusive in essence;

- The activities in the module are so designed as to promote the development of higher order thinking skills as suggested by Revised Blooms' Taxonomy.

1.2 NEED AND SIGNIFICANCE OF THE STUDY

1.2.1 Need of the Study

Twenty-first century classrooms challenge traditional, teacher-centered curriculum to meet the increasingly diverse needs of students. Classroom dynamics, diverse student needs, educational renewal, and technological advances place demands on teachers. The emergence of learner-centered classroom acts as a model for countering classroom challenges because of its viability for meeting diverse needs. Learner-centered classrooms place students at the center of classroom organization and respect their learning needs, strategies, intelligences and styles. In learner-centered classrooms, students can be observed working individually or in pairs and small groups on distinct tasks and projects on their areas of interest.

The premise 'one teaching-learning approach fits all' does not work for a growing number of diverse student populations and has prompted the need of an inclusive setup (Kathy. L, 2003). An essential factor for a learner-centered approach is placing the learning characteristics of all learners under the microscope with specific emphasis on low-performing learners. The focus in a learner-centered approach is on individual learners' experiences, perspectives, backgrounds, talents, interests, capacities, and needs. Learner-centered approach is a foundation to create positive learning contexts to increase the likelihood of more students experiencing success and all students of learning. Teachers provide a variety of instructional methods and techniques for helping learners construct their learning. Differentiated instruction meets the needs of diverse student populations by coupling student needs with a focus on content, process, and learner characteristics. Learner needs and characteristics take precedence over knowledge of facts and skills; the emphasis is on engaging learners in learning for understanding and thinking, to help them build their own conclusions.

Multiple intelligence, constructivism, active learning are the buzz words all over the world among the academicians, but not much is translated into action, at least, in our

country. Children today are active and more willing to participate because they feel control over their own learning. Students are more reliant upon themselves and their peers. *Constructivist Approach* focuses on learning how to think and understand, creating a way for students to apply their knowledge in varied situations, which is not groomed to a large extent in schools, this is indeed an apathy in the growing world of social interaction and co-operative learning scenario. Children are born with *Multiple Intelligences* which most of the times are not catered to; in the classrooms this restricts their growth to a nutshell. Prof. H. Gardner believes that our society suffers from three biases, "Westist", "Testist", "Bestist". 'Westist' involves putting certain western cultural values, 'Testist' suggests a bias towards focusing upon those human abilities or approaches that are readily testable, 'Bestist' labels the best and brightest only (Gardner, 1993) It is necessary to recognize and nurture all the varied human intelligences, to have a better chance of dealing appropriately with the teaching – learning problems that we face in the world. Even today, some teachers markdown the importance of *learning styles*, they continue to teach in their one major method without trying to vary instructional methods leading to less learning in the classroom. Teachers fail to find ways to help students to access learning information in a style suited to their learning styles. *Educational objectives* describe the goal towards which the education process is directed - the learning that is to result from instruction. Instructional process is complete when the objectives are met, and with this purpose, teachers select instructional methods, media and evaluation. All the efforts go in drain due to lack of focus on the educational objectives and focusing only on scoring marks in the test and completing the syllabus.

Instruction is not geared to cater to the multiple intelligences in schools as teaching is purely verbal occasionally interspersed with some diagrams; teachers do not cater much to the individual differences though it is the duty of each teacher to realize the educational objectives with respect to every student in the class; the mushrooming of coaching classes bears testimony to the apathy of teachers towards the learning styles of children. The children who are not able to reproduce the verbal matter in the examination are stamped as '*dull' or 'good for nothing'* thus lowering their self-esteem. The students respond by either resorting to rote learning or join coaching classes and try to get what they cannot get through regular schools. Teachers working in schools feel that large classrooms restrict them from addressing to multiple

intelligences, learning styles and constructivist method of learning for their students. Some teachers are not techno – savvy which restricts them in the use of instructional technology. The teachers are always in a hurry towards completion of their portion without bothering about the students' understanding of the subject matter taught. Many teachers themselves are unaware of the concept of multiple intelligences, learning styles and constructivist methods of learning and therefore, concentrate on teaching the average group without being sensitive to the individual learning styles of the students.

It was at this point the researcher felt the need to know further with respect to the teachers' incorporating MI in their lessons. Since the study was across the four different Boards and the researcher knew that MI was being catered to in some schools, the researcher wanted to find out the extent to which multiple intelligences is fostered by the teachers in their daily classroom practices. Hence the researcher used the Multiple Intelligence rating scale that was employed by the researcher at the M.Ed dissertation.(The same is presented in Appendix 8) The percent mean scores were computed to identify the extent to which multiple intelligences fostered by the teachers in their daily classroom practices. The researcher collected data from 120 secondary school teachers 15 teachers from each school, all the teachers were from the same 8 schools of the four different Boards that the researcher had chosen for the conduct of the study as this would help the researcher to analyze the results critically at a later period. The percent mean scores were computed to identify the level of multiple intelligences catered to, by the teachers in their daily classroom practices.

Table 1.1 Percent Mean scores of Multiple Intelligences fostered in schools by Teachers through their Instructional Process.

Sr. No	Intelligences	Mean	Percent Mean	Extent to which Fostered*
I	Mathematical	24.83	63.83***	Substantial
II	Linguistic	26.65	80.7***	Substantial
III	Visual	16.93	52.88**	Moderate
IV	Musical	6.93	32.83*	Low
V	Bodily	11.66	53.25**	Moderate
VI	Inter-personal	18.26	52.57**	Moderate
VII	Intra-personal	16.89	48.16**	Moderate
VIII	Naturalistic	3.53	36.14*	Low

*21-40 Low, ** 41-60 Moderate, ***61-80 Substantial*

From the above Table 1.1, it could be concluded that Linguistic and Mathematical intelligences were fostered to a substantial level followed by Bodily Kinesthetic, Visual, Intrapersonal and Intrapersonal intelligences to a moderate level. Naturalistic and Musical intelligences were fostered at a low level.

The above results aligned the thoughts of the researcher towards the same direction of adopting MIA to curriculum transaction thereby realizing the objectives of RBT.

Recent research studies have shown that an individual learns in different ways and teaching should be seen as an easy access to enrich, enhance the learning at all levels and effectively gain knowledge (*Allen, 2009*); intelligence is dynamic and not inherent and can be improved through education (Moberg, 2009), hence teachers need to teach not only ideas, concepts and subjects but also ability to learn. Differentiated methods of instruction in a classroom setting increases motivation and allows students to be more successful in academics by social behaviour and collaborative participation (Fenner, Dorraine, 2010). Emphasis on tackling communication skills in English through MI Based Instruction as learner-cantered approach caters to different learning styles (Abdallah, Mahmoud, 2008). Co-operative Learning Method supported by MI (CLMI) towards academic achievement and retention (Isik, Dilek, 2009).

The review of related researches showed that very few studies have experimented with multiple intelligence approach to achieve instructional objectives. The researcher strongly believes that the Gardner's MI theory coupled with learning activities can facilitate learning and can meet different learning styles, foster inclusion and develop higher order thinking. This motivated the researcher to study the feasibility of catering to multiple intelligences in large classrooms so as to achieve the educational objectives as given by Revised Bloom's Taxonomy.

1.2.2 Significance of the Study:

Students' success plays a vital role in the teaching learning process. It becomes imperative on the teachers' part to facilitate the teaching learning process. Every learning environment can raise successful students by effectively catering to the learning needs of the students. The traditional book oriented classroom instruction is geared towards verbal and mathematical intelligence but based on the MI theory each student has the capability to activate the different intelligences in different degrees within themselves.

The study throws light on the effect of achievement on inclusive learning environment, different learning styles which will make an impact of educational system as follows:

Policy makers: The policy makers who are entrusted with the responsibility of writing the textbooks could incorporate activities thereby catering to Multiple Intelligence at all levels.

Curriculum framers: At the various syllabus revision committees the curriculum framers can discuss about implementing Multiple Intelligences through variety of teaching- learning activities catering to the different learning styles and creating an inclusive learning environment.

Administrators: As inclusion is gaining momentum in schools it could be made more meaningful by engaging students in various activities. The impact of syllabus revision should not be restricted only to the completion of the portion but also provide scope for the teachers to involve students in their teaching- learning process. The administrators can take initiative towards the use of Multiple Intelligence Theory as a classroom practice.

Teachers: The burden of large amount of portion to be completed in stipulated period of time forces the teachers to rush with students resulting in lack of concept clarity, surface thinking and not being able to cater to all children. The MIT can provide a solution to the on-going problems of teachers by catering to the different learning styles of students, students with multiple intelligences through co-operative and collaborative approach of learning and thereby encouraging inclusive learning setup. The teachers will be able to reach all their students in the class through the MI Approach of learning through the various activities that caters to their dominant intelligence and also enhance their other submissive intelligences in the periodic process. The teachers will be sensitized to the MI Approach of learning thus catering to the diverse learning needs of the students. The teachers will be inclined to use MI Approach of learning across the various subjects and thereby encourage integrated learning. The teachers will be able to identify students interest and abilities and can channelize their efforts in the right direction. The teachers will be able to cater to students who are weak and unable to cope with the huge portion and can plan teaching-learning to meet their educational needs. The teachers can devise alternate assessment methods for students who are not strong in Linguistic/ Mathematical Intelligence, which gives them an opportunity to showcase their concept understanding and be successful in his/her own way. The teachers can plan their activities in such a way that encourages creativity and deep thinking among the students. The study throws light on teachers' initiative towards curriculum transaction to foster multiple intelligences through alternative teaching methodology thereby attempting to achieve the educational objectives as stated in the Revised Bloom's Taxonomy.

Students: The students will be able to enjoy learning; the teaching-learning activities would cater to their individual needs. The students will be able to perform better; their self confidence will be high and will no longer treated as 'dumb'. The students capacities will be enhanced and the learning skills would be sharpened. The students will be in a position to identify their preferred learning style and could adopt this in their daily learning. The students will be able to identify their dominant Multiple Intelligence which would help them choosing their career option in the future.

Parents: The parents will be aware of their child's likes, dislikes, interests, weakness, and strengths and can cater to the individual needs of the child. The parents will be

able to provide help at home to sharpen their child's dominant intelligence and can also encourage the weak intelligence to a substantial level. The parents will be able to plan the future possible careers for their child and motivate their children in that direction.

1.3 STATEMENT OF THE PROBLEM

Multiple Intelligence Approach to Curriculum Transaction and Achievement of Educational Objectives at Secondary School Level

1.4 VARIABLES OF THE STUDY:

Independent Variable in the Present Study*:* MIA to teaching two units in Science-Pollution and Energy- to standard VI of secondary school students using an instructional module developed by the researcher

Dependent Variable in the Present Study: The achievement of objectives of RBT in the two units in Science-Pollution and Energy - among secondary school students

1.5 DEFINITIONS OF KEY TERMS:

1.5.1 Operational Definitions of Key Terms:

Revised Bloom's Taxonomy **(RBT):** Revised Bloom's Taxonomy is the revised classification of educational objectives given by Anderson (2001). In the present study, only the cognitive objectives have been considered. They are – Remembering, Understanding, Applying, analyzing, Evaluating and Creating. These have been the basis for instructional design, delivery and evaluation.

Achievement of educational objectives of RBT: This is indicated by the scores of the students on the post test which comprises of the questions to test the achievement of the students in Science on the two topics- Pollution and Energy at the different levels of Revised Bloom's Taxonomy.

Multiple Intelligence Approach **to** ***Curriculum Transaction****:* The instructional intervention in which the curricular contents are transacted into learning activities that caters to the following intelligences: Spatial, Linguistics, Logical- Mathematical, Bodily- Kinesthetic, Musical, Interpersonal, Intrapersonal and Naturalistic and are presented to the learner to achieve the objectives in the cognitive domain of Revised Bloom's Taxonomy.

Levels of Achievement: It is the level of achievement of the secondary school students based on their average marks in the unit tests and terminal examinations in their schools as indicated in their school records. Those students who scored between 40-60% were classified as Average, those students above 60% were classified as Above Average and those below 40% were Below Average.

Secondary School Students: - These are the students studying in class 6th, 7th and 8th standard of schooling in various schools following SSC/ CBSE/ CISCE/ CIE curricula.

SSC Board Schools: - These are the schools that are affiliated to the Maharashtra State Board of Secondary Education.

CBSE Board Schools: - These are the schools that are affiliated to the Central Board of Secondary Education, which is an autonomous body working under the Ministry of Human Resource Development.

CISCE Board Schools - The schools that are affiliated to the Indian School Certificate Examination Board.

CIE – The schools that are affiliated to the University of Cambridge International Examinations

1.6 AIMS AND OBJECTIVES OF THE STUDY:

1.6.1. Broad Aims of the study:

1. To study the effectiveness of Multiple Intelligence Approach to curriculum transaction among secondary school students in realizing the educational objectives as given by Revised Bloom's Taxonomy;

2. To study the attitude of secondary school students towards Multiple Intelligence Approach to curriculum transaction, in realizing the educational objectives as given by Revised Bloom's Taxonomy;

3. To study the main effect as well as the interaction effects of the Traditional and Multiple Intelligence Approach to curriculum transaction in relation to some variables.

1.6.2 Objectives of the Study:

1. To study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction among secondary school students in realizing the educational objectives as given by Revised Bloom's Taxonomy;

2. To study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction at secondary school level in transforming the learning environment into a constructivist one;

3. To study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction at secondary school level in promoting inclusive education;

4. To study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction at secondary school level in catering to multiple learning styles of students as given by Prof. H. Gardner;

5. To study the main effect as well as the interaction effects of the Multiple Intelligence Approach mode to curriculum transaction and the level of achievement of the students (Average, Below Average and Above Average) on the achievement of educational objectives among secondary school students, as given by Revised Bloom's Taxonomy;

6. To study the main effect as well as the interaction effects of the Multiple Intelligence Approach mode of curriculum transaction and the type of schools (SSC, CBSE, CISCE and CIE) on the achievement among secondary school students of the educational objectives as given by Revised Bloom's Taxonomy;

7. To study the main effect as well as the interaction effects of the Multiple Intelligence mode of curriculum transaction and gender of secondary school students on the achievement of educational objectives, as given by Revised Bloom's Taxonomy.

1.7 RESEARCH QUESTIONS AND HYPOTHESES OF THE STUDY

1.7.1 Research Questions

In pursuit of the first four objectives of the study, the following research questions were raised:

R1. To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in realizing the educational objectives as given by Revised Bloom's Taxonomy?

R2. To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in transforming the learning environment into a constructivist learning environment?

R3. To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in promoting inclusive education at secondary school level?

R4. To what extent is the Multiple Intelligence approach to transaction of the curriculum at secondary school level effective in catering to different learning styles of students as given by Prof. H. Gardner?

1.7.2 Hypotheses:

In pursuit of objectives 5-7, the following null hypotheses were formulated:

H_0**1.** There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the level of achievement (LOA) of the participants (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school students;

H_0**2.** There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the type of schools (SSC, CBSE, CCISCE and CIE) on the achievement of educational objectives of RBT among secondary school students;

H_0**3.** There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA, TA) and gender on the achievement of educational objectives of RBT among secondary school students.

1.8 SCOPE AND DELIMITATIONS OF THE STUDY:

1.8.1 Scope of the Study

1. The study used Multiple Intelligence Approach as an alternative mode of curriculum transaction of teaching two topics in science to class 6th English medium secondary school students studying in schools affiliated to SSC, CBSE, CISCE and CIE Boards and located in central Mumbai.

2. The present study compared the influence of Traditional Approach and Multiple Intelligence Approach to curriculum transaction among secondary school students on the basis of their gender, type of schools, and levels of achievement in achieving objectives of Revised Bloom's Taxonomy

1.8.2 Delimitations of the Study:

1. The study was delimited to only 6th standard students studying in the schools located in Mumbai were selected;

2. The sample for the study was delimited to only 8 English medium schools: two schools each of the following: SSC, CBSE, CISCE, CIE schools and two intact classes from each school.

3. The Instructional module consisted of only two units in science of 6th standard which were of equal difficulty level. The units taught through the instructional module were on Energy and Pollution.

4. The Instructional module consisted of activities planned across the eight multiple intelligences as proposed by H. Gardner and the levels of educational objectives as given by Revised Bloom's Taxonomy and feasible within the classrooms in the given time.

5. The tool for assessing the impact of the MI approach was delimited to a post test only.

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CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

A literature review provides a rationale for the research in terms of what has gone before, a justification of its value and significance. A literature review provides the meaningful context of the research within the universe of already existing research. "Meaningful context" can elevate the research from disconnected observations or number-crunching to the level of significance in the field of investigation. The literature review sets the basis for discussion or analysis or contemplation of implications or anticipation of further research.

2.2 Review of Related Literature of the Present Study

The review of literature discussed has been on the Learning styles, Multiple Intelligence, Revised Bloom's Taxonomy, Inclusive Education as the crucial point in teaching – learning process. This review reveals how researchers are viewing closely at the alternate modes of curriculum transaction that encompass the multiple intelligences and different learning styles of students, thereby creating an inclusive learning environment and achieving the educational objectives as given by Revised Bloom's Taxonomy.

The studies in this area have been classified and reviewed under the following categories:

1. **Studies Conducted in India**

2. **Studies Conducted Abroad**

2.2.1 Researches conducted in India

While going through the various sources it was observed that not too many researches were conducted on Revised Bloom's Taxonomy, but quite a few researches were conducted on learning styles and multiple intelligences.

Hans (1986) studied the relation among teaching style, learning gains and teaching effectiveness. He compared the effects of two teaching styles on learning gains in classroom situations and studied the perception of students in respect of teaching

styles, a casual comparative experimental study by teachers teaching either Biology or Civics. Data was analyzed using t-test and ANOVA. The major findings were:

- The indirect teaching styles teachers in general were characterized by higher scholastic mental capacity, higher ego strength, less dominance.

- The direct teaching style teachers were characterized by lower mental scholastic ability, lower ego strength, dominance and low integration.

- Intellectually superior teachers intended to adopt indirect teaching style and less superior teachers adopted direct teaching style.

Verma and Sharma (1987) correlated the academic achievement to learning styles of adolescents. The objectives of the study were to compare academic achievement of adolescents students possessing independent and dependent learning styles in respect to Hindi, English and Mathematics, Science, Social Studies and total area of study; to ascertain the effects of competitive and collaborative learning styles on academic achievement of adolescent students in Hindi, English and Mathematics, Science, Social Studies and total area of study; to analyze the effect of avoidant and participant learning styles on academic achievement of adolescent students in Hindi, English and Mathematics, Science, Social Studies and total area of study. They found that

- The group of dependent learning styles students is significantly better than the group of independent learning styles students so far as achievement in social studies is concerned.

- Participant learning styles appears to be superior as compared to avoidant learning styles in various school subjects such as Hindi, English and Mathematics, Science, Social Studies and total area of study.

Verma (1992) conducted a study of learning style, achievement- motivation, anxiety and other ecological correlates of 2000 high school students comprising of boys and girls of rural and urban areas. The objectives were to study the interrelationships among learning style, anxiety and achievement- motivation. They found that:

- Sex did not make a difference in the learning style of students but it had a direct bearing on achievement- motivation and anxiety.

- There are rural- urban differences in learning styles of students.

Dhakam (1995) studied the influence of intelligence and creativity on the learning strategies of students in relation to their academic achievement. They compared learning strategies of secondary school students having different levels of intelligence; academic achievement of secondary school students with different levels of learning strategies. The causal comparative and co relation type study revealed that there was no significant difference in meaning oriented learning style of students with different levels of intelligence, but there was a significant difference in the reproducing oriented learning style of the student with different levels of intelligence.

Trama (1998) studied the Academic Achievement in relation to Intelligence and Children's Motivational Resources - Control Understanding, Perceived Competence and Self-Regulation at Upper Elementary and Secondary School Levels, comprising of 496 students of class V and VI and 451 students of class IX and X (secondary school). The objectives were to study the effect of motivational resources of control understanding, perceived competence, and self-regulation on the academic achievement of children; to study the role of intelligence in influencing the motivational resources of control understanding, perceived competence, and self-regulation and to find out the applicability of the model for upper elementary and secondary school children. They found that:

- Intelligence affected academic achievement direct as well as indirectly through the motivational variables.
- Intelligence emerged as the most potential predictor of academic achievement for upper elementary school children. For the secondary school children, however, most of the motivational resources emerged as stronger predictors of achievement than intelligence.
- Control understanding, perceived competence, and self regulation were positively and significantly related with academic achievement.

Shrivastava (2002) studied the Learning Styles of Secondary School Students with Scientific Attitude and their Achievement in Science through an Ex – Post Facto Research with a sample of 500 Science Students of Class XI from 10 different schools. The objectives were to study the learning style of secondary school students; to study the learning style and scientific attitude of students; to study the relationship between learning styles of students and their achievement in science; to study the

learning style of the students in relation to their intelligence; to study whether there is any differences in the learning style of boys and girls. They found that:

- Accommodative learning style was popular among the students and second popular learning style was convergent.

- Convergent learning style is most preferred and assimilative is less preferred by the students with high intelligence. Most of the students with low I.Q. prefer the accommodative learning style.

- Students with high intelligence possess more scientific attitude.

- Girls preferred convergent and accommodative learning style and very few girls preferred divergent and assimilative learning styles. Whereas all the four learning styles are preferred by almost equal number of boys.

Rizvi (2004) conducted a study on junior college students' learning styles in relation to their academic achievement adopting a descriptive and comparative method for the study. The aims of the study were to identify and compare the different learning styles of junior college students; to suggest appropriate measures to improve academic achievement by issuing different learning styles. They found that:

- Sequential learning styles groups were found to have higher number of students with above average academic achievement.

- Group of sequential learning style students is significantly better than the other learning styles group in academic achievement.

- Sequential learning styles appear to be superior when compared to visual learning style in academic achievement.

- There is no significant difference between the mean scores of academic achievement of the students with respect to aural, active and reflective learning styles.

Kagdi (2004) conducted a study of secondary school students' perceptions of teaching styles of their teachers and the academic climate of the classroom. The study included four teaching styles of teachers, viz., formal authority, demonstrator, facilitator, and delegator. The sample included 780 students from standard VIII and IX from 10 SSC and 4 ICSC schools situated in Greater Mumbai and with English as the medium of instruction. The study found that:

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- Students from SSC schools perceived their teachers to be using the teaching styles of formal authority, facilitator and delegator more frequently as compared to students from ICSC schools.

- There is no significant difference in the teaching style of demonstrator as perceived by students from SSC and ICSC schools.

- A very high, positive and significant relationship between teaching styles of their teachers and the academic climate of the classroom.

Varghese (2005) carried out study on learning and thinking styles of secondary school students and their academic achievement adopting the descriptive method of comparative and co relational type for the study. The total sample comprised of students of standard IX of English medium school of Greater Mumbai from 21 schools of which 16 were SSC schools and 5 were CISCE schools. The aims were to study the learning and thinking styles of secondary school students; to study the academic achievement of secondary school students; to ascertain the relationship between the learning and thinking styles of secondary school students and their academic achievement. Major findings of the study were:

- Students learning and thinking styles with both hemisphericity have positive relationship with the academic achievement for the total sample.

- Students learning and thinking styles left hemisphericity have negative relationship with the academic achievement for the total sample.

- CISCE students learning style left hemisphericity have negative relationship with the academic achievement.

- SSC students thinking style right hemisphericity have negative relationship with the academic achievement.

- SSC student learning and thinking style both hemisphericity have positive relationship with the academic achievement.

- There is a significant difference in relationship between learning and thinking style, right hemisphericity with academic achievement on the basis of school type.

Mridula (2006) conducted a study on 23 female student teachers, having Science Education as one of their subjects, the objectives of the study were to develop a training programme based on Multiple Intelligences Approach for strengthening lesson-planning skills of Science student teachers; to study the effect of the CAI presentations and the training program on Science lesson planning by student teachers. Single-group pre-test post-test experimental design was used for the research. Initially, rigorous formal training in the MI approach to lesson-planning was provided through CAI presentations, discussions and a workshop. The students were reminded of the MI concepts during lesson guidance throughout the academic year. Demonstration lessons, a specially compiled MI-Ideas workbook and special assignments were also included in the training. In the workshop, Student-teachers worked in small groups to analyze the content in school Science textbooks from the MI viewpoint, and to records suggestions for inclusion of various MI-based activities. An MI evaluation tool (MI checklist) was prepared for scoring lesson-plans.

Cynthia (2009) studied on the relationship between nine areas of Multiple Intelligence and teacher effectiveness of Secondary School teachers. The aim of the study was to draw up a Multiple Intelligences based profile for effective teachers.

The sample consisted of 300 Secondary School teachers; all minimum graduates and professionally trained .They were from Marathi and English medium schools. Teachers teaching Languages, Social Sciences, Science and Mathematics were part of the sample. It was found that:

- Effective Teachers display high scores in all areas of Multiple Intelligence as compared to their Average or Low Effectiveness counterparts. The mean Inter Personal Intelligence for Teachers with Low Effectiveness was higher than the overall mean Inter Personal Intelligence. Effectiveness show higher Multiple Intelligences in all areas.

- Teachers with High Inter Personal, Existential and Logical Intelligences were more effective than those who were Low in the above mentioned Intelligences.

- Effectiveness showed significant difference in means for all areas of Multiple Intelligences when compared to their counterparts with Low Presage Effectiveness.

- It was seen that Teachers displaying Low Effectiveness use Lecture Method to a significantly greater extent as compared to teachers with High Effectiveness. It was also seen that Teachers with High effectiveness show significantly greater use of Computer Aided Instruction when compared to their counterparts with Low Effectiveness.

- Teachers who reported high scores in Existential Intelligence were found to use games, demonstrations, discussions, Small group Learning and Jingles top a significantly greater extent.

- Teachers high in Multiple Intelligences took more efforts to plan their interaction techniques rather than just depending upon lecture method. Teachers who reported lesser scores in different areas of Multiple Intelligence were found to be complacent in the use of one or two techniques. More child centered methods were used by teachers who were high in Inter Personal, Existential and Kinesthetic intelligences.

Karthika (2009) reports on pre-schools developing multiple intelligence cater to the school of thought that children begin learning from an early age, educational centers across the city work to ensure holistic development of children before the advent of formal schooling. While their emotional and social quotient is developed by the observations children make of the environment around them, a child's intelligence can be developed by a variety of simple activities by using flash cards and games.

Diravidamani, Sundarsingh (2010) in their article examine the use of the multiple intelligence method in teaching a second language by analyzing the poem "The Fly," by William Blake, linguistically and allowing students to interact to enable them to build in inter and intrapersonal intelligences. The multiple intelligences theory proposes that every person has the capacity to develop seven kinds of intelligence to a reasonably high level. It is asserted that applying the multiple intelligence method of teaching helps encourage students' involvement in the process of language acquisition.

R. Ravi and P. Xavier (2009) in their article Multiple Intelligence as alternate means for students with LD's view that in classroom student differ in their academic progress and one of the major problems is the learning disability. Different methods of teaching and learning have been recommended for learning disabled. MI provides

multiple ways to learn that can overcome the drawbacks and can be the best means of learning for the disabled in the traditional classroom itself. This could be done by Identification of the MI and preparation of Multiple Intelligence Approach Based Teaching (MIABT). This was done by preparing 8 different types of teaching methods through lesson plans, teaching- learning activities and teaching- learning materials. By using role play co-op learning, reflection, visualization, storytelling, etc as well as assessment methods that account to diversity of intelligences, learning experiences was richer and faster.

2.2.2 Research conducted abroad:

Josephine (1996) aimed to investigate students taking responsibility for their own learning with a target population of 120 intermediate and middle school students in 5 classes. The aim of the study was to analyze the probable causes of students' lack of responsibility for their own learning as documented in teachers' anecdotal records and interviews indicated that lack of higher-order thinking skills, lack of ability to transfer learning, and lack of self-motivation were responsible. This was addressed through intervention such as graphic organizers, problem solving strategies, higher order thinking skills and portfolios to show ownership. The Post-intervention data obtained during cooperative learning activities revealed an increase in students' taking responsibility for learning and an improvement in students' higher-order and critical thinking skills, problem-solving strategies, and self-evaluation.

Anderson, Lorin (1999) describes on the second edition of "Taxonomy of Educational Objectives, The Classification of Educational Goals that makes a distinction between knowledge as the process of recall and knowledge as the content that is recalled, designating the first category of the cognitive process dimensions as "remember." The importance of diversity in educational assessment, the relationships among tasks in designing assessment; and the realization that the structure of the taxonomy is more likely to be evident in the scoring rubric than in the tasks themselves.

Fred (1999) highlights the right blend and amalgamation of the classic theories in pedagogy of John Dewey and Jean Piaget and establishes its foundation in building new knowledge about the teaching/learning paradigm to design instructional program that enables students to acquire knowledge and master skills. The technique represents an adaptation multiple intelligences designed to model the application of

constructivism to students' development of a comprehensive understanding of B. Bloom's Taxonomy.

Julie (1999) implemented and evaluated an individualized approach to multiple intelligence instruction. It focused on the fact that traditionally book-oriented classroom, instruction is typically geared toward the verbal/linguistic and logical/mathematical intelligences. Each student's dominant intelligence was identified. Thematic lessons, planning webs, monthly themes that strengthened the multiple intelligences of the students were constructed. Lesson plans were developed utilizing a variety of planning tools. In addition, informal journals were kept to highlight progress, successes, and trends. The effects of multiple intelligence instruction were documented through observations, product choices, student reaction, and survey checklists. Observations and checklists reaffirmed expectations that the manner in which information is presented and taught and the strategies utilized has a great impact on student learning.

Marci (1999) hypothesizes that young students would exhibit fewer classroom behavior problems when engaged in activities linked to their strengths and interests, the aim of the study was to examine the use of Gardner's multiple intelligence to improve student behavior. Targeted were 20 students in prekindergarten, kindergarten, and first grade classrooms in two suburban Chicago schools. Misbehavior such as talking out, not keeping their hands to themselves, being off-task, not cooperating, and not participating was documented by means of classroom observations and anecdotal records. The intervention was comprised of 16 classroom lessons using each of the 8 intelligences. Visual aids were used to ensure that students understood the intelligences, and graphic organizers were used to engage students in the learning process. Anecdotal records, progress reports, and report cards were used to document changes in student behavior. The finding suggested 77 percent of students showed an improvement in their behavior when working on activities geared toward their strongest intelligence.

Virginia (1999) in the article Addressing Multiple Intelligence in the Classroom gives indications of early associations with behaviorism, programmed instruction, and mastery learning, skeptics which claims that Bloom's taxonomy is a useful tool for creating the learner-centered classroom so prized in contemporary education circles. Bloom's taxonomy represents a tool for planning and implementing the student-

centered classroom, thereby fostering critical thinking and the process of knowledge construction. It also facilitates the design of rewarding learning experiences for students, the identification of student learning difficulties, and the assessment of the impact of our teaching on student learning

Harvey Richard (2000) suggests educators at all grade levels and all content areas to implement a holistic learning program that seamlessly integrates learning styles and multiple intelligences into instruction, curriculum, and assessment. It is designed to help educators' process ideas and analyze their current practices; and planning templates for designing integrated lessons, assessments, and curriculum instruments. It also assists teachers in helping students become more reflective, self-aware learners and identify their own style and intelligence profiles.

Mandy, Jennifer (2000) reports low student achievement in language arts and to determine the effect of incorporating multiple intelligence strategies into the language arts curriculum. The targeted students were in the second, third, and fifth grades, in a western suburb of Chicago, Illinois. The factors that impact low student achievement are mobility, lack of teacher training and support in implementing existing curriculum, and teachers not addressing students' various learning styles. The selected intervention led to a comparison between traditional methods of teaching and multiple intelligence strategies. The Post intervention data indicated a general trend toward an increase in achievement through the use of multiple intelligences strategies. An improvement was also noted in homework completion, quality of homework, student time on task, and student enjoyment of activities.

Wentland, Daniel (2000) reports that many students perceive economics as a challenging subject, and therefore can successfully communicate economics education to students through Bloom's Taxonomy of Educational Objectives through teacher or student oriented learning activities, technology based learning activities, and individual or group based learning activity and can be quantitatively assessed to evaluate the influence teaching methodology in the learning process and the outcome achieved by the students.

McKay, Annette (2000) sought to improve student motivation in order to increase academic performance among eighth graders in an urban community incorporating a variety of cooperative learning and social skill activities. The findings were:

- Post-intervention data indicated an overall improvement in areas such as interest in class content, and academic achievement.

- The incorporation of cooperative learning and multiple intelligence lessons strengthened student motivational levels and academic achievement.

Chris (2001) designed to improve the performance of sixth-grade social studies students based on content-area work and teacher-made tests. The students possessed very limited opportunities to think beyond the knowledge and comprehension levels defined by Bloom's Taxonomy of Cognitive Skills thereby restricting critical thinking. The findings were:

- The direct-instruction sheets positively influenced student performance.

- The most successful strategies incorporated simple and complex questions in teaching Bloom's Taxonomy to students.

- These methods improved student ability to identify critical-thinking vocabulary, which allowed them to engage in high-level questions and activities.

Marlow(2001) claims that teacher-made tests could be made more effective than standardized tests. Using Multiple Intelligences Theory (H. Gardner, 1993) can show ways to assess student achievement through their individual strengths and the use of the various types of intelligence suggested by the theory. Learning styles theory also has much to offer classroom assessment. Teacher observation is another important aspect of assessment in science. It is also important to consider metacognition skills when evaluating student achievement in science. Students must learn the skills required for self-evaluation, and teachers must help them develop these skills.

Thomas (2001) focuses on the notable contribution by Bloom towards teaching and learning and practice of mastery learning. Mastery learning was developed as a way for teachers to provide higher quality and more appropriate instruction for their students. Mastery learning depends on feedback, correctives, and enrichments, combined with another essential element of mastery learning, congruence among instructional components and allows educators at all levels to make great strides toward the goal of all children learning excellently.

Lori, Diane (2001) describes a program for increasing student reading motivation through the use of cooperative learning activities, differentiating reading instruction, and active reading strategies. The aim of the study was to increase reading motivation through co-operative learning activities. Materials were often picked for students with thought for relevance to their lives and interests. Students lacked the skills required to read rich and engaging books. Books competed with video games, television, and other electronic devices. The strengths and weaknesses of the students' reading abilities were identified. Through the planned lessons these strengths and weaknesses were improved. Reading reluctance decreased. The findings of the Post intervention data indicated an overall improvement in reading skills and motivation when lessons incorporated cooperative learning activities, differentiating reading instructions, and active reading strategies.

Krathwohl, David (2002) reviews the framework of the original Taxonomy of Educational Objectives, a scheme for classifying educational goals, objectives, and standards, also describing the revised Taxonomy from the original thereby examining its two dimensions (cognitive processes and knowledge) and illustrating its use in making sense of a variety of educational objectives and standards.

Anderson, Lorin (2002) suggests that the revised Taxonomy provides a framework for analyzing curriculum alignment and illustrating the Taxonomy Table can be used to estimate curriculum alignment.

Peter, Miranda (2002) examines the assessment implications of the revised Taxonomy of Educational Objectives, discussing such challenges as finding valid and reliable ways to assess more complex cognitive processes and to assess meta-cognitive knowledge thus evaluating current approaches to assessment and suggesting improvements in this area.

Ferguson (2002) describes the importance of Revised Taxonomy to plan and implement a co-taught, integrated, thematic unit, examining statements of objectives, instructional activities, and assessments to develop units and describing three ways that the revised Taxonomy assist in unit design (providing a common language; suggesting ways to integrate factual, conceptual, procedural, and meta-cognitive knowledge; and offering different perspectives on the purpose, structure, and format of classroom assessment.

James (2002) examines the revised Taxonomy Table as a tool for instructional improvement, describing what counts as improved instruction and discussing how the revised Taxonomy can assist in instructional improvement efforts. The paper asserts that by working within the framework of the revised Taxonomy, teachers can increase the alignment of objectives, instruction, and assessment and raise the learning target.

Richard (2002) examines the cognitive process dimension of Bloom's Taxonomy Table, and describes three learning outcomes; it focuses on retention versus transfer of learning and rote versus meaningful learning, discussing how teaching and assessment can be broadened beyond an exclusive focus on the cognitive process of remembering.

Cluck, Hess (2003) describes a plan for using the multiple intelligences to increase student motivation. The target population consisted of a sixth grade reading class in a rural setting, and second, fourth, and fifth grade students in a pullout ESL (English-as-a-Second-Language) program in an urban setting. The lack of motivation became evident as observed in incomplete assignments, low test scores, and disinterest in subject matter. Traditional teaching methods often do not target individual student learning styles and suggested that an emphasis on changing teaching styles can improve motivation. These styles included using cooperative learning and implementing multiple intelligences in the curriculum. De-emphasizing extrinsic rewards such as grades, verbal praise and tangible rewards may foster a natural curiosity for learning. As a result of implementing multiple intelligences and cooperative learning groups, students showed an increased motivation in class work. Use of multiple intelligences improved assignment completion, class participation, and engagement of learners. All students benefited from choosing how they learn.

Christine (2003) attempted to examine an 8th grade Tennessee adolescent science student's integration of science concepts within a project-based setting using the multiple intelligence theory. The project-based approach allowed students to learn in personally diverse modalities using a linear or nonlinear fashion based on personal choice. However, upon analysis of results, significantly more students chose the spatial intelligence to represent integration.

Iris (2005) focuses the attention on poor student motivation and problematic social skills that may interfere with the academic growth of elementary school students, this action research project examined the impact of a multifaceted intervention on student

motivation and achievement. Participating in the study were second and third graders from 3 schools. The 12-week intervention was comprised of 3 elements: use of the multiple intelligence approach to instruction, incorporation of cooperative learning strategies, and the provision of an engaged learning environment. Students worked in teacher-selected base groups weekly for 15 minutes for data collection and reflection and in randomly-assigned cooperative learning groups at least twice weekly for 30 to 45 minutes. Cooperative learning activities taught appropriate social skills. Multiple Intelligence activities and a series of engaged learning activities were incorporated into classroom practices. Data were collected through student surveys and journals completed weekly, teacher observation checklists, attendance records, and unit reading test scores. The findings of the post-intervention data were:

- The theory of multiple intelligence had a positive effect on the targeted classrooms. There were decreases in missed reading assignments for two sites, and an increase for one site.

- Students revealed positive attitudes toward themselves and their school.

Participating teachers concluded that cooperative learning and engaged learning were used together to successfully increase student motivation and achievement.

Audrey (2003) conducted a study containing 13 curriculum units designed to enhance differentiated instruction for learners with special needs from grades 1-12, including gifted students. It integrates Benjamin S. Bloom's levels of cognitive understanding with Howard Gardner's eight domains of intelligence to provide a framework for individualized instruction. Each unit has activities for the eight multiple intelligences (logical-mathematical intelligence, linguistic intelligence, bodily-kinesthetic intelligence, spatial intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence, and naturalistic intelligence) at each of Bloom's taxonomic levels: knowledge, comprehension, application, analysis, synthesis, and evaluation.

Brian, Taggart (2005) focuses on the impact of primary teachers work for children with special educational needs (SEN). The investigation is set with the theory of multiple intelligences expounded by Howard Gardner, and the ideas about different learning styles advocated by Kolb, and other educationalists. It taps into a sense of capitalizing on important and innovative educational ideas and concepts, with special significance for SEN teaching.

Bahaddin (2005) discusses the arrangement of teaching and learning environment to achieve learning, and effective contribution by teachers in this process. Gardner "multiple intelligence theory" (MIT) is applied to a wide variety of fields ranging from teaching of mathematics to music, education of gifted students, improvement of the quality of guidance for students in schools rearrangement of evaluation systems, and the perfection of apparatus used for education purposes. The study aims to emphasize that the applicability of the theory in classroom teaching- learning. In this study, the post-test pattern of experimental study without a control group is used. The results were:

- MIT makes important contributions to class control and efficiency of the lessons.

- Through MIT, an individual's active participation and showing his or her abilities provides a more effective assessment.

Helena, Almeida (2006) identified the types of questions that students ask during the learning of chemistry; discuss the role of students' questions in the process of constructing knowledge, and investigate the relationship between students' questions, approaches to learning, and learning styles. The paper concludes that it is possible to relate students' questions to their learning styles and approaches to learning. Students, who show a surface approach and stay within the acquisition stage, tend to formulate low-level questions. Students at the other end of this continuum seem disposed to ask higher-level questions. Appreciating the diversity of learners, and their approaches to learning, enhances the possibilities of improving the quality of teaching at this level.

Ronald (2006) in his article highlights the application of improvisational based ice breakers and exercises with scalable levels of risk written to approach learning styles as architected by Multiple Intelligences theory, students develop their natural proficiency for synthesis and recognition in an environment that mimics real-life decision making. With the use of authentic assessment, specifically portfolio and performance models, as well as subsequent traditional testing applications, evidence can be gathered to demonstrate improvement in overall academic achievement with the correct implementation of improvisational methodologies.

Jenna (2006) in this article focuses on enriching, engaging, rigorous, meaningful learning opportunities that are interwoven. In classrooms at various times, teachers

find themselves wondering if students are grasping the content. Constructing learning experiences that are based on the multiple intelligences and the standards provides all students with the opportunity to be successful. When it comes to assessment of that learning, educators can use the same concept in designing authentic situations. To demonstrate understanding, learners need to have options so they can show evidence of their learning through the intelligence of their choice. To be a useful assessment, that learning should be applied in a setting that demonstrates understanding.

Temur, Dogan (2007) aimed at the effects of teaching activities prepared according to Multiple Intelligence Theory on mathematics achievements and permanence of information learned by 4th Grade Students. Two classes were selected, 4-A was selected as an experimental group and 4-B as a control group considering their pre-test points. It was found that the average of the final test's points of the experimental group who studied in accordance with Multiple Intelligence Theory was 18.08, whereas the average of the final test's points of the control group was 15.95 and it is understood that the result is to the advantage of the experimental group.

Carol (2007) in the article on teaching Multiple Intelligence through a "Slime Trail" has reported her concern of present age teacher accountability and high-stakes testing. One way to increase achievement and address the needs of young adolescents is to employ an assortment of innovative teaching methods. At the same time, teachers' assessments should allow for a wider range of evaluation of student performance that expands traditional assessments. Gardner's theory of Multiple Intelligence (MI) accounts for a broader range of potential among individuals to develop this range of intelligences, instructional methods need to be varied so that students may use their intellectual strengths to better understand a topic.

Bumen, Nilay (2007) focuses our attention to the Multiple-intelligence (MI) theory and the application of MI theory has lead to increases in learning objectives and other holistic outcomes. It explores the characteristics of MI-based instructional planning and implementation, the effects of this planning on students' cognitive and affective capabilities also its effects on teachers' individual and professional capabilities, and the problems encountered during implementation.

Ellis, Daniel (2007) reports on the varied academic ability as a problem across the country and to reach all learners with their mathematics instruction. The aims of the study were to increase mathematical performance in a varied ability mathematics

classroom; to address varied ability levels in the classroom. The teacher researchers implemented differentiation instruction and modified three areas of instruction: curriculum, strategies, and student work. The teacher researchers encountered academic achievement that ranged from high, medium, and low. The students that performed at a high academic level were often finished with their work early and often left unchallenged. The students that performed below average academically needed constant support and redirection which took away from the teacher's instruction time. The only students that were benefiting were the average students. The interventions consisted of cooperative learning lessons; multiple intelligence based lessons, student choice of assignments, and differentiated assignments. Cooperative learning is one way in which teachers can help students learn to work with one another. It allows students to work in groups to achieve a goal.

Implementing lessons using Howard Gardner's Multiple Intelligences was another intervention used. Gardner suggests that each individual has the ability to learn in many different ways, yet we all have one preferred learning style. Student choice encourages students to be in charge of their own learning and help them to gain a better sense of personal and social responsibility. One way to accommodate for the many levels in today's classrooms is to differentiate assignments to suit individual needs. After reviewing the results of the pre- and post-test data the four teacher researchers noticed a marked change in student performance. They found the positive change in student performance led to believe that interventions were effective in some way.

Melissa (2007) studied the impact of increasing the motivation in reading among elementary and middle school students through the Use of Multiple Intelligences. This project was conducted by four teacher researchers who taught in the second, fourth, sixth, and eighth grade levels and consisted of 133 students. It also showed that the two most common intelligences addressed in the classroom were verbal/linguistic and interpersonal, while the least common were intrapersonal and naturalistic intelligence. The teacher researchers chose to implement multiple intelligences as their primary solution to increasing reading motivation in elementary and middle school students. Multiple intelligences incorporate eight major intelligence areas. They found that the students became skilled in selecting books and choosing activities that suited their

dominant intelligence while the teacher researcher became more tolerant of students' needs and behaviours that are attributed to their dominant intelligence.

Lopez, Linda (2008) developed an action research project that was designed to maximize learning for all students by addressing different learning styles and implementing various strategies. The students in the targeted school exhibited difficulty in experiencing academic success while exposed to conventional teaching strategies. To teach students individually, the teacher researchers used the following strategies: varied multiple intelligence lessons, chunking, tiered assignments, differentiated instruction, and cooperative learning groups. Cooperative learning groups were used weekly and all instruction was delivered by chunking information. Prior to the intervention, students were given direct instruction as a class and then they worked independently. After the interventions were executed, assessments revealed higher than average grades when the teaching methods were varied. The researchers also advocate the use of cooperative learning groups whenever possible.

Abdallah A.(2008) studied the effect of Multiple Intelligences strategies comprising logical-mathematical intelligence, verbal-linguistic intelligence, intrapersonal intelligence and interpersonal intelligence on ninth grade students' reading comprehension achievement in an EFL setting. The sample of the study consisted of four ninth grade sections, which were selected purposefully (two male sections and two female sections). To answer the questions of the study, the researchers used the following procedures and instruments: (1) A reading comprehension test was constructed. It was judged by a jury of three professors, two English supervisors and three experienced teachers; and it was modified according to their comments; and (2) The instrument was applied on the sample of the study at the beginning of the second semester of the academic year. To analyse the collected data, means, standard deviations and two-way ANOVA analysis were used with multiple intelligences strategies and gender as variables. The findings of the study showed a significant difference in the students' reading comprehension due to the teaching strategies in favour of the experimental group and no significant difference in the students' reading comprehension due to the students' gender.

Abdallah, Sayed (2008) state of multiple ways to be smart emphasising on Gardner's Theory of Multiple Intelligences in teaching English and oral communication. It highlights the educational applications and implications of MI Theory in English

Language Teaching, with special focus on MI-Based Instruction. It also tackles communications skills in English and the importance of the communication process, with special focus on speaking. Learning styles and strategies as a learner-centred approach is closely related with MI Theory.

Carmel, Scott (2008) explores methods of improving the learning styles and outcomes of first year university students within large class environments. The students were exposed to more student-centric teaching styles within tutorial groups, with a view to encouraging deeper student learning and self-regulated learning behaviors which resulted in a more positive learning experience for both students and teachers.

David (2008) focuses our attention our attention on the varying approaches to learning by the students in order to cope with the assessment tasks. The research questions of the study were i) Do students who participate in a constructivist learning environment change their perception of assessment demands towards more deep level demands? ii) Do students in a constructivist learning environment change their approaches to learning towards a more deep approach to learning? One questionnaire measured their approaches to learning and the other their general perceptions of the assessment demands. The findings of the study were:

- Students' approach to learning at the beginning of the course seems to have a higher impact on the extent to which they change their approach to learning than how students perceive the demands of the assessment within the course.

- The results also indicated that students did not change their approach to learning towards a more deep approach. On the contrary, students seem to develop more surface approaches to learning during the course. These results point us to the complexity of the relationship between the learning environment, the students' perceptions of assessment demands, and students' approaches to learning.

Mustafa (2008) draws attention in the areas of learning, specifically, constructivism, conceptual change and cognitive development. This paper aims to communicate this research to teachers, textbook authors, and college professors who are involved in the preparation of science teachers. It seeks an answer to the question "What are some guiding principles of constructivist thinking that we must keep in mind when we

consider our role as science teachers?" It also describes the nature of students' alternative conceptions, the ways of changing cognitive structure, and cognitive aspects of learning and teaching science.

Loyens (2008) investigated the relationships between students' conceptions of constructivist learning on one hand, and their regulation and processing strategies on the other hand. Students in a constructivist, problem-based learning curriculum were questioned about their conceptions of knowledge construction and self-regulated learning, as well as their beliefs regarding their own (in)ability to learn and motivation to learn. Results showed that structural relations exist between conceptions of constructivist learning and regulation and processing strategies.

Kausar Gujjar (2008) in their study aimed to evaluate the effectiveness of CAI v/s Classroom lecture for computer science at ICS level. The objectives were to compare the learning effects of two groups with class room lecture and computer assisted instruction studying the same curriculum and the effects of CAI and CRL in terms of cognitive development. Hypothesis of this research were based on six levels of blooms taxonomy as there was one major hypothesis - There is no significant difference exist for CAI student in gaining a high cognitive achievement than students of same level having Traditional CRL. The research was true- experimental in nature. The research design followed by researcher is the Pre-test - Post test Equivalent groups Deign. The software used for CAI group was basically the combination of Discovery environment and simulation soft ware's, however, the time for drilling and practice was given to student. It a designed to cover the all levels of cognitive domain described by B. S. Blooms (1956). A question paper containing 30 items multiple choice test was compiled from the curriculum, with a representative number of questions from each of the cognitive levels. Findings of this research indicate:

- The total gain in cognitive domain by CAI was significantly superior to the total gain in cognitive domain by CRL teaching method.

- This study concluded that the skills of knowledge, analysis and synthesis assured significant increase.

- The CAI proved to be very much effective in increasing the evaluation and application skills of students to experimental group.

- Comprehension skill, however, not much affected by the CAI.

They suggested that CAI as an effective teaching method should be applied to improve teaching quality and by using CAI it will be possible to eliminate lingual, regional and ethical biases between teacher and student.

Murphy (2009) reports adopted an alternating day (A/B) block schedule. The shift in schedule has resulted in less movement throughout the building and fewer instances of disruptive behaviors. As a result of having 80-minute blocks of time for instruction, teachers were able to shift their approach to instruction and embraced a constructivist approach to instruction and assessment. Now teachers view themselves as true facilitators of learning (they provide the work) and allow their students to construct their own knowledge (they do the work), learn from one another, and become responsible for their own learning.

- Teachers challenge their students to become independent learners by engaging them in rigorous, challenging, meaningful, and increasingly complex work.

- This commitment to student-directed learning has allowed teachers to be responsive to the ever-changing needs of a global society by creating authentic learning activities.

- The students learn best when they are engaged in meaningful, relevant, and authentic learning tasks

Sheau–Wen (2009) describes the development and application of the New Constructivist Learning Environment Scales, that includes four dimensions: attitude concerning instruction, interaction, scientific inquiry, and understanding, as perceived by elementary and middle school students in Taiwan. Qualitative data analysis based on classroom observation and interviews of students and their science teachers confirm that the students' attitudes were associated with the dimensions of understanding and interaction.

Jalil, Pasl (2009) sought to shift and strengthen students' positive attitudes towards science learning, self-efficacy towards invention, and achievement. Focusing on an important aspect of student's positive attitude towards learning, their preference (like/dislike) towards independent study with minimal or no teacher interference, which leads to increased learning autonomy, was investigated. The study aimed at stimulating higher thinking levels in learning science using a highly student-centered and constructivist learning approach. The study revealed:

- 73% of the students preferred minimal or no explanation at all, favoring to be left with the challenge of finding out what to do, compared to 20% of the control group, indicating a positive attitude shift in their learning approaches.

- The experimental group achieved slightly more (9.5% difference) than the control group in knowledge-comprehension-level based exam; however, the experimental group scored much higher (63% difference) in challenging exams which required higher thinking levels.

Buket (2009) investigates the effect of learning styles on students' achievement in different learning environments designed according to principles of Generative Theory of Multimedia Learning. Research was conducted in the framework of single group repeated measures experimental design model and three different learning environments (text based, narration based and computer mediated (narration + music + text + static picture) were planned and study group studied in these environments at different times. The two instruments were used to collect data for this study. The pre-posttest designed to identify students' achievement score and Kolb's Learning Style Inventory to measure students' learning style. The type of the learning style was significantly effective on students' achievement in different learning environments.

Bahar, Mehmet (2009) studied the relationship between pupil's learning styles and their performance in science. The study aimed at the degree of the relationship between pupils' learning styles and their performance in mini science projects; the enjoyment of pupils with different learning styles towards mini projects. The study revealed that all categories of pupils except avoidant were stimulated to varying degrees by the mini projects.

Kamuran (2009) studied on the effects of cooperative Learning method and Multiple Intelligence Theory among the Turkish Elementary Students' in mathematics achievement and retention towards the mathematics course were investigated. The participants of the study were 150 students who were divided into two experimental (used CLMI) and two control groups (used traditional method). The findings revealed CLMI had a more significant effect on the academic achievement than the traditional method but the CLMI had not significant effect on retention.

Jackson, Allen (2009) conducted a study on the use of technology in curriculum integration. Gardner's theory suggests there are a variety of possibilities to facilitate

learning. Verbal, linguistic students learn best through the comprehension of language which includes speaking, writing, reading, and listening. Students with verbal linguistic intelligences can easily access information through worldwide databases and computer networks. Any subject content can be enhanced, enriched, and updated from a variety of easily accessed sources which allow students to master the use of technology to access and share information. Students with logical mathematical intelligence are individuals who are number smart and have innate skills which involve logical, problem solving abilities, creative and manipulative skills, and are adept visual learners. Educators can enhance logical-mathematical intelligence through challenging and innovative multimedia technology. It was found that:

- Innovative multimedia technology helped students learn at all levels and effectively gain knowledge through a variety of different software programs that offer immediate feedback.

- Learners with visual-spatial intelligence are aesthetically oriented and may have a greater capacity for learning certain sciences like anatomy or topology.

- Learning for visual-spatial students takes place all at once, with large chunks of information grasped in intuitive leaps.

- Students with bodily-Kinesthetic intelligence learn best through tactile learning experiences. Bodily-kinesthetic proficiency can be enhanced for students through the use of the whole body to express ideas and feelings.

- The person with interpersonal is able to collaborate, understand and work effectively with others. They are aware of their interactions with others and usually take notice of and react to the feelings of others. The interpersonal learner learns best in group situations and structured class settings.

- Learners with intrapersonal intelligence have accurate self-understanding and are skilled in problem-solving. There is a multitude of different ways to integrate technology into our classrooms and all should focus on learning theory and educational practices.

The use of Howard Gardner's Theory of Multiple Intelligences, coupled with an understanding of enhancing the learning community through effective technology can meet the diverse learning needs of all students.

Moberg, Eric (2009) states Intelligence is dynamic and can be taught. The authors review empirical studies, theoretical frameworks, qualitative research, and conceptual frameworks. There are many competing and complementary theories of intelligence. The implications for educators are that we can teach not only ideas, concepts, subjects, and even fields, but also the ability to learn.

Di Fatta, Jenna, Stephanie (2009) investigated the increasing student learning in mathematics using collaborative teaching strategies. In this study a group of three teachers conducted an action research project to increase their 54 high school students' achievements in mathematics. The study arouse out of a concern by the teacher researchers who noticed a trend of low scores on teacher-made chapter tests and non-completion of daily homework; standardized tests showed that most students scored below average on the mathematics portion, and the number of students having to repeat mathematics courses had increased; students' overall grades in mathematics had dropped, along with their attitudes towards mathematics learning. The project included 40 high school students boys and girls. The teachers' planned three different interventions including incorporating multiple intelligence based lessons, offering positive reinforcement for homework, and involving the students in more regular group work. The teachers started by having their students participate in a multiple intelligence survey and based their lessons on intelligences most prominent in their classes. To increase homework completion, the teachers rewarded students who completed five consecutive assignments with a free homework pass. The group work took place during homework time in class. Students were divided into groups of four or five based on their ability level and worked as a team on homework and other activities. The teachers gathered data using three different tools which included obtaining average test scores, average homework completion, and student surveys to understand how the collaborative setting affected their learning. They found mixed results from both classes regarding the average test scores and overall, the majority of the students felt that being in a collaborative setting helped to improve their learning in mathematics.

Vigentini (2009) examines the relationship between styles, the usage of learning technology, and academic performance in the course. It is determined that the measure of approaches to learning is the stronger predictor for successful use of the material. They found that the academic performance of students who used the online

resources were significantly higher than those who either choose not to use the online materials at all or choose to use to the materials to a lesser extent.

 Leahy (2009) reports that design is a discipline involving many domains, skills and professions. In an attempt to improve design teaching and learning, and thus students design ability, consideration of students preferred mode of learning has been investigated. Educators have attempted to improve instruction through the influential adaptation of pedagogy intervention in the context of learning and cognitive styles of students. The preferential learning styles will be one of the prime considerations in meeting the requirement of best practice design pedagogy, where there is a compatibility of his or her learning style and the instructor's teaching style.

 Tzu- Chien (2009) addresses that learning management systems (LMSs), teachers have more difficulties to notice and know how individual students behave and learn in a course, compared to face-to-face education. The approach is based on inferring students' learning styles from their behavior in an online course and was developed for LMSs in general. It has been evaluated by a study with 127 students, comparing the results of the automatic approach with those of a learning style questionnaire. The evaluation yielded good results and demonstrated that the proposed approach is suitable for identifying learning styles.

 Loyens, Sofie (2009) discusses the Constructivist views of learning. Conceptions are considered important determinants of effective learning. Students can differ in their conceptions depending on their educational experience. The study investigates students' conceptions of constructivist learning; students with greater experience in their academic programme differ in their conceptions of constructivist learning compared to students with less experience; the conceptions of constructivist learning differ in a conventional, lecture-based curriculum compared to a constructivist, problem-based learning curriculum. Three groups (i.e. first-year, second-year, and third-year students) in two different curricula (i.e. conventional, lecture-based and constructivist, problem-based) were tested. A cross-sectional design was used. Students' conceptions of constructivist activities (i.e. knowledge construction, cooperative learning, self-regulation, use of authentic problems, self-perceived inability to learn, and motivation to learn) were measured by a questionnaire. Data were analyzed using a two-way multivariate analysis of variance (MANOVA). The study revealed:

- A significant difference in questionnaire's scores between year 1 and year 2 was found with respect to conceptions about knowledge construction, self-regulation, and the use of authentic problems, but not for cooperative learning and motivation to learn.

- An interaction effect was found for self-perceived inability. Furthermore, results showed significant differences between both curriculum groups on all dependent measures.

- Differences in conceptions can be perceived between students who enter a new learning programme (i.e. higher education) and students who already have one year of experience in higher education.

The study shows that the learning environment can make a difference with respect to students' conceptions of constructivist learning activities.

Akar, Hanife (2009) emphasizes on the conceptual change teacher candidates went through in a constructivist learning environment in a classroom management course from a "controlling" or "leading" type of classroom management approach indicating a disciplinary vision to a more leading type of classroom management that entailed messages of cooperation and sensitivity toward individual differences. The results showed that a constructivist learning process may result in a change in teacher candidates' conceptions of classroom management.

Sandhya, Whitney (2009) reports that constructivism is an important theory of learning to guide the development of new teaching methods in science education. However, because it is a theory of learning and not of teaching, constructivism is often either misused or misunderstood. The four essential features of constructivism: eliciting prior knowledge, creating cognitive dissonance, application of new knowledge with feedback, and reflection on learning. It was suggested that application of the four essential criteria will be a useful tool for all professional educators who plan to implement or evaluate constructivist teaching methods.

Gordon (2009) highlights a constructivist discourse that has emerged as a very powerful model for explaining how knowledge is produced in the world, as well as how students learn. It attempts to develop a pragmatic discourse of constructivism.

Alister (2010) reports the Grade 12 students' biology learning during interactive teaching classes in 2001 in Taiwan. The researcher as teacher, working within an

interpretive framework, set out to improve the senior high school student biology teaching and learning. An intervention based on a social constructivist view of learning was designed, implemented and evaluated. The findings of this study were:

- Through the intervention students' cognitive development was facilitated, their reasoning and social abilities were enhanced, and they enjoyed the lessons more.

- Their first term examination outcomes were comparable with those in the traditional teaching classes.

This study, therefore, provides an example for interactive teaching, based on a social constructivist view of learning that can be effectively used for teaching and learning biology in the senior high school in Taiwan

Bay, Erdal (2010) reports the need to develop democratic learning environments based on constructivist approach. In this study, learning environment which supported democratic values such as learner independence-autonomy, appreciation-respect, justice, respect for different ideas, acceptance of differences, shared understanding, collaborative work, responsibility and critical thinking, were constructed. The findings of the study are:

- The perceptions of the prospective teachers revealed that the learning environments established in line with the principles of constructivist approach were democratic.

- The teacher training institutions should take into consideration of designing learning environments regarding constructivist approach.

- Prospective teachers' perceptions also suggested that establishing a democratic learning atmosphere may teach them how democracy affects the minds of minors in schools as the future citizens.

Neo, Tse-Kian (2010) investigates the students' perceptions in developing a multimedia project within a constructivist-based learning environment. They were then given a survey and asked for their comments and feedback to elicit their perceptions and attitudes towards this learning environment. A factorial analysis was performed on the survey and results showed that 5 factors influenced students' perceptions in developing a multimedia project within a constructivist learning

environment. Multiple regression analysis further showed that motivation played a significant role in students' perception towards developing a multimedia project in this learning environment. These results were further supported by their survey comments and feedback. The findings of the study were students became highly motivated learners and active in their learning process and provided strong support and encouragement by setting an authentic task, via a multimedia project, into a constructivist learning environment into their classrooms.

Prakash (2010) tested the possibility that interactive lectures explicitly based on activating learners' prior knowledge and driven by a series of logical questions enhances the effectiveness of lectures. Student pretest scores in the two groups were comparable. Students that received the constructivist lectures did much better in the posttest conducted immediately after the lectures. Although both types of lectures were well received, students that received the constructivist lectures appeared to have been more satisfied with their learning experience. This study adds to the increasing body of evidence that there is a case for the use of interactive lectures that make the construction of knowledge and understanding explicit, easy, and enjoyable to learners

Youyan, Shun (2010) examined how constructivist and didactic instruction was related to students' cognitive, motivational, and achievement outcomes in English classrooms, using a sample of 3000 Grade 9 students from 108 classrooms in 39 secondary schools in Singapore. Results of hierarchical linear modeling showed differential cross-level relations. After controlling for students' prior achievement, constructivist instruction was a significant positive predictor of students' deep processing strategies, self-efficacy, task value, and English achievement; whereas didactic instruction was a significant positive predictor of students' surface processing strategies and a negative predictor of English achievement.

Poncy, Mc Callum (2010) aimed to study and identify that although basic math skill deficits are commonly encountered across elementary and secondary school students, few empirically validated, group-administered interventions are available for educators attempting to prevent or remedy such problems. The aim of this study was to compare the effectiveness of two theoretically distinct interventions for improving the subtraction-fact fluency of a general education class of second-grade students. An alternating treatments design was used to compare a behavioral intervention, "Cover, Copy, and Compare" (CCC), to an intervention from a constructivist-oriented

resource, "Facts That Last" (FTL). It was found that CCC led to increases in math-fact fluency. Two months post intervention, maintenance data revealed that the fluency increases associated with CCC were sustained.

Bimbola, Oludipe (2010) focused on the fact that integrated science played a vital role in Nigerian science education programme. Research reports indicate that this negative attitude was caused, majorly, by teachers' conventional (lecture) method of teaching integrated science. Research reports on the effectiveness of constructivist-based teaching strategy revealed that the strategy enhanced students' academic performance. It studied aimed the effectiveness of constructivist-based teaching strategy on academic performance in integrated science by Junior Secondary School students in South-West Nigeria. Quasi-experimental research design was used to achieve the purpose of this study. Participants were 120 Junior Secondary School Students randomly selected from four out of the 25 co-educational Junior Secondary Schools. Findings revealed that the constructivist instructed students had higher scores on the post test and the delayed post test, compared to those exposed to conventional (lecture) method of teaching.

Daniel (2010) express that Educational constructivism has long been associated with advanced pedagogy on the basis that, it champions a learner-centered approach to teaching, advocates learning in meaningful contexts and promotes problem-based activities where learners construct their knowledge through interaction with their peers. Involving language learners in video projects allows a seamless incorporation of constructivist assumptions into the teaching and learning experience. However, practicing educational constructivism has been caught with a number of pedagogical dilemmas and challenges. First among these dilemmas is the need to promote learner autonomy while, at the same time, maintaining a solid framework for the learning experience. Secondly, constructivist teaching and learning require proper assessment strategies that take into account the uniqueness of this educational practice. This article describes a video project implemented by Russian language learners and deliberates on possible ways to deal with these pedagogical dilemmas

Chamberlin (2010) discusses that mathematics instructors must respond to diverse needs of individual students, including different abilities, interests, learning styles and cultural backgrounds through the use of differentiated instruction. A concurrent mixed methods research study was used to address the central research question. A quasi-

experimental pre-test and post-test control-group research design measured the relationship between the differentiated instruction in the course and the students' mathematical understandings. Simultaneously, the impact of the differentiated instruction on the students' mathematical understandings was explored using interviews and analyses of students' work. The participants included elementary education majors enrolled in a mathematics course covering the topic of number and operations. The findings of the study revealed that the students receiving differentiated instruction experienced greater gains in their mathematical understandings.

Nicole (2010) investigates the effects of large classes and demonstrates that students are disadvantaged in terms of higher order learning because interactions between teachers and students occur at lower cognitive levels. This has significance for social work education, with its emphasis on the development of critical thinking and problem solving, both higher order cognitive skills. This paper reports on quantitative and qualitative research that explored social work students' perceptions of different teaching and learning strategies in a large mental health course designed with reference to principles of student-centred learning and constructive alignment. The study revealed:

- Well-integrated design, relevance to the real world and teacher enthusiasm were seen as most useful by students, rather than particular learning strategies.

- Higher satisfaction ratings and grades were also associated with this student-centred course compared with an earlier traditional lecture-style course.

The paper concludes that design based on the interplay between diverse learning activities, including lecture input, strengthened the student-centred orientation of learning and recommends further research that compares learning outcomes associated with these contrasting approaches to professional education.

Pape (2010) focuses our attention towards "Blended learning" using online tools to communicate, collaborate, and publish, to extend the school day or year and to develop the 21st-century skills students need. With blended learning, teachers can use online tools and resources as part of their daily classroom instruction. Using many of the online tools and resources students already are using for social networking, blended teaching helps teachers find an approach that is more engaging for this

generation of students. The benefits of blended learning include giving students a variety of ways to demonstrate their knowledge while appealing to diverse learning styles and fostering independent learning and self-directed learning skills in students, a critical capacity for lifelong learners. Blended learning extends teaching and learning beyond the classroom walls, developing critical thinking, problem solving, communication, collaboration, and global awareness.

Cavas (2010) reports that learning styles are not really concerned with "what" learners learn, but rather "how" they prefer to learn and it is also an important factor for students' academic achievement and attitudes. The purpose of this study was to investigate the learning styles of pre-service teachers enrolled at elementary education department of Faculty of Education in Turkey. The sample consisted of six hundred six pre-service teachers from elementary science, mathematics and class teacher program. The Kolb's Learning Style Inventory was used to determine the pre-service teachers' learning styles as divergent, assimilator, convergent, and accommodator, and the information sheet for demographic factors such as gender, grade, program and age was used to collect information from participants. The data were analyzed by using frequency, percent value, mean scores, standard deviation, independent samples t-test and one-way ANOVA. The findings of the study were:

- The dominant learning style among the pre-service teachers is divergent and it is followed by accommodator learning style.

- The learning style components did not significantly differ by gender in all three groups, except for Active Experimentation.

- The mean scores for Abstract Conceptualization (AC), Active Experimentation (AE) and AE-RO scores of pre-service science teachers were significantly different from class teachers.

- The grade level progresses, the mean scores of CE, AE, AC, AC-CE, and AE , and AE-RO also increased.

Adeyemi, Babatunde (2010) addresses the fact that teacher plays a significant role in the intellectual development of the pupils, using various assessment and teaching styles to improve pupils' performance in school subjects through a co relational study. They found that there was a significant relationship among teacher related factors and pupils' achievement in Social Studies and that only two predictors teaching and

assessment styles of teachers had significant relative effect on pupils' achievement in Social Studies.

Gottler, Rose (2010) investigates the reasons behind fifth grade students' participation or non-participation in mathematical discussions, and determine whether this affected their understanding of the learning material. The researcher observed twenty-four students' participation or non-participation in mathematical discussions in a fifth grade classroom over the course of three months. The first half of the study documented student participation or non-participation when the teacher used a lecture-based teaching model. The second half of the study documented student participation or non-participation when the researcher used an inquiry-based teaching model. Quantitative and qualitative data was collected to determine which students participated and in what manners. Assessment results were also collected and evaluated for each of the lessons in the study. The findings of the study were:

- All the students were participating in mathematical discussions for both styles of teaching.

- The rates of that participation and the nature of the participation were different from student to student, and from lesson to lesson.

- The inquiry-based method of teaching produced more favorable results in terms of total student participation than did the lecture-based format.

- Changes in the nature of student participation were affected by the mode of presentation of the learning material.

Educators need to apply inquiry-based methods for teaching mathematics in order to change the nature of student participation in mathematical discussions from passive listener to active learner.

Kimberly (2010) report on the concept of learning styles having tremendous logical and intuitive appeal, and educators' desire to focus on learning styles is understandable. Recently, a growing emphasis on differentiated instruction may have further increased teachers' tendency to look at learning styles as an instructionally relevant variable when individualizing instruction in increasingly heterogeneous classrooms. The authors discuss the overlapping concepts of individualized instruction and differentiated instruction, briefly review the evidence base for learning styles, and argue that instruction should indeed be individualized and differentiated.

They conclude that there is insufficient evidence, however, to support learning styles as an instructionally useful concept when planning and delivering appropriately individualized and differentiated instruction.

Fenner, Dorraine (2010) studied the effects of differentiation and motivation on students' performance through differentiated assignments. The volunteers that participated in this study were 6th, 7th, and 8th graders. Students struggle academically to meet the expectations of their instructors. These struggles impact how students learn academically, behave socially, and participate collaboratively within a classroom. Implementation of differentiation showed some improvement in students' learning as well as increases in student motivation. Participants received a multiple intelligence survey to see how their individual learning styles impacted their academic success. These collection tools were documented to show how students progressed academically. As teachers, the researchers influenced the attitudes and motivational levels of our students. Providing positive reinforcement and levelled assignments, students experienced success and progressed academically. It was found that the intervention resulted in academic growth. Using differentiated strategies allowed students to become motivated according to their ability. These tools allowed students to become successful in their academics.

Anne Guignon (2010) in the article Multiple Intelligences: *A Theory for Everyone* gives a deeper insight on awareness of multiple-intelligence theory has stimulated teachers to find more ways of helping all students in their classes. This is done in some schools by adapting curriculum as per Linda Campbell's *"How Teachers Interpret MI Theory,"* (*Educational Leadership*, September 1997), five approaches to curriculum change:

- Lesson design. This involves team teaching ("teachers focusing on their own intelligence strengths"), using all or several of the intelligences in their lessons, or asking student opinions about the best way to teach and learn certain topics.

- Interdisciplinary units. Secondary schools often include interdisciplinary units.

- Student projects. Students can learn to "initiate and manage complex projects" when they are creating student projects.

- Assessments. Assessments are devised which allow students to show what they have learned. Sometimes this takes the form of allowing each student to devise the way he or she will be assessed, while meeting the teacher's criteria for quality.

- Apprenticeships. Apprenticeships can allow students to "gain mastery of a valued skill gradually, with effort and discipline over time." Gardner feels that apprenticeships "…should take up about one-third of a student's schooling experience."

2.3 EPILOGUE

The purpose of literature review is to make the researcher aware of the gaps in research. An analysis of these prior researches has been of immense use in the present research.

The research findings and conclusions in the study on learning styles revealed a positive academic achievement among students. Sex – boys and girls did not make a difference in the learning style but had a direct bearing on achievement and motivation. It was also found that students with high intelligences possess more scientific attitude. By catering to the different learning styles a very high positive academic climate could be witnessed in the classroom. However, there was hardly any study that addressed the learning styles as propounded by H.Gardner. The lack of related review on the influence of learning styles while addressing the Multiple Intelligences among the students was an indication to the researcher to work on these lines.

A number of major research studies have focused on Multiple Intelligences in the teaching learning activities. Multiple intelligence approach based teaching could overcome the drawbacks of traditional learning even for the students with special educational needs. An extensive use of thematic lessons, web plans, monthly themes strengthened Multiple Intelligences among the students thereby leading to mastery learning. The researches catered to MI-based instructional planning and implementation which had a positive impact on students' cognitive and affective capabilities. The studies also revealed that the teachers were sensitive towards the dominant intelligences among the students and addressed the activities accordingly. The use of Multiple Intelligences in CAI also had steering influence in student

achievement, the findings revealed that Multiple Intelligences coupled with an understanding of enhancing the learning community through effective technology could meet the diverse learning needs of all students. Multiple Intelligences was found to be a solution to the classroom problems and low achievement among students. The emergence of Multiple Intelligences was a boon to the student community, the teaching was addressed in a variety of ways as seen in the review and each research had laudable findings to prove the same. It not only catered to their academic progress but the holistic outcomes. All the research findings revealed significant difference with the use of Multiple Intelligences either through a survey, observation, checklist or through an experimental study. The findings revealed that the Use of multiple intelligences improved assignment completion, class participation, and engagement of learners. There was hardly any research that addressed the MI and catered to the educational objectives, most of the researches were based on the consistent shortcoming that was seen among the students during the academic course. The objective was either on the research that was undertaken to overcome the shortcomings or to prove the effectiveness of the MIT. But there was no research that was done to address the Multiple Intelligences and cater the educational objectives as given by Revised Blooms' Taxonomy. However the research by Audrey (2003) dealt with addressing Multiple Intelligences and Blooms' Taxonomy and consisted of 13 units each of the lesson addressed the 7 Multiple Intelligences and the 6 levels of Blooms' Taxonomy, the researcher took Audrey's (2003) research as a guideline to frame the activities and channelize the present research in a new dimension by inculcating 8 Multiple Intelligences and levels of objectives as per Revised Blooms' Taxonomy.

The literature review shows that the studies have also focused on constructivism and co-operative learning as an important aspect in student motivation and high academic achievement through group based, technology based, student oriented activities. The findings revealed that the incorporation of cooperative learning and multiple intelligence lessons strengthened student motivational levels and academic achievement. Co-operative learning activities also taught appropriate social skills which also addresses the interpersonal intelligence. The findings also stressed that constructing learning experiences based on the multiple intelligences provides all students with the opportunity to be successful. The review gives a glimpse of the

various data analysis through pre-test post-test design that shows a positive impact of co-operative learning methods in student achievement. Though a few researches focused on constructivist approach while addressing MI there was hardly any research that catered to the educational objectives as given by RBT and addressing MI through constructivist approach. Hence the researcher focused on creating a constructivist learning environment thereby catering to the 8 Multiple Intelligences and levels of objectives as per Revised Blooms' Taxonomy.

The Bloom's taxonomy had a major contribution towards mastery learning. It provided with opportunities to think beyond knowledge and understanding thereby engage in high level questions and critical thinking. Different learning methodologies can assist in evaluating student performance through Bloom's Taxonomy of Educational Objectives There was few discussions on the cognitive dimension of the RBT which redefines the perspective of objectives, instruction, and assessment and raises the learning target. A break through from the traditional aspect of learning from retention to transfer of learning and rote to meaningful learning thus offering different outlook on the structure and format of classroom teaching, learning and assessment. However lack of considerable study in this direction of realizing the educational objectives as given by RBT and addressing the MI motivated the researcher to budge ahead in this direction. The knowledge of the other researches assisted the researcher to plan activities accordingly thereby leading to higher order thinking skills among the students.

The above discussions created a synergy in the researcher to progress in the direction that was unexplored. The various dimensions of the research and the review helped the researcher to gain extensive knowledge about the different teaching methodology, research designs and evaluation methods that could be employed during the conduct of this research. The present study was a brainwave conceived to figure out the needs of a child who comes to school with such a lot of aspirations to be winner in his / her desired manner but often is disheartened. It is the child who should be given prime importance in his/ her learning. The child learns through multiple ways with basic aim to achieve the educational objectives. This study throws light on the Multiple Intelligence theory suggested by H. Gardner and the achievement of educational objectives as given by the Revised Blooms' Taxonomy. This study is an endeavor to unearth the innate desires of the child towards an experiential learning that would

enlighten his experiences thus making learning a joyful experience. Traditional approaches emphasize the presentation of information, and define learning as its absorption. In this study the researcher aims to relate teaching excellence equal to sound academic knowledge, through variety of activities and achievement of higher order educational objectives. The researcher aims at making teaching an intentional activity in which the researcher guides the students and isolates learning difficulties along the way before those difficulties hinder the mastery of important course outcomes.

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CHAPTER 3

CHAPTER 3

RESEARCH DESIGN

3.1 INTRODUCTION

Research design provides the glue that holds the research project together. The researcher herself had few years of school experience, but always questioned in her mind as to how far have the teaching-learning process catered to the interests, likes and needs of the students? Whether the understanding led to higher order thinking? Most of the times students are taught through the traditional lecture method which rarely catered to the Multiple Intelligences and higher levels of learning objectives, this was reflected in their marks and produced children who could only replicate knowledge and not create knowledge. Learning should cater to the cognitive, affective and psychomotor domain of the students. This would enable in creating an ownership in the teaching learning process. Thus the researcher developed an IDEA model that facilitated the Research Design.

IDEA MODEL
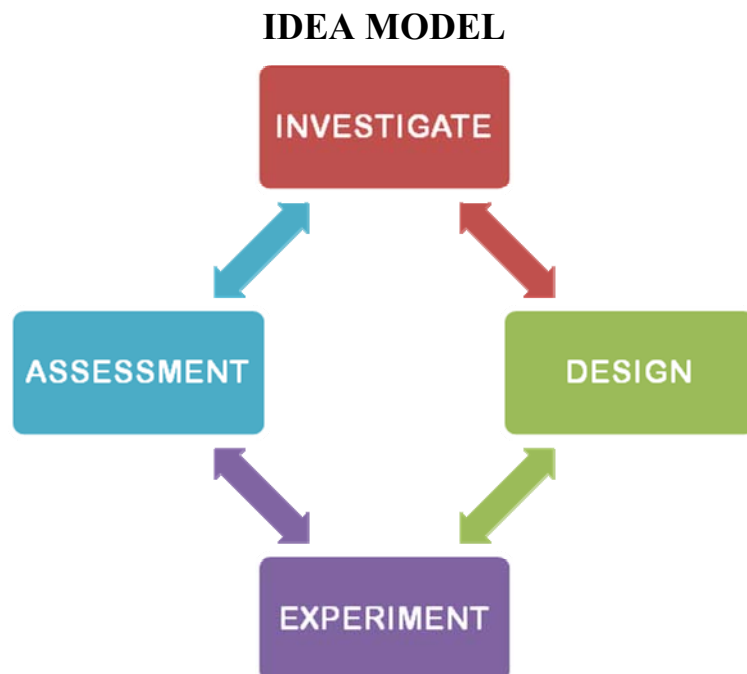
INVESTIGATE: The researcher informally spoke to few friends and interacted with students studying in different schools. The findings revealed that teaching-learning process in the class mainly focused on verbal and logical intelligence and at times interspersed with few activities that catered to the visual and kinesthetic learners. The

learning focused on rote memorization and writing down answers from the blackboard. The needs of all the learners with multiple intelligences were not met and the levels of achievement of educational objectives were not as per the students needs. Overcrowded classrooms, lack of space and time constraint were a hurdle for the teachers to involve students in their learning process. Few teachers were not aware of innovative and new teaching methods that they could incorporate in their classroom teaching-learning process. Based on all these factors the researcher planned an experimental study to find out the effectiveness of Multiple Intelligence Approach to curriculum transaction thereby catering to the levels of educational objectives as given by Revised Bloom's Taxonomy. The study consisted of students studying in standard VI of 8 schools 2 from each of the Boards - SSC, CISCE, CBSE and CIE. Since the students were from different boards it was essential to have a common base for the all students for uniform content delivery and assessment procedure. The study was conducted for 5 days in each school.

DESIGN: The researcher based on the findings planned the content to be delivered to the class. The researcher conducted a Multiple Intelligence Inventory to know the diverse Multiple Intelligences among the students. The researcher with the help of her guide developed the Instructional Module that was to be presented to the students. MI/RBT grid was made and learning objectives were framed. It catered to the different multiple intelligences and the educational objectives as given by Revised Bloom's Taxonomy. Two units of equal difficulty level were taken. The units were Pollution and Energy. The grid consisted of the activities that had to be taught on the two units. Since the researcher had given prior information to the schools of the units chosen for the study, the units were not taught to the students before.

EXPERIMENT: The study was conducted in each school for 5 days. The students were divided into 5-6 students per group, all the activities catering to the 8 Multiple Intelligences were carried out by all the students. The students were provided with the necessary resources for the smooth conduct of the activities. On the first day the unit – Energy was taught to X_1 by Traditional Approach of teaching. The second day the unit – Pollution was taught to X_2 through the by Multiple Intelligence Approach. On the third day the unit – Pollution was taught to X_1 through the by Multiple Intelligence Approach. And on the fourth day the unit Energy was taught to X_2 by the Traditional Approach of teaching. After completing each unit, a criterion test (Post

test) on that unit was administered to assess the conceptual clarity of the unit taught and the mean gain score (O_1, O_2 and O_3, O_4) was computed.

ASSESSMENT: The students were evaluated at regular intervals, each activity gave scope for analysis, evaluation and creation which aimed at higher order level of thinking. The students could clarify doubts that they faced during the learning process. The researcher assessed the activities through close observations and field notes. Feedback from the students with respect to the activities, illustrations, demonstrations, content delivery, and impact on the teaching –learning process were also encouraged at the end of each day. The criterion referenced post-test was also conducted at the completion of the unit. The post-test catered to the levels of thinking as per the Revised Bloom's Taxonomy.

3.2 RESEARCH DESIGN:

Two units of approximately equal difficulty level in Science subject were selected and modules were prepared for instructional intervention by Multiple Intelligence Approach in order to realize the educational objectives as given by Revised Bloom's Taxonomy. Since random assignment of the subjects into two groups was not possible to establish equivalence, a quasi-experimental study following the Counter Balanced Design (Two Groups Equivalent Materials Post Test Design) was adopted. The same can be depicted as follows:

(a) Counter Balanced Design / Two Groups Equivalent Materials Post Test Design:

X_1	MA1	O_1
X_2	MB1	O_2
X_1	MB2	O_3
X_2	MA2	O_4

In the first stage, a Multiple Intelligence checklist was administered to assess the students' interest level. The first unit was taught to the first group (X_1) by traditional chalk and talk method (MA1) and the second group (X_2) Multiple Intelligence Approach (MB1). After completing the unit, a criterion test (post test) on that unit was administered to both the groups to assess the conceptual clarity of the unit taught (O_1 and O_2)

In the second stage, the second unit was taught to X_1 by Multiple Intelligence Approach (MB2) and X_2 by Traditional Approach (MA2). After completing the unit, a criterion test (post test) was administered to both the groups to assess the conceptual clarity of the unit taught (O_3 and O_4).

The achievement scores of the two groups were analyzed as follows:

The column means of post test scores were computed to get the mean achievement for the two groups taught by the method shown by the column heading as follows:-

Content	TA	MIA
Unit 1 Pollution Unit 2 Energy	O1 O4	O2 O3
	Column mean	Column mean

Then the column mean scores were compared to find out the significant difference between them so as to ascertain the effectiveness of the modes of curriculum transaction on conceptual clarity in Science.

(b) Factorial design

Further, to find out the main effect and the interaction effects of

- ➢ the levels of achievement of secondary school students
- ➢ their gender and
- ➢ the types of schools from which they were selected

on the methods of teaching (Traditional vs MI approach), Factorial design was used as follows:

(i) Levels of achievement of secondary school students as shown below:

	TA	**MIA**
Above average	Column Mean Scores	Column Mean Scores
Average	Column Mean Scores	Column Mean Scores
Below average	Column Mean Scores	Column Mean Scores

(ii) On the basis of gender as depicted below:

	TA	MIA
Male	Column Mean Scores	Column Mean Scores
Female	Column Mean Scores	Column Mean Scores

(iii) On the basis of types of schools as depicted below:

	TA	MIA
SSC	Column Mean Scores	Column Mean Scores
CBSE	Column Mean Scores	Column Mean Scores
CISCE	Column Mean Scores	Column Mean Scores
CIE	Column Mean Scores	Column Mean Scores

3.2.1 Variables of the Study:

A) Independent Variable: MIA to teaching two units in Science-Pollution and Energy- to standard VI of secondary school students using an instructional module developed by the researcher.

B) Dependent Variable: The achievement of objectives of RBT in the two units in Science-Pollution and Energy - among secondary school students

C) Controlling Intervening Variables in the Present Study

- *Anxiety*: The researcher herself conducted the lessons. Researcher had created a rapport with the students and they were made to feel at ease. The researcher was with them always as a guide and facilitator to relieve them of any apprehensions. The researcher spent almost 4 hours in a day with the students.

- *Fatigue*: The researcher took special care to avoid any kind of mental, physical, social, emotional stress and strain. Due care was taken by the researcher in selection of the activities to avoid any tiredness during the conduct of the activity.

- *Motivation:* The researcher was always on the guard to keep up the motivation level of students at the positive end through constant reinforcement and active involvement of students. The researcher gave due attention to all the groups in the class who performed the activities. The students were highly motivated since the researcher was herself conducting the classes and administering the tools ensuring the confidentiality and objectivity of the data. Maintaining high level of motivation was an important aspect of this programme as it would result in appropriate feedback and post test results.

- *Boredom*: The researcher had selected the activities as per the age and maturity level of children. There were diverse activities included to avoid monotony and boredom. Active involvement of students through various activities dismissed the presence of boredom in class and ensured that the students were receptive and participative.

Controlling Extraneous Variables in the Present Study

- *Age*: The students selected for the present study belong to the same age group. They ranged between 11- 12 years in both the groups of all the four different Boards of Schools.

- *Grade*: Students of standard VI were selected for the study from all the different Boards of Schools.

- *Academic Background*: The VI standard students of 2 schools in each of four Boards of school - SSC/CBSE/CCISCE/CIE board syllabus pattern where they study science as compulsory subject right from primary along with other subjects.

D) Experimental Validity: If a study is valid then it truly represents what it was intended to represent. Experimental validity refers to the manner in which variables that influences both the results of the research and the generalizability to the population at large. It is broken down into two groups:

   (i)   Internal Validity

   (ii)   External Validity

(i) Efforts to Enhance Internal Experimental Validity

Internal validity of an experiment depends on the extent to which extraneous variables have been controlled / manipulated by the researcher. Researchers must be aware of aspects that may reduce the internal validity of a study and do whatever they can to control for these threats. These threats, if left ignored, can reduce validity to the point that any results are meaningless rendering the entire study invalid. In the present research the researcher has tried to overcome following:

- *Maturation:* Maturation of the participants over a period of time did not affect the study as the researcher gave the post-test to the group immediately after the instructional intervention.

- *History*: There were no chaotic events that took place in the community during the conduction of the experiment.

- *Testing:* Multiple Intelligence checklist was given to the group, some practice sheets and activities followed by the posttest at the end of instructional program.

- *Unstable Instrumentation*: The criterion test used was validated by consulting the experts in the field.

- *Statistical Regression*: The sample were not selected on the basis of their intelligence level. The group consisted of intact classes.

- *Selection Bias:* The participants did not consist of volunteers but two divisions of intact class.

- *Experimental Mortality*: Loss of subjects on the group was not seen since the duration of the experiment was one single day.

- *Experimenter Bias:* The experimenter had never previously met the subjects and had not known them before.

(ii) Efforts to Enhance External Experimental Validity

External validity refers to generalizability of a study. In other words, can we be reasonably sure that the results of our study consisting of a sample of the population truly represent the entire population? In the present research the researcher has tried to overcome following:

- ***Interference of Prior Treatment***: In the present study there was time gap kept in between two treatments and post-test. Hence there was very little chance of effect on post-test.

- ***Interaction of Selection and Treatment***: In the present study both the groups were containing boys and girls having nearly same abilities, qualities and scholastic achievement which indicated very less chance of any effect on generalizability of findings.

- ***Hawthorne Effect***: In the present study researcher tried to behave as possible as normal school teacher. The group was not informed about the purpose of the study. There was no bias in the treatment to the students in the classroom.

- ***Order Effects (or Carryover Effects)***: In the present study the researcher maintained the order effect systematically, the participants were given an exposure to the approaches one at a time. There was time gap maintained to avoid spillover effect of one approach on the other**. (CHECK)**

- ***Treatment Interaction Effects***: In the present study the activities were planned as per the participants characteristics- age, level of understanding, interest etc which did not affect the treatment interaction. Since all the participants were given opportunities to perform all the activities, there was no bias and difference that was created.

3.3 SAMPLE OF THE STUDY:

In the present study, the researcher made use of **stratified random sampling technique** in order to select the experimental groups for the study. The schools affiliated to the various Boards were listed and two schools affiliated to each of the Boards - SSC, CBSE, CISCE and CIE - were selected at random. From each of the schools selected, two divisions of Standard VI were selected at random. Total 736 students were selected which was the sample for this study. Care was taken to see that the sample characteristics represented the population from which it was drawn: girls and boys, who came from different family and academic backgrounds. For this, the researcher selected the schools from various localities in Mumbai and Navi Mumbai. They belonged to the age group between 11 to 12 years.

The list of the schools with their respective Boards and the area of their location are given in **Table 3.1.**

<div align="center">

TABLE 3.1
Detailed List of Schools of the Sample selected for the Study

</div>

Sr. No.	Name of School	Board	Locality	Number of Students	Boys	Girls
1.	St. Lawrence High School	SSC	Vashi	244	144	100
2.	OLPS High School	SSC	Chembur			
3.	Ryan International High School	CISCE	Chembur	164	105	59
4.	Cambridge School	CISCE	Kandivali			
5.	MSG's SGKM International School	CIE	Ghatkopar	164	107	57
6.	RBK International Academy	CIE	Chembur			
7.	St. Joseph High School	CBSE	New Panvel	164	110	54
8.	Ryan International School	CBSE	Sanpada			
Total	8 Schools			736	467	269

During the data collection the researcher noticed that the number of students in the SSC Board schools were more as compared to the students in CISCE,CBSE, CIE Board schools. This could be due the following reasons:

- The SSC Board schools are state run schools (aided) schools, therefore it follows the SSA (Sarva Shiksha Abhiyaan) and more number of students is admitted.

- The school fees of other Boards such as CISCE,CBSE,CIE are higher as compared to SSC board hence it might not have been possible for parents to bear the expense.

- There are not too many schools affiliated to CISCE, CBSE, CIE Boards, this affects the students in getting admission to schools in their vicinity.

The following **Figure 3.1** shows the number of Boys and Girls distribution of the sample.

Fig. 3.1 Gender Wise Distribution of the Sample across the Boards
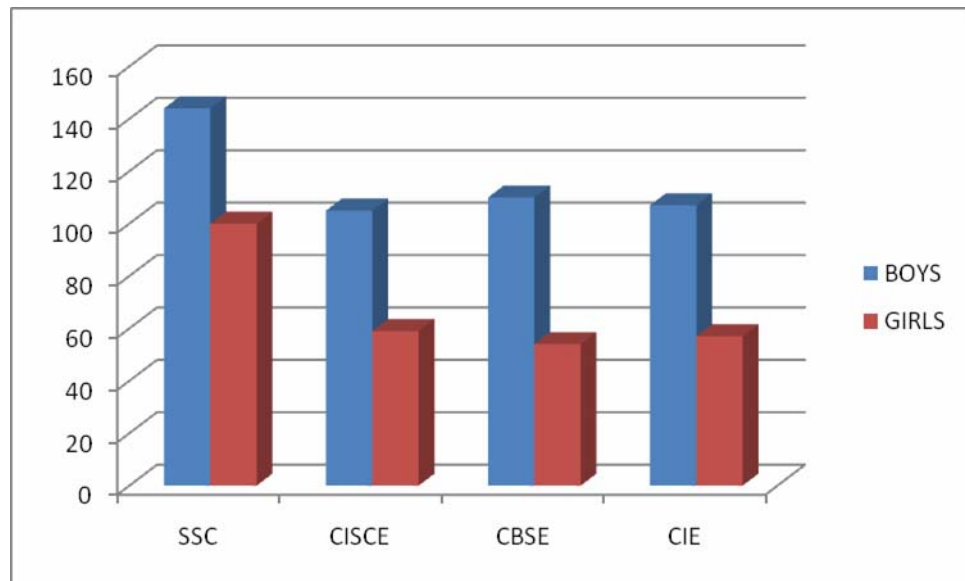
Equal representation on the basis of gender was not possible because the intact divisions were to be selected for instructional intervention.

3.3 TOOLS FOR DATA COLLECTION

The researcher will make use of the following tools to collect data:

a) Personal Data Sheet;

b) Multiple Intelligence Test;

c) MI/ RBT Grid;

d) Instructional Module;

e) Field notes;

f) School Records;

g) Criterion Referenced Post- test.

a) **Personal Data Sheet:** The researcher prepared the Personal Data Sheet which gave information on the Personal details of the students such as Name, Age, Gender and Type of school. It is presented in **Appendix 1**.

b) **Multiple Intelligence Test**: MI test was done to find out the likes/ dislikes of VI standard students, their dominant intelligences, introspection by the students thereby being aware of their strengths and weaknesses. The researcher made us of the readymade Multiple Intelligence test based on Howard Gardner's model. The Multiple Intelligence test is presented in **Appendix 2**.

c) **MI/ RBT Grid:** A two dimensional grid was prepared of activities with Multiple Intelligences vis-a-vis educational objectives of the Revised Bloom's Taxonomy. These activities were designed which formed the content of the Instructional Module. The MI/ RBT Grid consisted of activities on both the units in Science subject – Pollution and Energy. The researcher referred to **Audrey (2003)** who conducted a study that integrates Benjamin S. Bloom's levels of cognitive understanding with Howard Gardner's eight domains of intelligence to provide a framework for individualized instruction. The topics that were dealt in the present study are given below:

The unit on Energy:
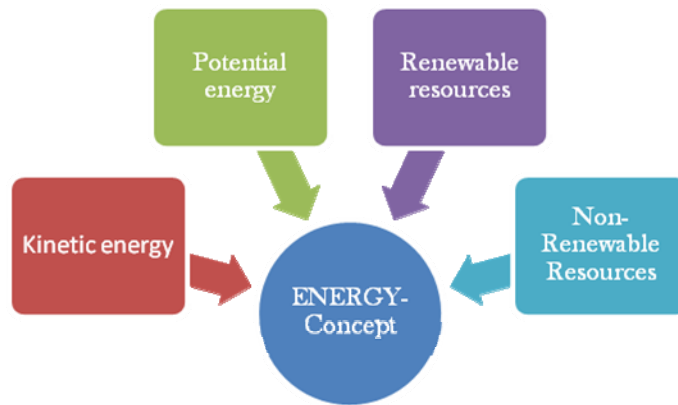
Table 3.2 GRID SHOWING THE ACTIVITIES BASED ON MULTIPLE INTELLIGENCES VIS-À-VIS THE OBJECTIVES OF REVISED BLOOM'S TAXONOMY ON THE TOPIC ENERGY

OBJECTIVES→ MI ↓	Remember	Understand	Apply	Analyze	Evaluate	Create
Verbal/ Linguistic	Read a story. Use pictures to enhance storytelling.	Comment and write about one of the character in the story.	List the energy resources used everyday, during vacations and different seasons.	Compare and contrast the story and the list and report it.	Students suggests a plan to save energy at home and to avoid power-cuts.	Students create a slogan on energy conservation.
Logical/Mathematical	Teacher shows a graph to identify energy consumption	Teacher asks to interpret the graph.	Students discuss on various factors contributing to it and present it creatively	Teacher asks students to list the number of appliances at home.	Students differentiate into necessary and luxury items and give reasons for the same	Students prepare a graph on the increasing number of appliances of a group.
Visual/ Spatial	Identify the energy sources used in the picture	List the advantages and limitations of the various stages of human history	Students record the electric inventory of all electrical home appliances.	Express your feelings of the appliance in ascending order of importance.	Students critique/ defend the use of few electrical appliances	Create a collage of words and pictures on theme "Energy Conservation"
Bodily/ Kinesthetic	Identify Renewable and Non- Renewable energy resources	Role play with friends on Renewable/ Non Renewable energy resources.	Prepare a chart Renewable and Non-Renewable energy resources highlighting the features	Interview a friend on Renewable and Non-Renewable energy resources	Collect advertisements from newspapers and magazine on energy conservation and explain them.	Design an advertisement that depicts Energy conservation.
Musical	Ask the students to close their eyes and identify the sounds	Write a 1 verse rap describing the sounds heard.	Students demonstrate the various sounds and discusses about them	Choose a sound to depict words associated with energy.	Make a jingle / tongue twister to highlight energy conservation	Write a poem on Energy Conservation.
Interpersonal	Identify the energy consumption of different electrical appliances from a pamphlet.	Students work in groups/ pairs and discuss about their energy usage	Students prepare a Detective Sheet and record the views of other groups in defining energy	Students are given clues to focus on the definition	Students interpret the clues/ answers and make their own definition and present it.	Create rules to control energy consumption and avoid wastage.
Intrapersonal	Reflect on energy used by you in your daily life.	Describe the quality you have that would help you in energy crisis.	Make a poster of items needed as an emergency kit to use when energy sources are missing.	Rearrange your house to enable energy conservation and give reasons for the same.	Debate on the various rearrangements with others.	Create a dream house plan for all possible things you want/ not want in the house.
Naturalist	Teacher introduces with a short story and asks students to make simple choices in life	Interpret the choices made based on lifestyle	List 5 eco-friendly products.	Analyze safe and dangerous aspects of 2 energy resources.	Develop an eco-friendly plan for your house.	Design an eco-friendly book cover on theme "environment"

The unit on Pollution:

- Pollution – Meaning,
- Types of Pollution – Air, Water, Noise Pollution,
- Cause and Effect of Pollution.

Table 3.3 GRID SHOWING THE ACTIVITIES BASED ON MULTIPLE INTELLIGENCES VIS-À-VIS THE OBJECTIVES OF REVISED BLOOM'S TAXONOMY ON THE TOPIC POLLUTION

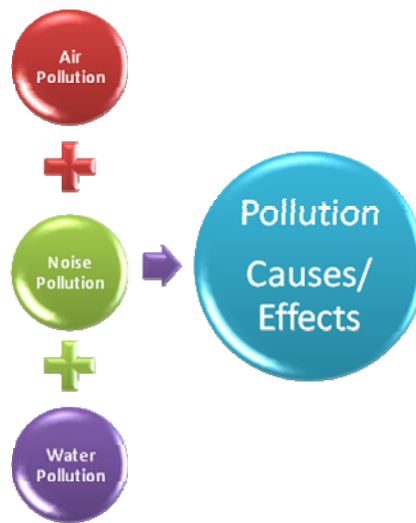| OBJECTIVES→ MI ↓	Remember	Understand	Apply	Analyze	Evaluate	Create
Verbal/ Linguistic	Read a story on Pollution using pictures.	Write a description on any one of the pollution.	Create a glossary of words associated with pollution.	Scan the newspaper about different pollution articles and pictures.	Write a response to any one of the news article.	Create a slogan on Pollution Awareness
Logical/ Mathematical	Identify the pollution levels based on the graph.	Predict the effects of Pollution levels	Make a mind map about pollution, causes and effects.	Conduct a survey in your class about pollution	Interpret your results with judgments	Prepare a graphical representation and analysis of the survey and display on the notice board.
Visual/ Spatial	Make an artwork of Pollution	Interpret the artwork and discuss its highlights.	Find pictures and photos on pollution and present it creatively with captions.	Select any one pollution and prepare an outline about it.	Plan suggestive measures to reduce pollution.	Make a booklet highlighting Pollution causes and effects.
Bodily/ Kinesthetic	Identify the pollution based on the pictures.	Role play on pollution and its effects.	Use sign and symbols language to depict pollution and words associated to it.	Analyze and categorize different pollution, effects and causes.	Develop a program to reduce pollution in school.	Design a cover page for your school annual magazine on the theme "Pollution"
Musical	Identify the different sounds.	Write a 1 verse rap describing the sounds heard.	Students demonstrate other sounds in their daily life and discusses about them	Write a poem on Pollution.	Debate on the effect of sound on human life.	Students create a simple alternate noise friendly appliance.
Interpersonal	As a media reporter, interview few teachers on pollution issues	With the friends prepare a news article/ broadcast story on it.	Develop a set of 5 criteria to pollution and its cause and effect. Survey students.	Analyze the problem based on different perspectives of student responses	Collect advertisements from newspapers and magazine on pollution and explain them.	Present an Advertisement to create Pollution awareness.
Intrapersonal	Students recall the pollution caused by them daily.	Describe the cause and effect of these pollution pictoral / verbal.	Students are given the freedom to re-arrange their house setup based on their likes.	Analyze and give reasons for the desired preferences.	Debate on the various rearrangements with others and evaluate it from a practical view point.	Create a dream house plan for all possible things you want/ do not want in the house.
Naturalist	Imagine the place you stay and identify the pollution	Give examples of health hazards in your locality	Record two different locality and their impact on environment	Distinguish between village and city life.	Design a pollution free environment plan for your locality	Imagine yourself in a forest and describe one day spend with respect to eating, playing etc.

Due care was taken to keep pace with the time, space constraint and the available resources. The MI/RBT Grid was designed in such a way to encourage participation by all the students and the formative evaluation was done during the end of each activity which the students performed at their own level. Thus addressing all the levels of MI and catering to the different levels of RBT.

To determine the *face validity and content validity*, the draft version of the Multiple Intelligence and Revised Bloom's Taxonomy Grid was given to 5 experts in the field of education. The list of experts is given in **Appendix 8**. Those activities which were agreed upon, by most of the experts were retained, as per the suggestions of the experts, a few activities were modified. The face validity and content validity of the tools were thus established.

d) Instructional Module: The Instructional Module was prepared by the researcher with the help of her guide. The Instructional Module consisted of the objectives of the lesson, content description, grid and the detailed explanation of each activity addressing the Multiple Intelligences and catering to the different levels of Revised Bloom's Taxonomy. The day-wise lesson in the Instructional Module with other details are presented in **Appendix 3**.

Rationale: The following principles were kept in mind while preparing the instructional module:

- Education becomes joyful and meaningful when the learning experiences provided are suitable to the learning styles and interests of the students.

- Active learning is to be facilitated by the teacher and the teacher has to devise activities to enable the students to 'learn by doing'.

- Multiple Intelligence Approach plays a very dominant role here in matching the learning activities to different abilities and interests of students, by providing them learning experiences suitable to their learning styles and to achieve the educational objectives;

- MI approach should expose all the learners to activities catering to all the different intelligences/learning styles and the activities have to be designed so as to develop the cognitive abilities mentioned in Bloom's Revised Taxonomy;

- Learners should be made to learn in groups so as to bring in synergy in the learning process and to break monotony and create interest;

- Learners need to observe, explore, investigate and describe objects and situations, which contributes to the empirical nature of science. Learning Science involves two key processes, namely investigation and analysis.

- Some of the scientific processes or enquiry skills that are fundamental to the learning of science in school programs are: classifying, creating models, experimentation, inferring, interpreting data, making decisions, manipulating materials, measuring, and observing, predicting, and recording data.

Overview of the Instructional Module

Day 1: Administer the Multiple Intelligence Test to both the divisions A and B.
Present the unit on Energy to Division A through the Traditional Approach to Curriculum transaction.

Day 2: Administer post-test on unit Energy to division A.
Present the unit on Energy to Division B through the Multiple Intelligence Approach to curriculum transaction.

Day 3: Administer post-test on unit Energy to division B.
Present the unit on Pollution to Division A through the Multiple Intelligence Approach to curriculum transaction.

Day 4: Administer post-test on Pollution to Division A.
Present the unit on Pollution to Division B through the Traditional Approach to curriculum transaction.

Day 5: Administer post-test on Pollution to Division B.

e) Field Notes: The researcher had a classroom walkthrough that enabled close classroom observations of the students to get specific information about the Instructional Intervention. The classroom walkthrough was not an evaluation; it was to make focused observations of peer interaction and student involvement in the activities. The checklist on the same was prepared by the researcher and is presented

in **Appendix 4**. The researcher also collected information in the form of daily field notes which helped the researcher to analyze and answer the research questions critically and closely.

f) School Records: In order to collect data about the level of achievement of students (to group them into average, above average and below average achievers), the researcher personally met the class teachers of the respective classes that were selected as the sample. The school cumulative records and the marks of the students in their terminal examination conducted in the school was taken down which helped the researcher in classifying the level of achievement of the students – Below average (below 40%), Average (40 – 60 %), Above Average (above 60%).

g) Criterion Referenced Post Test in Science

Criterion referenced test was developed in Science by the researcher on the topics **Pollution and Energy** to test the achievement of objectives as per the Revised Bloom's Taxonomy among the participants in both the units. There are 12 questions in the test. The questions given in the criterion test in Science were prepared keeping in mind the maturity level of students, previous knowledge and related to daily life situation and content of the unit learned. There were internal choices given to the students for some of the questions. The questions were framed in such a way that it catered to the below average, average and above average students. Its main purpose was to measure the achievement of students of standard VI of SSC/CISCE/CBSE/CIE Board in realizing the educational objectives as given by Revised Blooms' Taxonomy through the Multiple Intelligence Approach.

The criterion test was prepared by the researcher with help of her guide. The test prepared then was given for validation to Science subject teachers; the list of teachers is given in **Appendix 5.** The test was then modified according to the suggestions given by the teachers. Criterion Referenced tests in Science was administered as a post test. The scoring key for the test was also prepared. Criterion Referenced Post-test is presented in **Appendix 6.**

After finalizing the test and the instructional module, a **dry run** was conducted on a group of 30 students of Our Lady of Good Counsel School, Sion. The dry run helped in following ways:

- To determine the time required for each procedure.
- To determine the total time required for teaching through the Instructional Module.
- To determine the total time required to complete the test.
- To check if the questions were understood in the same way as the researcher wanted
- To check if the students had any doubt or any clarifications.
- To check if the students experienced any ambiguity at the time of conducting the test.

Internal – Consistency Reliability

The internal – consistency reliability was ascertained using **split – half** method. For this purpose the test was divided into two equivalent 'Halves' and the correlation found between these half tests. The coefficient of co-relation for the half tests was found to be 0.50.

From the reliability of the half test, the self correlation was then estimated by the **Spearman – Brown Prophecy formula.** Two sets of scores were made by combining alternate items in the test. The first set of scores represented performance on even items. From the self correlation of the half tests, reliability coefficient of the whole test was estimated from the Spearman – Brown Prophecy Formula. The coefficient of co-relation for the whole scale was found to be 0.67.

3.4 PROCEDURE FOR DATA COLLECTION

The researcher sought permission from the schools selected for the conduct of the study. The researcher personally met the Principals of all the 8 schools – 2 from each board **SSC/CBSE/CISCE/CIE** explained the need for such a study to the Principals. The researcher ensured the Principal that the identity of the students will be kept confidential and the data collected will be used for research purpose only. The researcher received good support from the teachers, students and staff. The researcher got an opportunity to interact with different people like the Principals, Management personalities, teachers, supervisors and students of all the four different boards. This was indeed a great learning experience for the researcher. The Principals and the supervisors were extremely kind and very cooperative and gave their consent towards the conduct of the research procedure.

At this stage the researcher even collected the record of the students – their marks in the Terminal Examination to classify the students on the basis of Below Average, Average and Above Average. In order to get maximum support from the school, the researcher had to explain the need for such a study. The researcher then introduced herself to the teachers and explained them about the study and the MI/RBT Grid with the help of a small PowerPoint presentation. The same is presented in **Appendix 7**. The teachers then introduced the researcher to the class. The researcher found some of the students were highly enthusiastic and were cooperative. Some of the students were initially a bit shy but later on got along during the different activities and shared a good rapport with the researcher.

The researcher introduced each activity with utmost clarity for the students so that they do not have any confusion in performing the task assigned to them. The activities were circulated among each of the groups so that all the students had the opportunity to perform and experience all the activities. The researcher provided the students with the materials that were required for each activity. While conducting the experimental study a good rapport was built between the researcher and the students. The researcher at every stage of data collection maintained the confidentiality of the data.

The researcher first administered the Multiple Intelligence Test to the students of both the divisions. This program was conducted for five days in each school; each day was utilized for conducting the intervention of the unit. On the first day instructional intervention through the Traditional Approach on the unit Energy was conducted in division 'A' of Standard VI. The second day the same unit of Energy was conducted in division 'B' using the Multiple Intelligence Approach. The third day instructional intervention through the Multiple Intelligence approach on the unit Pollution was conducted in division 'A'. On the fourth day the same unit of Pollution was taught in division 'B' through the Traditional Approach. The researcher divided the class into 5 – 6 groups based on the class strength. The activities based on the MI/RBT Grid catering to the different Multiple Intelligences were given to students. The researcher had allotted 10 mins for each activity. The 8 activities and the informal discussions and evaluation that took place during the Instructional Intervention in each class was for 1 ½ hr. The researcher was in constant interaction with the students throughout the instructional intervention as a guide and a facilitator. After the conduct of each of the day-wise session, a post-test was conducted for a period of 2 hrs. The total duration of

the entire proceedings for each day was for 4hrs including the recess/ break given to the students. The researcher spent 5 days in each school. The total number of days in 8 schools for the conduct of the Instructional Intervention was 40 days, which began from June 2010 – August 2010. Likewise the researcher carried out the experiment in each of the schools as a part of the sample for the study.

3.5 TECHNIQUES OF DATA ANALYSIS:

The researcher collected the data in the form of post-test scores. The data from all the schools were compiled and was entered in the Excel sheet of Ms- Excel 2007. The data was entered school wise, gender wise, and on the basis of their achievement on the post- test and their marks in the Terminal examination. The data thus collected was subjected to Descriptive and Inferential analysis.

The data thus collected from the tools in the form of field notes and checklist added value to analyze the data descriptively through the research questions. It enhanced the quality of the research focusing on the inclusive teaching-learning scenario, fostering constructivist learning, thereby catering to different learning styles of the students and addressing the MI and achieving the educational objectives as given by RBT.

3.5.1 TECHNIQUES OF ANALYSIS OF DATA

3.5.1.1 Descriptive Analysis:

This included the following:

1) Measures of Central tendency, viz., Mean, Median and Mode.

2) Measures of Variability: Standard Deviation, Skewness, Kurtosis.

3) Measures of Probability: Fiduciary Limits of Mean and SD

4) Graphical representation of data, viz - bar diagrams.

3.5.1.2 Inferential Analysis:

1. To verify the hypotheses, Two Way ANOVA was used.

2. To estimate the magnitude of variance of the means of Traditional Approach and MI Approach to curriculum transaction on gender, type of schools, and levels of achievement in achieving objectives of Revised Bloom's Taxonomy of secondary school students, the researcher used $\omega^2_{est.}$

CHAPTER 4

CHAPTER 4

DESCRIPTIVE ANALYSIS OF DATA

4.1 INTRODUCTION:

Descriptive analysis of the data is presented in this chapter. The measures of central tendency-mean, median and mode, and measures of variability-standard deviation, measures of divergence from normality-skewness and kurtosis-have been calculated to ascertain the normality of the distribution of the scores. Fiduciary limits of mean and standard deviation have been calculated to estimate the population parameters at 0.95 level and 0.99 level of confidence.

Percent mean has been calculated to compare the performance of the participants in the TA and MIA on the basis of gender, levels of achievement and type of schools. The researcher has then presented the descriptive analysis of the data collected in order to answer the research questions raised in pursuit of the objectives of the study. For the sake of convenience, the objectives and research questions are restated below:

Objectives of the Study:

1. To study the extent of effectiveness of MIA to curriculum transaction in realizing the educational objectives among secondary school participants as given by Revised Bloom's Taxonomy.

2. To study the extent of effectiveness of MIA to curriculum transaction at secondary school participants in transforming the learning environment into a constructivist learning environment.

3. To study the extent of effectiveness of MIA to curriculum transaction at secondary school participants in promoting inclusive learning environment.

4. To study the extent of effectiveness of MIA to curriculum transaction at secondary school participants in catering to Multiple Learning styles of participants as given by Prof. H. Gardner.

Research Questions raised in pursuit of the achievement of objectives:

1. To what extent is the MIA to transaction of the curriculum at secondary school level effective in realizing the educational objectives as given by Revised Bloom's Taxonomy?

2. To what extent is the MIA to transaction of the curriculum at secondary school level effective in transforming the learning environment into a constructivist learning environment?

3. To what extent is the MIA to transaction of the curriculum at secondary school level effective in promoting inclusive environment?

4. To what extent is the MIA to transaction of the curriculum at secondary school level effective in catering to different learning styles of participants as given by Prof. H.Gardner?

To facilitate parsimony, the following abbreviations are used in this chapter:

TA Scores (TAS)

MIA Scores (MIAS)

4.2 Descriptive Analysis of TAS and MIAS of the Total Sample

4.2.1 Descriptive Statistics of TAS and MIAS of the Total Sample

Table 4.1 shows Descriptive Statistics of TAS and MIAS of the Total Sample.

Table 4.1
Descriptive Statistics of TAS and MIAS of the Total Sample

	TAS						MIAS					
N	Mean	Median	Mode	SD	Skew	Kurt	Mean	Median	Mode	SD	Skew	Kurt
736	20.59	21	21	7.90	-0.16	-0.62	30.47	29	29	6.89	0.34	0.04

From the table 4.1, it could be observed that the differences between the mean, median and mode of TAS and MIAS are marginal. The skewness and kurtosis also indicate that the TAS and MIAS are near normally distributed.

4.2.2 Fiduciary Limits of Mean and Standard Deviation of TAS and MIAS of the Total Sample

Table 4.2 shows standard error and fiduciary limits of the mean and standard deviation of TAS and MIAS of the Total Sample

Table 4.2
Fiduciary Limits of Mean and Standard Deviation of TAS and MIAS of the Total Sample

TAS   **MIAS**

Total Sample	Standard Error	Fiduciary Limits at 0.95 level	Fiduciary Limits at 0.99 level	Total Sample	Standard Error	Fiduciary Limits at 0.95 level	Fiduciary Limits at 0.99 level
N =736 M=20.59 SD=7.90	SEM= 0.29	20.03; 21.15	19.85;21.33	N =736 M=30.47	SEM= 0.25	29.98; 30.96	29.83;31.11
N =736 M=20.59 SD=6.89	SESD= 0.20	20.20; 20.98	20.08; 21.10	N =736 M=30.47	SESD= 0.17	30.14 ; 30.80	30.04 ;30.90

From the above table the probability is that

- 95 times out of 100 the population Mean of TAS of Total Sample will lie between 20.03 and 21.15 and the population SD will lie between 20.20 and 20.98, while 99 times out of 100 the population mean of TAS of Total Sample will lie between 19.85 and 21.33 and the population SD will lie between 20.08 and 21.10 respectively

- 95 times out of 100 the population Mean of MIAS of Total Sample will lie between 29.98 and 30.96 and the population SD will lie between 30.14 and 30.80, while 99 times out of 100 the population mean of MIAS of Total Sample will lie between 29.83 and 31.11 and the population SD will lie between 30.04 and 30.90 respectively.

4.2.3 Percent Mean of TAS and MIAS of the Total Sample

Table 4.3 shows Percent Mean of TAS and MIAS of the Total Sample

Table 4.3
Percent Mean of TAS and MIAS of the Total Sample

Percent Mean	TA	MIA
N = 736	40.32	59.67

Figure 4.1
Graphical representation of the Percent Mean of TAS and MIAS of the Total Sample
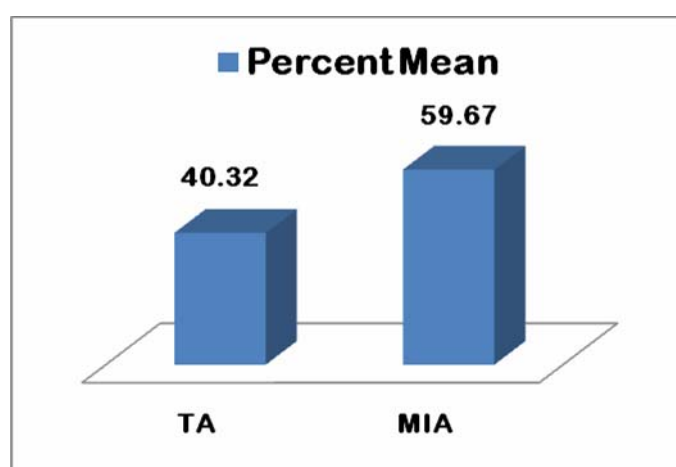
4.3 Descriptive Analysis of TAS and MIAS on the basis of Gender

4.3.1 Descriptive Statistics of TAS and MIAS on the basis of Gender

Table 4.4 shows Descriptive Statistics of TAS and MIAS on the basis of Gender.

Table 4.4
Descriptive Statistics of TAS and MIAS on the basis of Gender

	TAS						MIAS					
N	Mean	Median	Mode	SD	Skew	Kurt	Mean	Median	Mode	SD	Skew	Kurt
467 Boys	19.67	20	21	7.95	-0.14	-0.75	30.17	29.00	29.00	7.48	0.20	-0.58
269 Girls	21.31	23.00	23	7.55	-0.18	-0.42	30.21	29.00	28.00	7.70	0.18	-0.55

From the table 4.4, it could be observed that the differences between the mean, median and mode of TAS and MIAS are marginal. The skewness and kurtosis also indicate that the TAS and MIAS are near normally distributed.

4.3.2 Fiduciary Limits of Mean and Standard Deviation of TAS and MIAS on the basis of Gender

Table 4.5 shows standard error and fiduciary limits of the mean and standard deviation of TAS and MIAS on the basis of Gender

Table 4.5
Fiduciary Limits of Mean and Standard Deviation of TAS and MIAS
on the basis of Gender

TAS				MIAS			
Gender	Standard Error	Fiduciary Limits at 0.95 level	Fiduciary Limits at 0.99 level	Total Sample	Standard Error	Fiduciary Limits at 0.95 level	Fiduciary Limits at 0.99 level
N=467(Boys) M=19.67 SD=7.95	SEM= 0.36	18.96 ;20.38	18.75; 20.59	N=467(Boys) M=30.17	SEM= 0.46	29.27;31.07	28.99;31.35
N=269(Girls) M=21.31 SD=7.55	SEM= 0.46	18.77; 20.57	18.49;20.85	N=269(Girls) M=30.21	SEM= 0.46	29.30;31.12	29.03;31.39
N=467(Boys) M=19.67 SD=7.48	SESD= 0.26	19.16;20.18	19.00;20.34	N=467(Boys) M=30.17	SESD = 0.24	29.70;30.64	29.56;30.78
N=269(Girls) M=21.31 SD=7.70	SESD= 0.32	19.05;20.29	18.85;20.49	N=269(Girls) M=30.21	SESD= 0.33	29.56;30.86	29.36;31.06

From the above table the probability is that

Fiduciary Limits of Mean and SD of TAS and MIAS of Boys

- 95 times out of 100 the population Mean of TAS of Boys will lie between 18.96 and 20.38 and the population SD will lie between 19.16 and 20.18, while 99 times out of 100 the population mean of TAS of Boys will lie between 18.75 and 20.59 and the population SD will lie between 19.00 and 20.34.

- 95 times out of 100 the population Mean of MIAS of Boys will lie between 29.27 and 31.07 and the population SD will lie between 29.70 and 30.64, while 99 times out of 100 the population mean of MIAS of Boys will lie between 28.99 and 31.35 and the population SD will lie between 29.56 and 30.78.

Fiduciary Limits of Mean and SD of TAS and MIAS of Girls

- 95 times out of 100 the population Mean of TAS of Girls will lie between 29.30 and 31.12 and the population SD will lie between 29.56 and 30.86, while 99 times out of 100 the population mean of TAS of Girls will lie between 29.03 and 31.39 and the population SD will lie between 29.36 and 31.06.

- 95 times out of 100 the population Mean of MIAS of Girls will lie between 29.30 and 31.12 and the population SD will lie between 29.56 and 30.86, while 99 times out of 100 the population mean of MIAS of Girls will lie between 29.03 and 31.39 and the population SD will lie between 29.36 and 31.06.

4.3.3 Percent Mean of TAS and MIAS on the basis of Gender

Table 4.6 shows Percent Mean of TAS and MIAS on the basis of Gender

Table 4.6
Percent Mean of TAS and MIAS on the basis of Gender

Percent Mean	N	TA	MIA
Boys	467	39.46	60.53
Girls	269	42.32	57.67

Figure 4.2

Graphical Representation of the Percent Mean of TAS and MIAS

on the basis of Gender

4.4 Descriptive Analysis of TAS and MIAS on the basis of Levels of Achievement

4.4.1 Fiduciary Limits of Mean and Standard Deviation of TAS and MIAS on the basis of Levels of Achievement

Table 4.7 shows standard error and fiduciary limits of the mean and standard deviation of TAS and MIAS on the basis of Levels of Achievement

Table 4.7
Fiduciary Limits of Mean and Standard Deviation of TAS and MIAS
on the basis of Levels of Achievement

	TA			MIA		
LOA	Standard Error	Fiduciary Limits at 0.95 level	Fiduciary Limits at 0.99 level	Standard Error	Fiduciary Limits at 0.95 level	Fiduciary Limits at 0.99 level
N =171 (BA) M=10.90 SD=1.51	SEM= 0.11	10.69; 11.11	10.62; 11.18	N =88 (BA) M=18.42 SD=0.80	SEM= 0.08	18.27 ; 18.57	18.22; 18.62
	SESD= 0.08	10.75 ; 11.05	10.70; 11.10		SESD= 0.06	18.31 ; 18.53	18.27 ; 18.57
N =419 (A) M=21.41 SD=1.27	SEM= 0.06	21.30 ; 21.52	21.34 ; 21.48	N =324 (A) M=26.51 SD=1.10	SEM= 0.06	26.40 ; 26.62	26.36 ; 26.66
	SESD= 0.04	21.26 ; 21.56	21.31; 21.51		SESD= 0.04	26.44 ; 26.58	26.41 ; 26.61
N =146 (AA) M=32.25 SD=1.49	SEM= 0.06	32.02 ; 32.48	31.95 ; 32.55	N =324 (AA) M=35.91 SD=5.73	SEM= 0.31	35.30; 36.52	35.12 ; 36.70
	SESD= 0.08	32.19 ; 32.40	32.05 ; 32.45		SESD= 0.22	35.48 ; 36.34	35.35 ; 36.47

From the above table the probability is that

Fiduciary Limits of Mean and SD of Below Average Students:

- 95 times out of 100 the population Mean of TAS of BA will lie between 10.69 and 11.11 and the population SD will lie between 10.75 and 11.05, while 99 times out of 100 the population mean of TAS of BA will lie between 10.62 and 11.18 and the population SD will lie between 10.70 and 11.10.

- 95 times out of 100 the population mean of MIAS of BA will lie between 18.27 and 18.57 and the population SD will lie between 18.31 and 18.53, while 99 times out of 100 the population mean of MIAS of BA will lie between 18.22 and 18.62 and the population SD will lie between 18.27 and 18.57.

Fiduciary Limits of Mean and SD of Average Students:

- 95 times out of 100 the population Mean of TAS of A will lie between 21.30 and 21.52 and the population SD will lie between 21.34 and 21.48, while 99 times out of 100 the population mean of TAS of A will lie between 21.26 and 21.56 and the population SD will lie between 21.31 and 21.51.

- 95 times out of 100 the population Mean of MIAS of A will lie between 26.40 and 26.62 and the population SD will lie between 26.44 and 26.58, while 99 times out of 100 the population mean of MIAS of A will lie between 26.36 and 26.66 and the population SD will lie between 26.41 and 26.61.

Fiduciary Limits of Mean and SD of Above Average Students:

- 95 times out of 100, the population mean of TAS of AA will lie between 32.02 and 32.48 and the population SD will lie between 32.19 and 32.40, while 99 times out of 100 the population mean of TAS of AA will lie between 31.95 and 32.55 and the population SD will lie between 32.05 and 32.45.

- 95 times out of 100 the population Mean of MIAS of AA will lie between 35.30 to 36.52 and the population SD will lie between 35.48 and 36.34, while 99 times out of 100 the population mean of MIAS of AA will lie between 35.12 and 36.70 and the population SD will lie between 35.35 and 36.47.
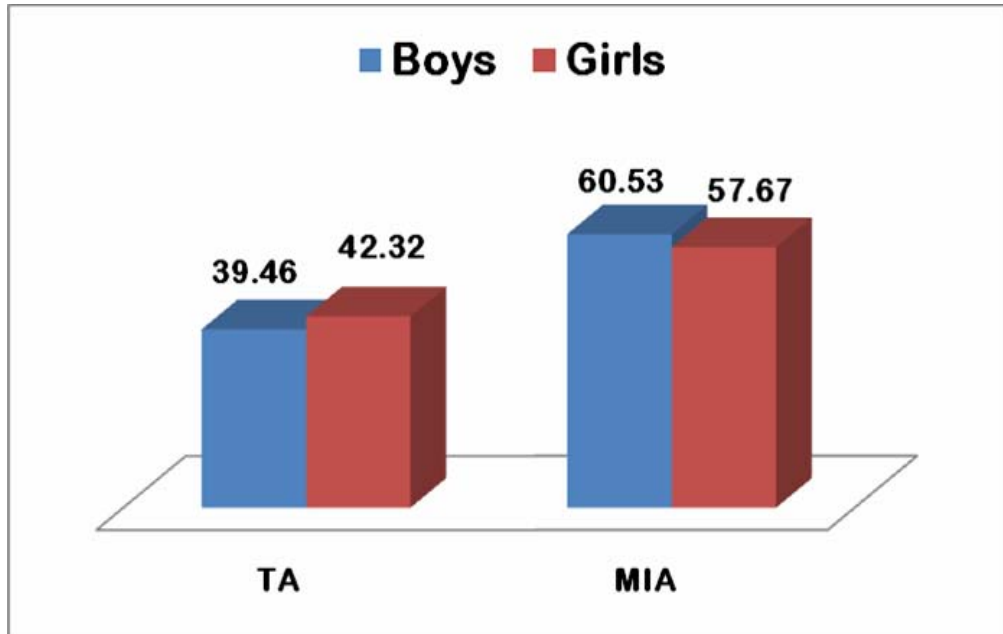
4.4.2 Percent Mean of TAS and MIAS on the basis of Levels of Achievement

Table 4.8 shows Percent Mean of TAS and MIAS on the basis of Levels of Achievement

Table 4.8
Percent Mean of TAS and MIAS on the basis of Levels of Achievement

Levels of Achievement	N	TA	N	MIA
Below Average	171	47.64	88	52.35
Average	419	49.45	324	50.54
Above Average	146	68.81	324	71.18

4.5 Descriptive Analysis of TAS and MIAS on the basis of Types of Schools

4.5.1 Descriptive Statistics of TAS and MIAS on the basis of Types of Schools

Table 4.9 shows Descriptive Statistics of TAS and MIAS on the basis of Type of Schools.

Table 4.9
Descriptive Statistics of TAS and MIAS on the basis of Type of Schools

	TAS						MIAS					
N	Mean	Median	Mode	SD	Skew	Kurt	Mean	Median	Mode	SD	Skew	Kurt
SSC (244)	20.62	21	21	8.6	-0.24	-0.8	30.62	29	29	8.38	0.3	-0.79
CISCE (164)	20.13	21	21	7.29	-0.12	-0.56	31.89	30	29	7.98	-0.31	-1.09
CBSE (164)	20.25	21	20	6.86	0.03	-0.31	31.15	29	29	7.8	-0.04	-1.04
CIE (164)	20.48	21	20	6.9	0.1	-0.38	32.02	30	29	7.33	-0.01	-0.87

4.5.2 Fiduciary Limits of Mean and Standard Deviation of TAS and MIAS on the basis of Types of Schools

Table 4.10 shows standard error and fiduciary limits of the mean and standard deviation of TAS and MIAS on the basis of Type of Schools.

Table 4.10
Fiduciary Limits of Mean and Standard Deviation of TAS and MIAS on the basis of Types of Schools

TAS				MIAS			
Type of School	Standard Error	Fiduciary Limits at 0.95 level	Fiduciary Limits at 0.99 level	Type of School	Standard Error	Fiduciary Limits at 0.99 level	Fiduciary Limits at 0.99 level
SSC N =244 M=20.62 SD=8.60	SEM= 0.55	19.53;21.70	19.19;20.04	**SSC** N =244 M=20.62 SD=8.38	SEM= 0.55	29.59;31.65	29.26;31.98
	SESD= 0.38	19.85; 21.38	19.10 ;21.62		SESD= 0.39	29.88; 31.36	28.72; 32.52
CISCE N =164 M=20.13 SD=7.29	SEM= 0.56	19.04 ;21.22	18.64 ;21.57	**CISCE** N =164 M=20.13 SD= 7.98	SEM= 0.56	30.90; 32.88	30.58; 33.20
	SESD= 0.40	19.35 ;20.91	19.30 ;21.20		SESD= 0.40	31.19; 32.59	30.97; 32.81
CBSE N =164 M=20.25 SD=6.86	SEM= 0.60	19.22 ; 21.28	18.89 ; 21.61	**CBSE** N =164 M=20.25 SD= 7.8	SEM= 0.53	30.17; 32.13	31.23; 32.09
	SESD= 0.43	19.53 ; 20.97	19.30 ; 21.20		SESD= 0.37	30.45; 31.85	30.23; 32.07
CIE N =164 M=20.48 SD=6.90	SEM= 0.57	19.45 ; 21.51	19.12 ; 21.84	**CIE** N =164 M=20.48 SD=7.33	SEM= 0.53	31.12; 32.92	30.04; 33.20
	SESD= 0.40	19.74 ; 21.22	19.50 ; 21.46		SESD= 0.38	31.38; 32.66	31.17; 32.87

From the above table the probability is that

Fiduciary Limits of Mean and SD of TIA and MIA of SSC School Students

- 95 times out of 100 the population mean of TAS of SSC school students will lie between 19.53 and 21.70 and the population SD will lie between 19.85 and 21.38, while 99 times out of 100 the population mean of TAS of SSC school students will lie between 19.19 and 20.04 and the population SD will lie between 19.10 and 21.62;
- 95 times out of 100 the population mean of MIAS of SSC school students will lie between 29.59 and 31.65 and the population SD will lie between 29.88 and

31.36, while 99 times out of 100 the population mean of MIAS of SSC school students will lie between 29.26 and 31.98 and the population SD will lie between 28.72 and 32.52 respectively.

Fiduciary Limits of Mean and SD of TIA and MIA of CISCE School Students

- 95 times out of 100 the population mean of TAS of CISCE school students will lie between 19.04 and 21.22 and the population SD will lie between 19.35 and 20.91, while 99 times out of 100 the population mean of TAS of CISCE school students will lie between 18.64 and 21.57 and the population SD will lie between 19.30 and 21.20.

- 95 times out of 100 the population mean of MIAS of CISCE school students will lie between 30.90 and 32.88 and the population SD will lie between 31.19 to 32.59, while 99 times out of 100 the population mean of MIAS of CISCE school students will lie between 30.58 and 33.20 and the population SD will lie between 30.97 and 32.81 respectively

Fiduciary Limits of Mean and SD of TIA and MIA of CBSE School Students

- 95 times out of 100 the population mean of TAS of CBSE school students will lie between 19.22 to 21.28 and the population SD will lie between 19.53 to 20.97, while 99 times out of 100 the population mean of TAS of CBSE school students will lie between 18.89 to 21.61 and the population SD will lie between 19.30 to 21.20

- 95 times out of 100 the population Mean of MIAS of CBSE school students will lie between 30.17 to 32.13 and the population SD will lie between 30.45 and 31. 85, while 99 times out of 100 the population mean of MIAS of CBSE school students will lie between 31.23 to 32.09 and the population SD will lie between 30.23 and 32.07.

Fiduciary Limits of Mean and SD of TIA and MIA of CIE School Students

- 95 times out of 100 the population mean of TAS of CIE school students will lie between 19.45 to 21.51 and the population SD will lie between 19.74 to 21.22, while 99 times out of 100 the population mean of TAS of CIE school students of will lie between 19.12 to 21.84 and the population SD will lie between 19.50 to 21.46 respectively.

- 95 times out of 100 the population mean of MIAS of CIE school students will lie between 31.12 and 32.92 and the population SD will lie between 31.38 to 32.66, while 99 times out of 100 the population mean of MIAS of CIE school students will lie between 30.04 and 33.20 and the population SD will lie between 31.17 and 32.87.
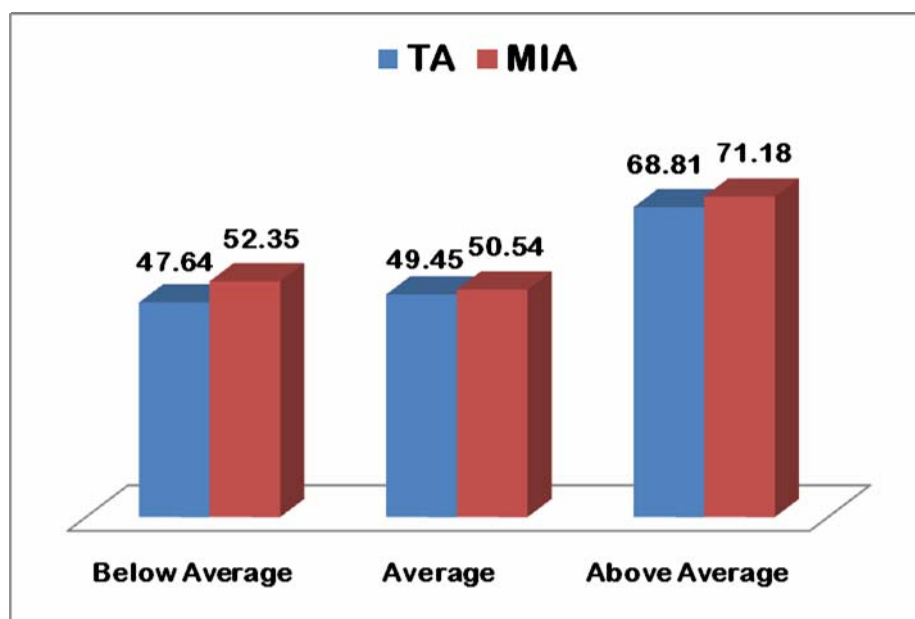
4.5.3 Percent Mean of TAS and MIAS on the basis of Types of School

Table 4.11 shows Percent Mean of TAS and MIAS on the basis of Types of School

Table 4.11
Percent Mean of TAS and MIAS on the basis of Type of Schools

Types of Schools	N	TA	MIA
SSC	244	40.93	59.06
CISCE	164	40.32	59.67
CBSE	164	39.93	60.06
CIE	164	37.75	60.24

Figure 4.4 shows the Graphical Representation of the Percent Mean of TAS and MIAS on the basis of Types of Schools
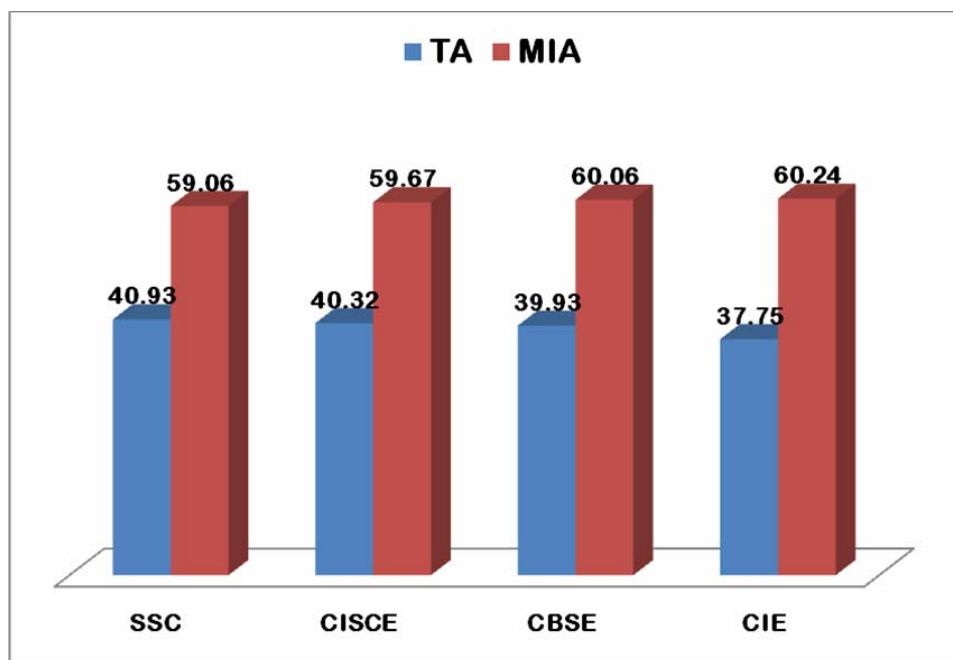
4.6 ANSWERING THE RESEARCH QUESTIONS

For the sake of convenience, the Research questions are restated below:

RQ 1. To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in realizing the educational objectives as given by Revised Bloom's Taxonomy?

RQ 2. To what extent is the MIA to transaction of the curriculum at secondary school level effective in transforming the learning environment into a constructivist learning environment?

RQ 3. To what extent is the MIA to transaction of the curriculum at secondary school level effective in promoting inclusive environment?

RQ. 4. To what extent is the MIA to transaction of the curriculum at secondary school level effective in catering to different learning styles of participants as given by Prof. H.Gardner?

4.6.1 Answering RQ 1: To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in realizing the educational objectives as given by Revised Bloom's Taxonomy?

MIA to curriculum transaction has been a radical shift from the teacher centered approach to learner centered approach that caters to the individual differences and achievement of the educational objectives. This approach is meant for facilitating learning thus aiming at mastery learning. A MI/RBT grid was made in which the activities designed under Multiple Intelligence vis a vis Revised Bloom's Taxonomy Objectives. For example, the grid incorporates stories for linguistic intelligence at the Remembering level that helps the participants to conduct a survey at the applying level of Interpersonal intelligence or develop a program at Bodily/ Kinesthetic Intelligence at the Evaluation level or create a booklet cover at the Creating level of Visual/ Spatial Intelligence. For the sake of convenience, the grid is reproduced below:

Grid Showing the Activities Based on Multiple Intelligences vis-a-vis the Objectives of Revised Bloom's Taxonomy on the Topic Energy

RBTOBJECTIVES→ MI ↓	Remember	Understand	Apply	Analyze	Evaluate	Create
Verbal/ Linguistic	Read a story. Use pictures to enhance storytelling.	Comment and write about one of the character in the story.	List the energy resources used everyday, during vacations and different seasons.	Compare and contrast the story and the list and report it.	Participants suggests a plan to save energy at home and to avoid power-cuts.	Participants create a slogan on energy conservation.
Logical/ Mathematical	Teacher shows a graph to identify energy consumption	Teacher asks to interpret the graph.	Participants discuss on various factors contributing to it and present it creatively	Teacher asks participants to list the number of appliances at home.	Participants differentiate into necessary and luxury items and give reasons for the same	Participants prepare a graph on the increasing number of appliances of a group.
Visual/ Spatial	Identify the energy sources used in the picture	List the advantages and limitations of the various stages of human history	Participants record the electric inventory of all electrical home appliances.	Express your feelings of the appliance in ascending order of importance.	Participants critique/ defend the use of few electrical appliances	Create a collage of words and pictures on theme "Energy Conservation"
Bodily/ Kinesthetic	Identify Renewable and Non- Renewable energy resources	Role play with friends on Renewable/ Non Renewabl energy resources.	Prepare a chart Renewable and Non-Renewable energy resources highlighting the features	Interview a friend on Renewable and Non-Renewable energy resources	Collect advertisements from newspapers and magazine on energy conservation and explain them.	Design an advertisement that depicts Energy conservation.
Musical	Ask the participants to close their eyes and identify the sounds	Write a 1 verse rap describing the sounds heard.	Participants demonstrate the various sounds and discusses about them	Choose a sound to depict words associated with energy.	Make a jingle / tongue twister to highlight energy conservation	Write a poem on Energy Conservation.
Interpersonal	Identify the energy consumption of different electrical appliances from a pamphlet.	Participants work in groups/ pairs and discuss about their energy usage	Participants prepare a Detective Sheet and record the views of other groups in defining energy	Participants are given clues to focus on the definition	Participants interpret the clues/ answers and make their own definition and present it.	Create rules to control energy consumption and avoid wastage.
Intrapersonal	Reflect on energy used by you in your daily life.	Describe the quality you have that would help you in energy crisis.	Make a poster of items needed as an emergency kit to use when energy sources are missing.	Rearrange your house to enable energy conservation and give reasons for the same.	Debate on the various rearrangements with others.	Create a dream house plan for all possible things you want/ not want in the house.
Naturalist	Teacher introduces with a short story and asks participants to make simple choices in life	Interpret the choices made based on lifestyle	List 5 eco-friendly products.	Analyze safe and dangerous aspects of 2 energy resources.	Develop an eco-friendly plan for your house.	Design an eco-friendly book cover on theme "environment"

Grid Showing the Activities Based on Multiple Intelligences vis-a-vis the Objectives of Revised Bloom's Taxonomy on the Topic Pollution

RBT OBJECTIVES→ MI ↓	Remember	Understand	Apply	Analyze	Evaluate	Create
Verbal/ Linguistic	Read a story on Pollution using pictures.	Write a description on any one of the pollution.	Create a glossary of words associated with pollution.	Scan the newspaper about different pollution articles and pictures.	Write a response to any one of the news article.	Create a slogan on Pollution Awareness
Logical/ Mathematical	Identify the pollution levels based on the graph.	Predict the effects of Pollution levels	Make a mind map about pollution, causes and effects.	Conduct a survey in your society about pollution	Interpret your results with judgments	Prepare a graphical representation and analysis of the survey and display on the notice board.
Visual/ Spatial	Make an artwork of Pollution	Interpret the artwork and discuss its highlights.	Find pictures and photos on pollution and present it creatively with captions.	Select any one pollution and prepare an outline about it.	Plan suggestive measures to reduce pollution.	Make a booklet highlighting Pollution causes and effects.
Bodily/ Kinesthetic	Identify the pollution based on the pictures.	Role play on pollution and its effects.	Use sign and symbols language to depict pollution and words associated to it.	Analyze and categorize different pollution, effects and causes.	Develop a program to reduce pollution in school.	Design a cover page for your school annual magazine on the theme "Pollution"
Musical	Identify the different sounds.	Write a 1 verse rap describing the sounds heard.	Participants demonstrate other sounds in their daily life and discusses about them	Write a poem on Pollution.	Debate on the effect of sound on human life.	Participants create a simple alternate noise friendly appliance.
Interpersonal	As a media reporter, interview few teachers on pollution issues	With the friends prepare a news article/ broadcast story on it.	Develop a set of 5 criteria to pollution and its cause and effect. Survey participants.	Analyze the problem based on different perspectives of participants responses	Collect advertisements from newspapers and magazine on pollution and explain them.	Present an Advertisement to create Pollution awareness.
Intrapersonal	Participants recall the pollution caused by them daily.	Describe the cause and effect of these pollution pictorial / verbal.	Participants are given the freedom to re-arrange their house setup based on their likes.	Analyze and give reasons for the desired preferences.	Debate on the various rearrangements with others and evaluate it from a practical view point.	Create a dream house plan for all possible things you want/ do not want in the house.
Naturalist	Imagine the place you stay and identify the pollution	Give examples of health hazards in your locality	Record two different locality and their impact on environment	Distinguish between village and city life.	Design a pollution free environment plan for your locality	Imagine yourself in a forest and describe one day spend with respect to eating, playing etc.

Since the research was conducted across the four Boards of Secondary schools, it was kept in mind to design activities catering to all the participants with different learning situations and scenario. Every activity engaged the children to perform tasks, explore the situation and learn from their own experiences and also from their peers. This enabled the researcher to get immediate feedback as and when the participants were doing the activities in the form of collages, presentations, notice board displays, poster presentations etc. Since all the participants had to participate in all the activities turn by turn, it could be observed that each group working on particular task could do it satisfactorily by their collective effort.

A criterion referenced post-test was conducted at the end of the TA and MIA of curriculum transaction to determine the achievement level of participants based on the activities and classroom transactions. The post-test scores were converted to Percent Mean scores. The conclusions are drawn as follows:

Table 4.12

Percent Mean Scores of the MIAS based on the Type of Schools

Schools→ Objectives of RBT ↓	Total Sample (N736)		SSC Schools (N= 244)		CISCE Schools (N= 164)		CBSE Schools (N= 164)		CIE Schools (N= 164)	
	MIA	TA	MIA	TA	MIA	TA	MIA	TA	MIA	TA
Creating	82.06**	53.80	84.83**	56.09	84.75**	64.87	79.26*	61.29	78.04*	64.09
Evaluating	72.8*	45.78	68.03*	43.85	79.26*	54.26	73.1*	58.61	73.1*	40.24
Analyzing	71.73*	46.05	68.85*	49.04	73.78*	58.46	73.17*	54.76	72.56*	43.29
Applying	74.5*	52.3	72.5*	46.3	78.04*	56.09	75*	55.48	73.78*	54.2
Understanding	86.6**	59.5	84.8**	56.1	85.3**	63.4	87.1**	62.65	90.24**	66.46
Remembering	87.5**	76.5	84.01**	76.6	89.6**	66.4	89.6**	64.8	88.4**	67.6
Average	79.19*	55.63	77.17**	55.39	81.78**	60.58	79.53*	59.59	79.35*	55.98

*** Very High; *Substantial*

From the Table 4.12, it could be observed that the MIA to curriculum transaction was found to be effective at all levels of the educational objectives given by Revised Bloom's Taxonomy as compared to the TA; the average overall performance of the MIA to curriculum transaction as compared to TA was 23.56% and there is a drastic improvement in the percent mean scores of the participants across the schools and at all levels of RBT, especially in remembering, followed by understanding, creating, analyzing and applying. The average overall performance of the schools shows that CIE school participants have benefitted the most (23.37%) as compared to TA followed by SSC school participants (21.78%); CISCE (21.20%) and the CBSE (19.94%).

This implies that the MIA of curriculum transaction had an overall positive impact on the learning. The activities enabled the participants to achieve the educational objectives RBT much better as compared to TA. The higher level educational objective of Creating was also achieved at Very High Level and this was due to the activities that enabled the participants to express their perceptions and understanding better. The objectives of Applying, Analyzing and Evaluating were also realized to a substantial level in MIA as compared to TA. This may be due to the interactive sessions and the differentiated activities that were catered to all participants which enabled them to grasp the concepts better. The concepts were learnt so deeply and collaboratively interwoven with fun and a variety of activities. Project making and collaborative learning helped the learning process smoother. The participants were asked to interpret the graph, read and analyze the story, create slogans, conduct a self inventory, critique and defend the situation, prepare a poster, interviewing a friend, designing an advertisement, role play, debating on the pros- cons, making a mind map, pictorial representation, use of slogans and signs, prepare a booklet, comparing and contrasting a situation, analyzing and give reasons for a desired preference these prepared the participants to answer the criterion referenced post-test that catered to the different levels of objectives; Remembering, Understanding, Applying, Analyzing, Evaluating and Creating as per the RBT. Their achievement was highly reflected in their post test scores which helped the researcher to be assured that MIA must have been favorable for mastery learning of the participants and also facilitated achievement of higher level objectives of RBT.

Table 4.13

Percent Mean Scores of the MIAS based on Gender

Gender→ Objectives of RBT↓	Total		SSC		CISCE(CISCE)		CBSE		CIE(CIE)	
	Boys (n=467)	Girls (n=467)	Boys (n=144)	Girls (n=100)	Boys (n=105)	Girls (n=59)	Boys (n=107)	Girls (n=57)	Boys (n=110)	Girls (n=54)
Creating	**90.64****	79.69*	**90.5****	83.96**	**92.47****	83.09**	**90.69****	71.79*	**88.76****	78.6*
Evaluating	**86.94****	72.72*	**86.2****	76.4*	**87.09****	74.64*	**86.04****	65.38*	**88.76****	73.3*
Analyzing	**85.71****	69.6*	**83.3****	72.64*	**89.2****	69.01*	**84.88****	64.10*	**86.51****	72*
Applying	**86.20****	71.81*	**85.5****	74.52*	**94.10****	71.8*	**84.88****	62.82*	**87.64****	77.3*
Understanding	**80.78****	77.57*	**81.80****	77.35*	**76.34***	78.87*	**82.55****	66.66*	**82.02****	88**
Remembering	**90.64****	85.45**	**92.02****	85.84**	**92.47****	88.73**	**88.3****	84.61**	**88.76****	82.6**
Average	**86.81****	76.14*	**86.55****	78.45*	**88.61****	77.69*	**86.22****	69.22*	**87.07****	78.63*

** Very High; *Substantial

From the Table 4.13; it could be observed that the Boys have responded at a Very High level at all levels as compared to the Girls who have performed at a Substantial level. The Boys have showed very high improvement in Remembering, and Creating; Girls on the other hand have shown Substantial improvement. The girls of SSC and CISCE schools have performed at very high level at Creating. The average overall performance of the Boys as compared to Girls was 10.67%. The Boys have performed well, especially in remembering and creating, followed by evaluating, applying, analyzing and understanding. Whereas the Girls have performed well, especially in remembering and creating, followed by understanding, evaluating, applying and analyzing. The overall average performance of the Boys shows that CISCE school boy participants have performed at a Very high level followed by CIE school boy participants; SSC school boy participants and the CBSE school boy participants. The overall average performance of the Girls shows that CIE school girl participants have performed at a Substantial level followed by SSC school girl participants; CISCE school girl participants and the CBSE school girl participants.

This implies that the MIA to curriculum transaction indicated a higher level of achievement of objectives among boys as compared to girls. The participants performed the activities with zeal and enthusiasm. The boy participants and the girl participants had a very high performance level at the creating level. The overall average among the girl participants were less as compared to the boys because

generally girls from the Indian families are more reserved as compared to the boys who are more explorative and have relatively more exposure to the things around. Gurian, M. & Stevens, K. (2004) "With Boys and Girls in Mind," states that Boys' brains are better suited to symbols, abstractions, and pictures, physical movement consequently, boys generally learn higher and better than girls. The activities in the MIA had scope for designing that enabled the boys to employ their fine motor skills in the learning space provided to them, as compared to the girls wherein the grass motor skills had to be catered. Since the activities focused on kinesthetic and experiential learning boys took a lead in it and kept the verbal learning short . The girls focused more on verbal activity and reproducing the content matter. The boys were faster in gathering information and took a lot of initiative in all the activities, whereas the girls focused on assimilating the information gathered. The girls were quite reserved and were judicial in their responses as compared to the boys who had overflowing ideas to describe, critique, judge, explain, debate on the given situation.

Thus the researcher concludes that the MIA to curriculum transaction in the present study was effective in realizing the educational objectives as given by RBT as compared to the TA. The comprehensive approach of learning that included a series of activities catered to the multiple intelligences and different levels of thinking in a sequential manner from lower level to higher level. This also proves the effectiveness of activities based learning rather than mere verbal exposition.

4.6.2Answering RQ 2: To what extent is the MIA to transaction of the curriculum at secondary school level effective in transforming the learning environment into a constructivist learning environment?

Learning is dynamic and participants need to be actively involved in the learning process rather than being passive listeners. In a constructivist learning environment participants add their treasure of existing knowledge with the help of materials provided to them. This enables the children to learn more, be actively involved in their learning through well grounded activities that makes learning interactive, integrative and authentic. Constructivist learning environment emphasizes on participants who interpret and construct meaning based on their own experience and interactions. In this research the researcher has made an attempt to involve the participants in a variety of activities thus enabling a constructivist learning environment.

Initially when the researcher approached the participants to check their Multiple Intelligence, there were few participants who resisted to fill in the details and few others who showed their disinterest towards a changed teaching –learning scenario. The researcher made a sincere attempt in explaining the participants about the teaching process and the conduct of the lessons. The researcher initially took a MI inventory and later divided the class into groups of 5 -6 participants per group. The researcher had planned a series of activities that catered to various intelligences and different levels of understanding as per the Revised Blooms Taxonomy.

By catering to these intelligences the researcher created a favorable learning environment by providing multiple representations of the learning material giving emphasis on knowledge construction and not mere reproduction, fostering reflective thinking process leading to context and content dependent knowledge through collaborative and social experience. The following activities led to a constructivist learning environment. Table 4.14 shows the Constructivist Learning Environment Activities.

Table 4.14 Constructivist Learning Environment Activities

Multiple Intelligence	Learning Activities	Constructivist Learning Environment
Verbal Intelligence	Story Telling and describing the characters, comparing, preparing a glossary of words, scan the newspaper	Suggestion on energy conservation and creating a Slogan, responding to related newspaper article
Mathematical Intelligence	Interpreting a graph, discussing contributing factors, Mind Map	Survey and graphical representation
Visual/ Spatial	Noting down the feedback from participants on the basis of an Inventory, an artwork with pictures and words	Preparing a collage of words and pictures, booklet.
Bodily/ Kinesthetic	Role -play , interviewing and Preparing a chart, use of signs/ symbols	Designing an advertisement, cover page, develop a program
Intrapersonal	Reflecting, Describing and preparing a poster	Debating and Designing and creating an ideal situation
Interpersonal	Group Work, Discussion and recording, Interview	Interpreting and creating Rules, Advertisement
Musical	Identify a rap, demonstrate a sound	Create a jingle, rap or song
Naturalist	Listing and Interpreting, distinguish between 2 situations	Designing a book cover Developing a plan, Visualizing and expressing

The topic of Energy included the meaning and definition, sources and types of Energy and Pollution included the meaning and definition, types of pollution causes and effects of pollution. This was done by designing activities catering to various intelligences and thus creating a constructivist learning environment. The participants were formed into heterogeneous groups. Each participants possessed different attitudes, different intelligence, learning style, likes and dislikes.

The participants groups were rotated among the activities that focused on the various intelligences because of which all the participants got an opportunity to put into maximal use their prime intelligence and also could benefit from others' intelligences by engaging in collaborative activities. The details of the same are given below:

Interpersonal Intelligence aimed at co-operative learning wherein participants worked in groups, even an introvert participants was given an opportunity to express his opinion in a group. This encouraged group representation and group compatibility. Through the activities such as group work, discussion, interview and recording and analyzing the participants could express their feelings better thus enabling group compatibility, group cohesiveness, group dynamics. This broke down the shackles of shyness to a large extent among participants and also highlighted the stars and isolates during few of their interactive sessions. The researcher's monitoring encouraged all the participants to participate in these activities.

Intrapersonal Intelligence gained momentum with the discussions at the previous level, the activities and insight of the various processes made each participants to introspect deeply and form individual understanding of the content matter. The participants formed multiple perspectives through the activities Reflecting, describing, debating and designing posters, charts, and creating an ideal (changed) scenario that each participants visualized and reflected upon after pondering over the difficult moments and with an intention to face the new challenges with a different perspective, this ignited in them deeper thought process formative activities, in such a way that learning was internally controlled and mediated by the participants himself/herself.

Participants with high **Verbal Intelligence** were motivated and felt an urge to express the satisfaction of his learning, this was done through words. The participants expressed through the various activities that took shape in putting down their feelings and emotions based on the story, comparing the characters and resulting in better understanding. The participants also tried and prepared a glossary of words that they came across during the course of the unit taught, they scanned the newspaper articles for the relevant article and took deep interest in preparing a slogan. This sharpened their literary skills as well as helped them boost their confidence in expression. Though we say that teaching is purely verbal it rarely gives scope for participants expression in verbal form. It is mainly the lecture method and the notes given that take prominence in the verbal format. These activities geared towards participants involvement and expression made even those not so good at language share their experiences and listen to others' thoughts and feelings.

Mathematical Intelligence aimed at having logical viewpoint among the participants. The participants have always solved sums from the blackboard or have been attentive listeners in this regard but most of them would get practically stuck when the same is being given to them to be completed individually. The researcher aimed at harnessing their logical skills and this was done by interpreting a graph, discussing it at length, finding out the possible solutions for the various hurdles, creating a mind map of the association formed. This enabled the participants to get a deeper insight by conducting a survey and analyzing it graphically. This gave hands-on experience to the participants. Though the entire process was not so easy, the researcher explained the steps and took regular rounds and guided the participants who weren't so clear about what they were supposed to do.

Activities related to **Visual / Spatial Intelligence** focused on the visualizing and representations based on that. The researcher was very particular about this stage because the activities need to cater not only to the eyes but the mind as well, because the mind would respond to this through words and expressions. The researcher focused on activities such as recording the inventory, identifying the pictures leading to preparing a collage and booklet. The inventory made each participants think deeper and express their feelings on the same. The participants found these activities quite interesting and were received by all the groups wholeheartedly. The researcher had provided the required materials and the booklet and collage were put up on display too.

Musical Intelligence based learning activity was unique for the participants. This intelligence is generally sparingly used in classrooms settings. The participants heard the sounds and interpreted / analyzed them; this itself was a different experience for them. The participants emphasized on sounds and noises and understood the importance as well as the deteriorating scenario that was caused due to the lack of sensitivity towards the sounds. Few participants who were keen in music came up to the researcher and expressed their excitement towards these activities. The participants formed a rap and jingle which emphasized the importance of a noise free environment.

Naturalist Intelligence has gained momentum in the last few years. The researcher had to focus on this intelligence due to natural hazards that are happening around us. To sensitize the participants to the nature around them and importance of natural

resources in our lives was an important task on hand for the researcher. The researcher used a story and made participants to make simple choices in their life which made the participants realize the importance of natural resources in their life. The participants designed an eco friendly book cover and house plan. The participants found these activities very close to their heart because it not only gave them an understanding of the present but also gave them a deeper thought of the future and made them think their acts responsible for their future. The researcher felt catering to this intelligence was not only within the limits of the classroom boundary but extended further towards the society and world at large.

The **Bodily / Kinesthetic Intelligence** involves participants with fine and grass motor skills and proper physical co-ordination thus enabling participants to learn and express themselves better through physical activities. The participants need to be involved in physical activities which are vital in a constructivist learning environment. In a traditional set up, the participants are glued to their seats, whereas catering to bodily/kinesthetic intelligence through role play, interview, sign and symbols helped participants to design an advertisement, develop a program and design a cover page. The researcher faced a few constraints in carrying out these activities due to lack of space and highly structured set up. However, the participants and school staff helped the researcher to a large extent to conduct the activities smoothly.

The activities were well knitted in such a way that the participants were learning something new or understanding a concept in greater depths. Each learning experience gave the opportunity to the participants to build strong foundation of their understanding through the 7E's: Engage, Explore, Explain, Elaborate, Exchange, Evaluate and Excite.

Fig 4.5 shows the 7 E's of Learning.
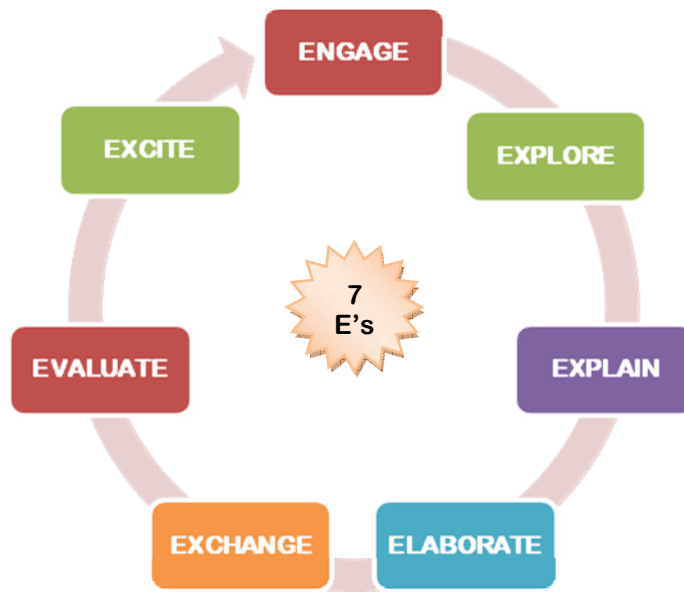
The participants were ***engaged*** throughout with activities such as story telling, showing pictures and asking questions, interpreting a graph, responding to newspaper article which made the participants focus on the topic and stimulate their involvement in the learning process.

In the ***exploratory*** phase the participants discussed, compared, reflected, debated on the views of other participants, forming a base of the common experiences, arriving at probable conclusions based on the graph, probing for the reasons towards the positive and negative aspect of the situation.

In the ***explanation*** phase the participants were asked to amalgamate the various ideas, thoughts into words or graphics. The participants were given an opportunity to present role play, prepare a collage / poster / notice board display/ slogans/ book cover/ advertisement/ graphical presentation which was shared among the peers, to the facilitator and kept for display. The participants experienced progress and development and sense of achievement.

Knowledge cannot be bound with chains it needs to be explored and ***expanded.*** The participants were asked to discuss with their peers, interview them and know their views and ideas. This was noted down and was put across for discussions which enabled the participants to get a clear idea of the situation; they debated on certain issues, reflected on the same and came with suggestions to create an ideal situation.

The participants also *exchanged* their views with the peers and with the researcher. They shared their information on the topic with others and even pooled in the ideas of others to arrive at a consensus decision or a viewpoint.

The participants *evaluated* these activities through interpretation, creating rules, suggestions, designing an ideal situation, graphs, slogans etc. The researcher evaluated them with their responses, enthusiasm to perform the activities, initiation, willingness, and finally completing all the activities. All the participants took part in all the activities that was given to them. The post-test scores also indicated the same.

All throughout the activities the researcher maintained interest and *excitement* among the participants. The activities were planned in such a way that it catered to all the participants with different dominant intelligences and also catered to the levels of educational objectives as given by RBT which was from remembering, understanding, applying, analysing, evaluating and creating. The participants were asked to prepare posters, compose a jingle or a rap, create an advertisement, prepare a collage, booklet, glossary of words etc which kept them involved in the learning process.

Thus the MI approach to curriculum transaction made an attempt to make learning interactive through a continuous exchange of views and opinions between the teacher and students this helped them construct their own knowledge. Active participation from the students was the highlight of this approach with ample scope for self reflection and group reflections though collaborative, inquiry based activities.

4.6.3 Answering RQ 3: To what extent is the MIA to transaction of the curriculum at secondary school level effective in promoting inclusive environment?

The teaching learning process is an inherently social process and the teachers need to be careful of the social and emotional dynamics that plays a vital role in the classroom. The researcher effectively catered to an inclusive learning environment through the MI approach of curriculum transaction. The activities were designed in such a way that no child was left behind. These activities were rotated to each group on a continuous basis thereby involving all the participants. in The activities created construction of knowledge which enriched discussions and enabled participants to actively participate in their learning process. By creating an inclusive learning environment participants could learn in groups with other participants different from

them in ways that facilitated the development of skills such as leadership, communication, and conflict resolution. The classroom exhibited learning experiences of discovery, joy, satisfaction and pride at one's accomplishments. These positive emotions motivated the participants to perform better for further learning. The researcher created a free classroom environment where the participants capitalized on their personal experience by engaging themselves in creative ways with resources and instructions provided. The researcher, through effective classroom organization, comprehensive activity programmes and climate of innovation, created a conducive learning environment giving opportunities for participants to interact, innovate during the learning process. This enabled the participants to progress gradually and avail of a stress free environment which gave space to each and every participants to perform based on his/ her ability. The activities were arranged as per participants' level and continuous monitoring was done to check if the participants lagged at any time during the learning process. The exposure to variety of activities encouraged the participants to quicker and deeper understanding of the concept. The activities catered to different senses and levels of understanding and led to group work wherein each and every child had to participate in the learning process. The use of pictures, music, stories, role-play, etc. made the participants relate the topic to their daily lives and participate actively in discussions, debates, critiquing, creating slogans and collage making.

MIA encompassed group activities and individualized activities that catered to the Multiple Intelligences thus creating an inclusive learning environment. The group activities included interviewing, recording the responses, preparing a glossary of words, artwork, booklet preparation, role play, preparing a news broadcast, develop a feasible program, survey, interpreting and graphically presenting, designing an advertisement, eco-friendly book cover, creating a jingle, poem. These group activities helped the participants to work in a group, ensure group compatibility, help the isolates to perform better, peer tutoring, showcase each one's talents and help to increase productivity, balance between the strengths and weakness of the group members, use the resources effectively, managing group conflicts, arrive at group consensus, hone individual strengths for group success. The activities catered to the Multiple Intelligences wherein the participants with dominant intelligences and weaker intelligences were all a part of a single group thus promoting inclusion. Hidden talents were exhibited that gave rise to self confidence and motivation to

perform better. The researcher took keen interest in the work produced by each and every participant's as one to one interaction was possible. The close interaction with participants helped few of them who generally remained aloof to come out of their shells and enthusiastically participated in all the activities.

4.6.4 Answering RQ4: To what extent is the MIA to transaction of the curriculum at secondary school level effective in catering to different learning styles of participants as given by Prof. H.Gardner?

The researcher conducted a Multiple Intelligence Inventory in the class before progressing ahead with the MIA to curriculum transactions. The MI test gave an indication to the researcher the dominant intelligence among the participants of each class. This became easy for the researcher to divide the class into heterogeneous groups of 5-6 participants in each group.

The dominant intelligence for the entire sample of 736 participants is given below

Table 4.13

Dominant Intelligences among the Participants.

Intelligences	Verbal	Mathematical	Visual	Kinesthetic	Interpersonal	Intrapersonal	Musical	Naturalist
N	186	133	95	104	89	73	21	35

Fig 4.6 shows a graphical representation of the dominant intelligences of the participants.

Figure 4.6 Dominant Multiple Intelligences
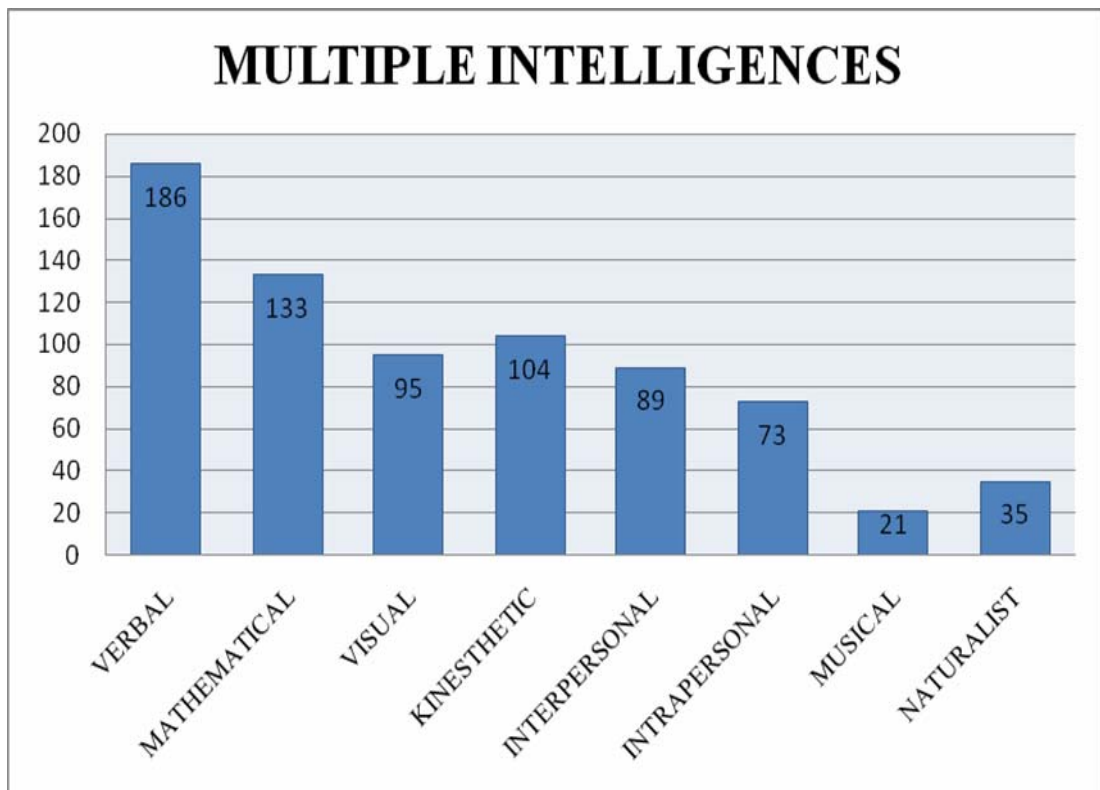
Gardener identified seven distinct learning styles. Visual/Spatial, Verbal/Linguistic Logical/Mathematical, Bodily/Kinesthetic, Musical/Rhythmical, Interpersonal, which corroborate with the multiple intelligences propounded by him (except naturalistic). Since the activities grid was prepared to cater to the MI as given by Gardner, it also catered to the learning needs of participants with diverse learning styles as given by Gardner. The following activities ensured that the module catered to all the learning styles;

Verbal Activities: Participants had to introduce the topic with a story,- Pollution and Energy and write their understanding of the same and later prepare a glossary of words that they came across during the teaching-learning process, compare the different characters in the story. The participants were to find out articles relating to the unit taught from the newspaper, respond to the article, suggest plans and finally create a slogan for the same.

Mathematical Activities: These included interpreting a graph, discussing and predicting the effects, preparing a mind map, conducting a survey, interpreting the results and graphical representing the same.

Visual Activities: The participants' activities included identifying the pictures, preparing an artwork, describing about the same, conducting an inventory, presenting pictures and captions creatively, planning suggestive measures, defending and critiquing and creating a booklet / a collage of pictures and words.

Kinesthetic Activities: The activities highlighted on identifying the pictures, conducting a role play, using signs and symbols, preparing a chart, interviewing a friend, developing a program, preparing a cover page, collecting an advertisement and finally creating an advertisement.

Interpersonal Activities: The activities expected the participants to interview, prepare a news broadcast, analyze the cause and effects, prepare an advertisement, collect information form participants and assimilate the clues and create rules.
Intrapersonal Activities: The activities highlighted on reflective and critical thinking, such as preparing a poster, arranging the scenario based on their likes, debating, and creating on one's own imagination.

Musical Activities: The activities focused on identifying the sounds, writing a rap, debate on the effects of sound, associating words to the sounds, creating a noise friendly device, a poem.

Naturalist Activities: The activities highlighted on identifying the surroundings, storytelling distinguishing between two different places, designing a pollution free environment, listing eco-friendly products, designing eco-friendly plan for their house and creating an eco-friendly book cover. This activity catered to the verbal, visual, bodily, interpersonal, intrapersonal learning styles among the participants to a large extent and the participants with dominant Naturalist intelligence.

Observations: The researcher found that the participants enjoyed working in groups. This was possible because the participants preferring a particular learning style were more active while doing those activities designed for them and could involve others in their groups. The activities catered to multiple learning styles because of which the experiences were reinforced, creating synergy among the participants. The participants not only were engrossed in those activities, but also could discover some

of their abilities in other areas as well. Every participants could contribute to the group activities which kept them all highly motivated throughout the learning sessions.

The fact that the participants have responded very well to the MIA as compared to TA (as indicated by their MIAS) shows that the module seemed to be successful in engaging successfully the learners with diverse learning styles as given by Gardner.

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CHAPTER 5

CHAPTER 5

INFERENTIAL ANALYSIS OF DATA

5.1 INTRODUCTION

In the present study, the researcher sought to study the effectiveness of Multiple Intelligence Approach to curriculum transaction in catering to the educational objectives as given by Revised Bloom's Taxonomy. The researcher also has attempted to compare the performance of the participants' school wise, (SSC, CISCE, CBSE, CIE), Gender wise and ability wise- (Below Average, Average, Above Average). The chapter presents the verification of hypotheses formulated in pursuit of the objectives. For the sake of convenience, the relevant objectives and the null hypotheses are restated below:

Objectives:

- To study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and the level of achievement of the participants (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school participants;

- To study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and the type of schools (SSC, CBSE, CCISCE and CIE) on the achievement of educational objectives of RBT among secondary school participants;

- To study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and gender on the achievement of educational objectives of RBT among secondary school students;

Hypotheses:

H₀1. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the level of achievement (LOA) of the participants (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school students;

H₀2. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the type of schools (SSC, CBSE, CCISCE and CIE) on the achievement of educational objectives of RBT among secondary school students;

H₀3. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA, TA) and gender on the achievement of educational objectives of RBT among secondary school students.

The parametric tests that have been used for testing the null hypotheses are two-way ANOVA and ω^2

5.1.1 Verification of the Hypothesis H₀1

The hypotheses reads: *There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the level of achievement of the participants (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school students.*

The statistical technique used to test this hypothesis was two way ANOVA. The table 5.1 shows the relevant statistics

Table 5.1

Main Effect and Interaction Effects of the TA, MIA and the LOA on the Achievement of Objectives of RBT

Sources	Sum of Squares	Df	Mean Square	F- ratio	Table Value of F	LOS*	$100\ \omega^2$
SS between MIA and TA	23245.31	1	23245.31	8500.22	6.676	S** (0.01)	98.29
SS between Levels of Achievement(LOA)	75014.5	2	37507.29	13715.47	6.676	S** (0.01)	98.93
Interaction	127.49	2	63.74	23.31	6.676	S** (0.01)	13.05
Residual Error	4009.02	1466	2.73				
Corrected Total	106140	1471					

*LOS=Level of Significance; S**=Significant*

1. The calculated F= 8500.22 (SS between MIA and TA) is significant at 0.01 level and therefore, the null hypothesis regarding the main effect of approaches on the achievement of objectives of RBT is rejected at 0.01 level. Hence, it can be concluded that there is significant main effect of the approaches to curriculum transaction (MIA, TA) on the achievement of objectives of RBT. Further, ω^2 estimate indicates that 98.29% variance of approaches is associated with the achievement of objectives of RBT.

2. The calculated F = 13715.47 (SS between LOA) is significant at 0.01 level and therefore the null hypothesis regarding the main effect on LOA is rejected at 0.01 level. Hence, it can be concluded that there is significant main effect of the LOA on the achievement of objectives of RBT. Further, ω^2 estimate indicates that 98.93% variance of LOA is associated with the achievement of objectives of RBT.

3. The calculated F = 23.31 (Interaction) is significant at 0.01 level and therefore, the null hypothesis regarding the interaction effect of approaches and LOA on the achievement of objectives of RBT is rejected at 0.01 level. Further, ω^2 estimate indicates that 13.05% variance of the interaction is associated with the achievement of objectives of RBT.

Conclusion:

There is significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA, TA) and the LOA (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school students at 0.01 level.

Discussion

This implies that the MIA to curriculum transaction interspersed with activities catering to the levels of objectives as given by RBT was favourable for student learning. The activities addressed the multiple intelligences of the participants, which helped them perform tasks as per their preferred learning styles. They seemed to have benefitted from group work which promoted inclusive learning environment. Below Average and Above Average students seemed to have benefitted the most from MIA.

Further t- test was done to find out the significance among the Levels of Achievement (Average, Below Average and Above Average)

Table 5.1.1 shows the Inferential Statistics for estimating the Significance of Difference between the Means of MIAS of Participants on the basis of their LOA

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Table 5.1.1

Inferential Statistics for estimating the Significance of Difference between the Means of MIAS of Participants on the basis of their LOA

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S. No.	Comparison of Groups	Mean	SD	t-ratio	LOS	100 ω^2
1.	**Below Average**	18.42	0.80	105.5	S* (0.01)	96
	Average	26.51	1.10			
2	**Below Average**	18.42	0.80	54.65	S* (0.01)	87
	Above Average	35.91	5.73			
3	**Average**	26.51	1.10	91.26	S* (0.01)	92
	Above Average	35.91	5.73			

LOS=Level of Significance; S=Significant.*

The calculated t=105.5 is more than 2.58. Thus 't' is significant at 0.01 level. Further, ω^2 estimate indicates that 96% variance of the Levels of Achievement among Below Average and Average students.

The calculated t=91.26 is more than 2.58. Thus 't' is significant at 0.01 level. Further, ω^2 estimate indicates that 92% variance of the Levels of Achievement among Average and Above Average students.

The calculated t=54.65 is more than 2.58. Thus 't' is significant at 0.01 level. Further, ω^2 estimate indicates that 87% variance of the Levels of Achievement among Below Average and Above Average students.

Conclusion: This confirms the findings from the table 5.1.1 that the BA and AA participants were the beneficiaries.

Discussion: The students maybe at an advantage as the activities catered to a broader range of intellectual ability. Drawing a picture, composing a rap, or listening to sounds and stories, interpreting the stories, preparing a collage, designing an alternate plan, debating, critiquing - all these activities catered to diverse learning styles and

promoted learning. The activities seemed to provide opportunities for real life and authentic learning experiences that was well suited to the participants' needs, interests and talents. Participants were at no time left unnoticed or isolated. Since the activities were planned as per the levels of objectives given by Revised Bloom's Taxonomy, the quest for evaluating and creating also increased among the participants. The activities emphasized multisensory approach to learning and this might have enhanced the motivation and conceptual clarity of students; group learning also might have contributed to the enhanced understanding of the subject matter and thus seemed to result in higher levels of achievement.

The findings of the present study were in consensus with the studies by Bahaddin (2005), Abdallah.A (2008), Temur, Dogan (2007); Kausar, Gujjar (2008), which have demonstrated the advantage of MIA in achieving the educational objectives.

5.1.2 Verification of the Hypothesis $H_0 2$

The hypotheses reads: *There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the type of schools (SSC, CBSE, CCISCE and CIE) on the achievement of educational objectives of RBT among secondary school participants.*

The statistical technique used to test this hypothesis was two way ANOVA. The following table 5.2 shows the relevant statistics.

Table 5.2

Main Effect and Interaction Effects of the TA, MIA and the Type of School on the Achievement of Objectives of RBT

Sources	Sum of Squares	Df	Mean Square	F- ratio	LOS*	100 ω^2
SS between approaches	26431.82	1	26431.82	494.16	S**(0.01level)	72.82
SS between type of Schools	816.33	3	272.11	5.087	S* (0.05 level)	37.4
Interaction	28.65	3	9.55	0.179	NS	
Residual Error	78306.12	1464	53.48			
Corrected Total	106140.10	1471				

*LOS=Level of Significance; S**=Significant; NS: Not Significant.*

Interpretation:

1. The calculated F= 494.16 (SS between approaches**)** is significant at 0.01 level and therefore, the null hypothesis regarding the main effect of approaches on the achievement of objectives of RBT is rejected at 0.01 level. Hence, it can be concluded that there is significant main effect of the approaches to curriculum transaction (MIA, TA) on the achievement of objectives of RBT. Further, the obtained value of ω^2 estimate indicates that 72.82% variance of the approaches is associated with the achievement of objectives of RBT.

2. The calculated F = 5.087 (SS between type of schools) is significant at 0.05 level and therefore the null hypothesis regarding the main effect on type of schools (of secondary school students) is rejected at 0.05 level. Hence, it can be concluded that there is significant main effect of the type of schools on the achievement of objectives of RBT at 0.05 level. Further, the obtained value of ω^2 estimate indicates that 37.4% variance of type of schools is associated with the achievement of objectives of RBT.

3. The calculated F = 0.179 (**Interaction)** is less than 3.86 and therefore, the 'F' is not significant at 0.05 level and the null hypothesis regarding the interaction effect is accepted. There is no significant interaction effect of the approaches to curriculum transaction (MIA, TA) and the type of schools on the achievement of educational objectives of RBT.

Conclusion:

1. There is significant main effect of approaches to curriculum transaction on the achievement of educational objectives of RBT among secondary school students.

2. There is significant main effect on the type of schools on the achievement of educational objectives of RBT among secondary school students.

3. There is no significant interaction effect of approaches to curriculum transaction and on the types of schools on the achievement of educational objectives of RBT among secondary school students.

Discussion:

This implies that the Multiple Intelligence Approach to curriculum transaction seemed to be beneficial to the participants across all the types of schools. The activities might have helped the participants to perform better in spite of the large student strength and lack of enough space for accessibility. The participants' motive was to learn through the different activities provided and ingrain concepts as much as possible through the conduct of the activities. Since the learning was a shift from their routine teaching-learning process, a forthcoming attitude and eagerness to learn was witnessed**.** Further 't' – test was done to find out the schools that had performed better.

Table 5.2.1 shows the Inferential Statistics for estimating the Significance of Difference between the Means of MIAS of Participants on the basis of their Type of School

Table 5.2.1

Inferential Statistics for estimating the Significance of Difference between the Means of MIAS Participants on the basis of their Type of School

S.No.	Comparison of Groups	Mean	SD	t-ratio	LOS	$100 \, \omega^2$
1.	SSC	30.62	8.38	2.04	S* (0.05)	0.76
	CISCE	31.89	7.98			
2	SSC	30.62	8.38	0.65	NS	
	CBSE	31.15	7.80			
3	SSC	30.62	8.38	2.33	S* (0.05)	10
	CIE	32.02	7.33			
4	CISCE	31.89	7.98	0.83	NS	
	CBSE	31.15	7.80			
5	CISCE	31.89	7.98	0.15	NS	
	CIE	32.02	7.33			
6	CBSE	31.15	7.80	1.03	NS	
	CIE	32.02	7.33			

LOS=Level of Significance; S=Significant; NS: Not Significant.*

From the above table 5.2.1 it could be observed that there is significant difference between the Means of MIAS participants of CIE, CISCE and SSC schools at 0.05 level of significance. There is a marginal difference in Means, however more research is required in this regard.

The 't' test scores indicates that CISCE,CIE,SSC schools were benefitted. The CISCE schools maybe exposed to a differentiated learning environment. These activities

might have helped them to pass through the learning process more smoothly, the students participation was quite motivating and high level involvement was also witnessed.

The CIE school also seemed to be benefitted with the present study and witnessed a participative learning environment in their schools. The participants were involved with reflective thinking and self evaluation, this could be observed in their classroom practices and the MI based lesson plans that were a part of their curriculum. However the research has to be done with a larger sample to say with conviction.

The students at SSC schools seemed to be taught through the lecture method and might have focused on rote memorization, which might have given less scope for interaction and reflective thinking. However these activities might have encouraged group work which seemed to enable them to learn differently.

This study corroborates the findings of Kagdi (2004) that witnessed significant relationship between teaching styles of their teachers and the academic climate of the classroom among the SSC and ICSC schools; it also reassured many research findings that incorporated MI in the daily classroom practices and was an advantage to the participants.

5.1.3 Verification of the Hypothesis $H_0 3$

The hypotheses reads: *There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and gender on the achievement of educational objectives of RBT among secondary school participants***;**

The statistical technique used to test this hypothesis was two way ANOVA. The table 5.3 shows the relevant statistics:

Table 5.3

Main Effect and Interaction Effects of the TA, MIA and Gender on the Achievement of Objectives of RBT

Sources	Sum of Squares	Df	Mean Square	F-ratio	LOS*	$100\ \omega^2$
SS between approaches	25589.34	1	25589.34	474.80	S**(0.01level)	70.14
SS between type of Schools	31.419	1	31.419	0.583	NS	
Interaction	3.180	1	3.180	0.589	NS	
Residual Error	79116.508	1468	53.894			
Corrected Total	106140.108	1471				

*LOS=Level of Significance; S**=Significant; NS: Not Significant*

Interpretation:

1. The calculated F= 474.80 (SS between approaches**)** is significant at 0.01 level and therefore, the null hypothesis regarding the main effect of approaches on the achievement of objectives of RBT is rejected at 0.01 level. Hence, it can be concluded that there is significant main effect of the approaches to curriculum transaction (MIA, TA) on the achievement of objectives of RBT. Further, the obtained value of ω^2 estimate indicates that 70.14% variance of the approaches is associated with the achievement of objectives of RBT.

2. The calculated F = 0.583 (SS between Gender) is less than 3.86 and therefore, the 'F' is not significant at 0.05 level and the null hypothesis regarding the main effect on type of gender is accepted. There is no significant main effect of Gender on the achievement of educational objectives of RBT.

3. The calculated F = 0.589 (**Interaction)** is less than 3.86 and therefore, the 'F' is not significant at 0.05 level and the null hypothesis regarding the interaction effect is accepted. There is no significant interaction effect of the approaches to curriculum transaction (MIA, TA) and Gender on the achievement of educational objectives of RBT.

Conclusion:

1. There is significant main effect of approaches to curriculum transaction on the achievement of educational objectives of RBT among secondary school students.

2. There is no significant main effect of gender on the achievement of educational objectives of RBT among secondary school students.

3. There is no significant interaction effect of approaches to curriculum transaction and gender on the achievement of educational objectives of RBT among secondary school students.

Discussion

The activities seemed to have benefitted both the boys and girls equally. The cognitive activities might have been beneficial to both boys and girls. This might have boosted that the MIA to curriculum transaction that may seem to be beneficial to both boys and girls almost equally.

The study corroborates the findings by Verma (1992) and revealed that the gender did not make a difference on the academic achievement and motivation; Abdallah. A (2008) also confirmed the results that the experimental study on the 9th grade participants' reading comprehension had no gender significance.

The present research seemed to showcase the preference of secondary school students for MIA to curriculum transaction, activity based constructivist approach to learning and for group learning.

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CHAPTER 6

CHAPTER 6

SUMMARY AND CONCLUSIONS

6.1 INTRODUCTION:

Learning is not attained by chance, it must be sought for with ardor and attended to with diligence. **Abigail Adams (1780)**

As human beings we are constantly in one learning process after the other. We need to rekindle our thirst of knowledge with which we are endowed from our childhood. "*what the student does is actually more important ... than what the teacher does*". In order to effectively facilitate student learning, teachers should design learning activities that will support students through each step in the learning process and cater to learner centered classrooms. Learners absorb information in many different ways not only at the time when it is given but also later through the reflective learning process. The participants today in schools look forward for more and more information and are a step ahead of their teachers' at times in information downloads which does not primarily relate to knowledge download. It becomes imperative for the teachers' to give scope towards this need among the participants'. But quite often we find a gap in this as a result the participants lose their focus towards learning. Learning aims at achieving the Learning outcomes and thus gradually leading the participants to higher order thinking ie. Analyzing, Evaluating and Creating. As the teachers' in schools are pre-occupied with so many activities- curricular and co-curricular activities, less emphasis is given to this finer aspect of teaching-learning process. This study focused on MIA as an alternate mode to curriculum transaction thereby achieving the educational objectives as given by RBT thus catering to the different learning styles, constructivist approach and creating an inclusive environment and the post test scores gave evidence to its significance.

6.2 STATEMENT OF THE PROBLEM:

Multiple Intelligence Approach to Curriculum Transaction and Achievement of Educational Objectives at Secondary School Level

6.3 AIMS AND OBJECTIVES OF THE STUDY:

6.3.1. Broad Aims of the Study:

1. To study the effectiveness of Multiple Intelligence Approach to curriculum transaction in realizing the educational objectives as given by Bloom's Revised Taxonomy among secondary school students;

2. To study the attitude of secondary school students towards Multiple Intelligence Approach to curriculum transaction, in realizing the educational objectives as given by Bloom's Revised Taxonomy;

3. To study the main effect as well as the interaction effects of the traditional and Multiple Intelligence modes of curriculum transaction in relation to some variables.

6.3.2 Objectives of the Study:

1. To study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction in realizing the educational objectives among secondary school students, as given by Revised Bloom's Taxonomy;

2. To study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction at secondary school level in transforming the learning environment into a constructivist one;

3. To study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction at secondary school level in promoting inclusive education;

4. To study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction at secondary school level in catering to multiple learning styles of students as given by Prof. H. Gardner;

5. To study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and the level of achievement of the participants (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school students;

6. To study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and the type of schools (SSC, CBSE, CISCE and CIE) on the achievement of educational objectives of RBT among secondary school students;

7. To study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and gender on the achievement of educational objectives of RBT among secondary school students.

6.4 RESEARCH QUESTIONS AND HYPOTHESES OF THE STUDY
6.4.1 Research Questions

In order to achieve the first four objectives of the study, the following research questions were raised:

R1. To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in realizing the educational objectives as given by Revised Bloom's Taxonomy?

R2. To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in transforming the learning environment into a constructivist learning environment?

R3. To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in promoting inclusive education at secondary school level?

R4. To what extent is the Multiple Intelligence approach to transaction of the curriculum at secondary school level effective in catering to different learning styles of students as given by Prof. H. Gardner?

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6.4.2 Hypotheses:

In order to achieve the next three objectives, the following hypotheses were formulated:

H_01. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the level of achievement of the participants (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school students;

H_02. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the type of schools (SSC, CBSE, CCISCE and CIE) on the achievement of educational objectives of RBT among secondary school students;

H_03. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and gender on the achievement of educational objectives of RBT among secondary school students.

6.5 DESIGN OF THE STUDY

6.5.1 Methodology of the study:

The present study is a **quasi-experimental study** following the Counter Balance Design

X_1	MA1	O_1
X_2	MB1	O_2
X_1	MB2	O_3
X_2	MA2	O_4

In the first stage, a Multiple Intelligence checklist was administered to assess the students' interest level. The first unit was taught to X_1 by Traditional method of teaching (MA1) and X_2 by Multiple Intelligence Approach (MB1). After completing the unit, a criterion test (Post test) on that unit was administered to assess the conceptual clarity of the unit taught and the mean gain score (O_1 and O_2) was computed.

In the second stage, the second unit was taught to X_1 by Multiple Intelligence Approach (MB2) and X_2 by traditional method (MA2). After completing the unit, the criterion test (Post test) was administered to assess the conceptual clarity of the unit taught and the mean gain score (O_3 and O_4) was computed.

6.5.2 Sample for the study:

In accordance to the design of the study, the sample for the study consisted of **736** students from 2 divisions of standard VI and from 2 schools in each of the SSC/CBSE/CISCE/CIE board syllabus pattern in Mumbai. The sample was selected by *Stratified Random Sampling Technique.*

6.5.3 Tools used:

The researcher developed the following tools for collecting data:

 a) Personal Data Sheet;
 b) Multiple Intelligence Test;
 c) MI/ RBT Grid;
 d) Instructional Module;
 e) Field notes;
 f) School Records;
 g) Criterion Referenced Post- test.

a) Personal Data Sheet: The researcher prepared the Personal Data Sheet which gave information on the Personal details of the students such as Name, Age, Gender and Type of school. The Personal Data Sheet is presented in **Appendix 1**.

b) Multiple Intelligence Tests: MI test was done to find out the likes/ dislikes of VI standard students, their dominant intelligences, introspection by the students thereby being aware of their strengths and weaknesses. The researcher made us of the readymade Multiple Intelligence test based on Howard Gardner's model. The Multiple Intelligence test is presented in **Appendix 2**.

c) MI/ RBT Grid: A two dimensional grid was prepared of activities with Multiple Intelligences vis-a-vis educational objectives of the Revised Bloom's Taxonomy. These activities were designed which formed the content of the Instructional Module. The MI/ RBT Grid consisted of activities on both the units in Science subject – Pollution and Energy. The researcher referred to **Audrey (2003)** who conducted a study that integrates Benjamin S. Bloom's levels of cognitive understanding with

Howard Gardner's eight domains of intelligence to provide a framework for individualized instruction.

d) Instructional Module: The Instructional Module was prepared by the researcher with the help of her guide. The Instructional Module consisted of the objectives of the lesson, content description, grid and the detailed explanation of each activity addressing the Multiple Intelligences and catering to the different levels of Revised Bloom's Taxonomy. The day-wise lesson in the Instructional Module with other details are presented in **Appendix 3**.

e) Field Notes: The researcher had a classroom walkthrough that enabled close classroom observations of the students to get specific information about the Instructional Intervention. The classroom walkthrough was not an evaluation; it was to make focused observations of peer interaction and student involvement in the activities. The checklist on the same was prepared by the researcher and is presented in **Appendix 4**. The researcher also collected information in the form of daily field notes which helped the researcher to analyze and answer the research questions critically and closely.

f) School Records: In order to collect data about the level of achievement of students (to group them into average, above average and below average achievers), the researcher personally met the class teachers of the respective classes that were selected as the sample. The school cumulative records and the marks of the students in their terminal examination conducted in the school was taken down which helped the researcher in classifying the level of achievement of the students – Below average (below 40%), Average (40 – 60 %), Above Average (above 60%).

g) Criterion Referenced Post Test in Science

Criterion referenced test was developed in Science by the researcher on the topics **Pollution and Energy** to test the achievement of objectives as per the Revised Bloom's Taxonomy among the participants in both the units. The same is presented in **Appendix 6**. There are 12 questions in the test. The questions given in the criterion test in Science were prepared keeping in mind the maturity level of students, previous knowledge and related to daily life situation and content of the unit learned. There were internal choices given to the students for some of the questions. The questions were framed in such a way that it catered to the below average, average and above

average students. Its main purpose was to measure the achievement of students of standard VI of SSC/CISCE/CBSE/CIE Board in realizing the educational objectives as given by Revised Blooms' Taxonomy through the Multiple Intelligence Approach.

6.6 TECHNIQUES OF ANALYSIS OF DATA:

6.6.1 Descriptive Analysis:

This included the following:

1) Measures of Central tendency, viz., Mean, Median and Mode.

2) Measures of Variability, viz, SD, Skewness, Kurtosis.

3) Graphical representation of data, viz - bar diagrams.

6.6.2 Inferential Analysis:

To verify the hypotheses, Two Way ANOVA was used.

To estimate the magnitude of variance of the means of Traditional Approach and MI Approach to curriculum transaction on gender, type of schools, and levels of achievement in achieving objectives of Revised Bloom's Taxonomy of secondary school students, the researcher used $\omega^2_{est.}$

For the purpose of present study, two types of analyses were used. They are

a) Descriptive Analysis

b) Inferential Analysis

6.7 MAJOR FINDINGS OF THE STUDY:

Objective 1 was to study the extent of effectiveness of Multiple Intelligence Approach to curriculum transaction in realizing the educational objectives among secondary school students, as given by Revised Bloom's Taxonomy; the following Research Question was framed

R1. To what extent is the Multiple Intelligence Approach to transaction of the curriculum at secondary school level effective in realizing the educational objectives as given by Revised Bloom's Taxonomy?

Findings for Objective 1 indicated that the MIA of curriculum transaction seemed to have an overall positive impact on the learning. The activities enabled the participants to achieve the educational objectives RBT much better as compared to TA. The higher level educational objective of Creating was also achieved at Very High Level

and this was due to the activities that enabled the participants to express their perceptions and understanding better. The objectives of Applying, Analyzing and Evaluating were also realized to a substantial level in MIA as compared to TA.

Discussions: This may be due to the interactive sessions and the differentiated activities that were catered to all participants which enabled them to grasp the concepts better. The concepts were learnt so deeply and collaboratively interwoven with fun and a variety of activities. Project making and collaborative learning helped the learning process smoother.

Objective 2 was to study the extent of effectiveness of MIA to curriculum transaction at secondary school participants in transforming the learning environment into a constructivist learning environment; the following Research Question was framed

R2. To what extent is the MIA to transaction of the curriculum at secondary school level effective in transforming the learning environment into a constructivist learning environment?

Findings for Objective 2 indicated that the participants groups were rotated among the activities that focused on the various intelligences because of which all the participants got an opportunity to put into maximal use their prime intelligence and also could benefit from others' intelligences by engaging in collaborative activities.

Discussions: The activities were well knitted in such a way that the participants were learning something new or understanding a concept in greater depths. Each learning experience gave the opportunity to the participants to build strong foundation of their understanding through the 7E's: Engage, Explore, Explain, Elaborate, Exchange, Evaluate and Excite. Thus the MI approach to curriculum transaction seemed to make an attempt in making learning interactive through a continuous exchange of views and opinions between the teacher and students helping them to construct their own knowledge. Active participation from the students was the highlight of this approach with ample scope for self reflection and group reflections though collaborative, inquiry based activities.

Objective 3 was to study the extent of effectiveness of MIA to curriculum transaction at secondary school participants in promoting inclusive learning environment; the following Research Question was framed

RQ 3 To what extent is the MIA to transaction of the curriculum at secondary school level effective in promoting inclusive environment?

Findings for Objective 3 showcased an inclusive learning environment through the MI approach of curriculum transaction. The activities were designed in such a way that no child was left behind. These activities were rotated to each group on a continuous basis thereby involving all the participants.

Discussions: By creating an inclusive learning environment participants could learn in groups with other participants different from them in ways that seem to facilitate the development of skills such as leadership, communication, and conflict resolution. The classroom exhibited learning experiences of discovery, joy, satisfaction and pride at one's accomplishments. These positive emotions motivated the participants to perform better for further learning. The researcher created a free classroom environment where the participants capitalized on their personal experience by engaging themselves in creative ways with resources and instructions provided. These group activities might have helped the participants to work in a group, ensure group compatibility, help the isolates to perform better, peer tutoring, showcase each one's talents and help to increase productivity, balance between the strengths and weakness of the group members, use the resources effectively, managing group conflicts, arrive at group consensus, hone individual strengths for group success.

Objective 4 was to study the extent of effectiveness of MIA to curriculum transaction at secondary school participants in catering to Multiple Learning styles of participants as given by Prof. H.Gardner; the following Research Question was framed

RQ 4 To what extent is the MIA to transaction of the curriculum at secondary school level effective in catering to different learning styles of participants as given by Prof. H.Gardner?

Findings for Objective 4 indicated that the activities planned catered to MI as given by Gardner as well as the learning needs of participants with diverse learning styles as given by Gardner.

Discussions: The researcher found that the participants enjoyed working in groups. This was possible because the participants preferring a particular learning style were more active while doing those activities designed for them and could involve others in their groups. The activities catered to multiple learning styles because of which the

experiences were reinforced, creating synergy among the participants. The participants not only were engrossed in those activities, but also could discover some of their abilities in other areas as well. The fact that the participants have responded very well to the MIA as compared to TA (as indicated by their MIAS) shows that the module seemed to have been successful in engaging successfully the learners with diverse learning styles as given by Gardner.

Objective 5 was to study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and the level of achievement of the participants (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school participants; the following hypothesis was framed.

H$_0$1. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the level of achievement of the participants (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school students.

The parametric tests that have been used for testing the null hypotheses are two-way ANOVA and ω^2 est (omega square estimate).

Findings for Objective 5 There is significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA, TA) and the LOA (Average, Below Average and Above Average) on the achievement of educational objectives of RBT among secondary school students at 0.01 level.

Discussions: The students seemed to be at an advantage as the activities catered to a broader range of intellectual ability. Drawing a picture, composing a rap, or listening to sounds and stories, interpreting the stories, preparing a collage, designing an alternate plan, debating, critiquing - all these activities catered to diverse learning styles and promoted learning. The activities provided opportunities for real life and authentic learning experiences that was well suited to the participants' needs, interests and talents. Participants were at no time left unnoticed or isolated. Since the activities were planned as per the levels of objectives given by Revised Bloom's Taxonomy, the quest for evaluating and creating also increased among the participants. The activities seemed to have emphasized multisensory approach to learning and this might have enhanced the motivation and conceptual clarity of students; group learning also might

have contributed to the enhanced understanding of the subject matter and thus resulted in higher levels of achievement.

Objective 6 was to study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and the type of schools (SSC, CBSE, CISCE and CIE) on the achievement of educational objectives of RBT among secondary school participants; the following hypothesis was framed.

H₀2. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and the type of schools (SSC, CBSE, CISCE and CIE) on the achievement of educational objectives of RBT among secondary school students.

The parametric tests that have been used for testing the null hypotheses are two-way ANOVA and ω^2 est (omega square estimate).

Findings for Objective 6:

1. There is significant main effect of approaches to curriculum transaction on the achievement of educational objectives of RBT among secondary school students.

2. There is significant main effect on the type of schools on the achievement of educational objectives of RBT among secondary school students.

3. There is no significant interaction effect of approaches to curriculum transaction and on the types of schools on the achievement of educational objectives of RBT among secondary school students.

Discussions: This implies that the Multiple Intelligence Approach to curriculum transaction has seemed to be beneficial to the participants across all the types of schools. The activities might have helped the participants to perform better in spite of the large student strength and lack of enough space for accessibility. The participants' motive was to learn through the different activities provided and ingrain concepts as much as possible through the conduct of the activities. Since the learning was a shift from their routine teaching- learning process, a forthcoming attitude and eagerness to learn was witnessed**.**

Objective 7 was to study the main effect as well as the interaction effect of the approaches to curriculum transaction (MIA,TA) and gender on the achievement of

educational objectives of RBT among secondary school students; the following hypothesis was framed.

H$_0$3. There is no significant main effect as well as interaction effect of the approaches to curriculum transaction (MIA,TA) and gender on the achievement of educational objectives of RBT among secondary school students.

The parametric tests that have been used for testing the null hypotheses are two-way ANOVA and ω^2 est (omega square estimate).

Findings for Objective 7:

1. There is significant main effect of approaches to curriculum transaction on the achievement of educational objectives of RBT among secondary school students.

2. There is no significant main effect of gender on the achievement of educational objectives of RBT among secondary school students.

3. There is no significant interaction effect of approaches to curriculum transaction and gender on the achievement of educational objectives of RBT among secondary school students.

Discussions: This implies that the Multiple Intelligence Approach to curriculum transaction may have boosted student achievement as compared to the Traditional approach. The activities seemed to help the participants to hone their skills related to each type of intelligence, learning style and constructivist approach and group learning also fostered the achievement of higher level objectives of RBT.

6.8 SUGGESTIONS:

- Learner-centered classrooms to be created for success-oriented students. Teachers should provide extensive opportunities for guided practice, repetition, and review for their students, giving them ample opportunities to practice before they are given tests or other forms of assessment.

- Creating an active learning environment thereby providing with opportunities for hands-on learning and construct their own knowledge. They should be allowed to work with concepts in different ways, including multisensory activities that enable them to see, hear, feel, smell, and even taste concepts.

- Student learning must be developmentally appropriate and compatible with students' levels of intellectual, physical, social, and emotional development.

- Teaching – learning must address many different learning styles. Teachers must remember that their students learn in different ways. Teachers should also keep in mind that students oftentimes will do their best if learning opportunities are aligned with their particular type of intelligence, e.g., verbal-linguistic, logical-mathematical, visual-spatial, bodily-kinesthetic, musical-rhythmic, interpersonal, intrapersonal, or naturalistic.

- Variety of instructional materials can be used during the teaching- learning process to make learning enjoyable and student centered.

- An awareness of constructivist approach of learning can be made through co-operative learning workshops among the school teachers. Teachers can engage students with care-share projects. This will give opportunities of peer tutoring and build student compatibility.

- An awareness of Multiple Intelligences and Multiple Intelligence Approach of curriculum transaction could be given at schools, which would help students identify their dominant intelligence and teachers to plan activities to meet the diverse student community.

- Teachers need to be oriented about the uniqueness of each child and not to label them as 'dumb' or 'good for nothing'. Teachers need to break down the shackles of rote memorization and invent new pedagogical practices for students welfare.

- Teachers need to be oriented with the Revised Bloom's Taxonomy and frame educational objectives to meet the needs of each and every child, so that No Child is Left Behind.

- Teachers can work in tandem with the parents about the Multiple intelligence of their children which will enable them to harness the child's capacity and ability to a better extent.

- Teachers should provide positive feedback to students performance during the assessment conducted at classroom level.

- Pre- service and In-service training program should provide teachers with a variety of experiences in innovative classroom teaching – learning methodology, students' problems in the classroom and classroom dynamics.

- Teachers can address the MI and RBT by preparing the MI/RBT grid while their lesson planning which would also be tool and direction to follow the same.

6.9 SUGGESTIONS FOR FURTHER STUDY:

The present study can serve as a foundation for numerous further studies. The researcher felt that many more areas could be explored, especially with respect to the Multiple Intelligences and Revised Bloom's Taxonomy. In the light of the present study, the researcher has made following suggestions for further study:

- A study to analyze the attitude of the teachers towards MIT with respect to social competency among students.

- A study to analyze the attitude of teachers towards Multiple Intelligence theory with respect to their teaching styles, self- efficacy and professional development.

- A study to analyze the impact of achievement of Revised Bloom's Taxonomy on student's success at school.

- A co-relational study to analyze Multiple Intelligence and Revised Bloom's Taxonomy on student achievement with respect to their gender, age and intelligence.

- A study to analyze the Multiple Intelligences and Achievement of educational objectives among the secondary school students on the basis of their socio-economic background and school climate.

- A study to analyze the impact of Multiple Intelligences and achievement of educational objectives in relation to burn-out among higher secondary school students.

- A critical study of the relationship between learning styles of students and teaching styles of the teachers on student achievement and intelligence.

- An experimental study to explore the effect of constructivist approach of learning catering to different learning styles among the students.

- A study to analyze the use of Multiple Intelligence by the teachers in their daily classroom teaching.

- An experimental study by using traditional teaching and innovative teaching methodology with respect to Multiple Intelligence.

- A study to analyze the impact of MI based lesson plans in classroom teaching.

- A study to analyze the impact of MIABT at various levels among secondary school students.

- A co-relational study between success of an individual and his intelligence with respect to MIT.

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APPENDIX 1
PERSONAL DATA SHEET

NAME   : _____

AGE   : _____

GENDER   : _____

SCHOOL   : _____

MULTIPLE INTELLIGENCE TESTS

| Tick the statements.	1	2	3	4
I like to learn more about myself				
I find it easiest to solve problems when I am doing something physical				
I find budgeting and managing my money easy				
When talking to someone, I tend to listen to the words they use not just what they mean				
I enjoy crosswords, word searches or other word puzzles				
I don't like ambiguity, I like things to be clear				
I enjoy logic puzzles such as 'sudoku'				
I like to meditate				
I am very interested in psychometrics (personality testing) and IQ tests				
People behaving irrationally annoy me				
I find that the music that appeals to me is often based on how I feel emotionally				
I like to be systematic and thorough				
I can throw things well - darts, skimming pebbles, frisbees, etc				
I enjoy a wide variety of musical styles				
I could manipulate people if I choose to				
I can predict my feelings and behaviours in certain situations fairly accurately				
I can identify most sounds without seeing what causes them				
I enjoy debates and discussions				
I care about how those around me feel				
My house is full of pictures and photographs				
I enjoy and am good at making things - I'm good with my hands				
I like having music on in the background				
I am a very tactile person				
I can easily imagine how an object would look from another perspective				
I never use instructions for flat-pack furniture				

I find it easy to talk to new people				
I often talk to myself – out loud or in my head				
When I am abroad, I find it easy to pick up the basics of another language				
I am realistic about my strengths and weaknesses				
I am very aware of other people's body language				
I can read a map easily				
I am good at solving disputes between others				
I have always dreamed of being a musician or singer				
I never get lost when I am on my own in a new place				
If I am learning how to do something, I like to see drawings and diagrams of how it works				

APPENDIX 3
LESSON TRANSCRIPT

General Objectives of the module:

- To identify the Multiple Intelligence among the students.

- To check the effectiveness of Multiple Intelligence Approach as an Instructional Intervention to curriculum transaction in relation to:

  a. realize the educational objectives as given by Revised Bloom's Taxonomy.

  b. transform the learning environment into a constructivist one.

  c. promote inclusive education.

  d. caters to multiple learning styles of students.

Content:
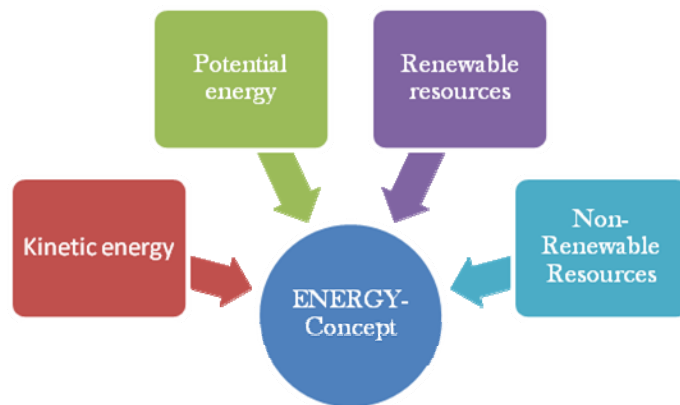
Energy: Concept.

Kinds of Energy: Kinetic and Potential.

Sources of Energy – Renewable and Non- Renewable sources.

Materials:

- Multiple Intelligence Test.

- Activity Sheets catering to the Multiple Intelligence / Revised Bloom's Taxonomy grid.

- Charts/ Newspapers/ Sketch pens/ Marker pens/ Inventory sheets, picture, cut outs specimens.

- Textbooks and reference books.

Transactional phase /entry behaviour (Day I):

Teacher behaviour:

The teacher provides general instruction to the students about the conduct of the lessons.

The teacher administers the Multiple Intelligence Test to the students.

The teacher prepares the student for various acrivities.

Learner behaviour:

- The pupil participates in the classroom activities.
- The pupil writes the notes given in the class.
- The pupil prepares verbally of what they have learnt.

Educational Objectives as given by Revised Bloom's Taxonomy:

• **Remember:**	• The pupil recalls kinds of energy, and sources of energy.
• **Understand:**	• The pupil distinguishes between types of energy, • The pupil identifies various renewable resources.
• **Application:**	• The pupil gives reasons of electricity power- cuts are in plenty, suggest ways to conserve energy, • The pupil analyse non- renewable resources and its feasibility
• **Analysis:**	• The pupil analyzes the cause and effect for power shortage, • The pupil analyzes the present scenario and suggest alternate sources of energy to cope up with growing demand.
• **Evaluate:**	• The pupil evaluates the feasibility of using alternate energy resources for future.
• **Create:**	• The pupil creates an alternate energy plan for a house / complex

Registration phase:

- The teacher elicits the Meaning of Energy,

- Teacher illustrates the Kinds of Energy – Kinetic and Potential Energy,

- Teacher explains Sources of Energy – Renewable and Non- Renewable sources.

- The teacher uses visual aids and discusses kinds of Kinetic and Potential Energy and Renewable and Non- Renewable energy sources.

Verification phase:

- The pupil defines Energy, Kinds of energy.

- The pupil gives examples of Kinetic and Potential Energy.

- The pupil gives examples of Renewable and Non- Renewable energy source.

- The pupil differentiates/distinguishes Renewable, Non- Renewable sources, Kinetic Energy, Potential Energy.

- The pupil prepares the model of an alternative energy source.

Exit phase   (Day 2):

- The researcher administers a post-test of 50 marks for 2 hours on the unit Energy.

Transactional phase/ Entry behaviour (Day 2):

Teacher behaviour:

- The teacher provides general instruction to the students about the conduct of the lessons.

- The class is divided into 8 groups and activities catering to each Multiple Intelligence are given to each group.

- The activities are designed to cater to the Multiple Intelligences and Levels of thinking as per Revised Bloom's Taxonomy among the students.

Learner behaviour:
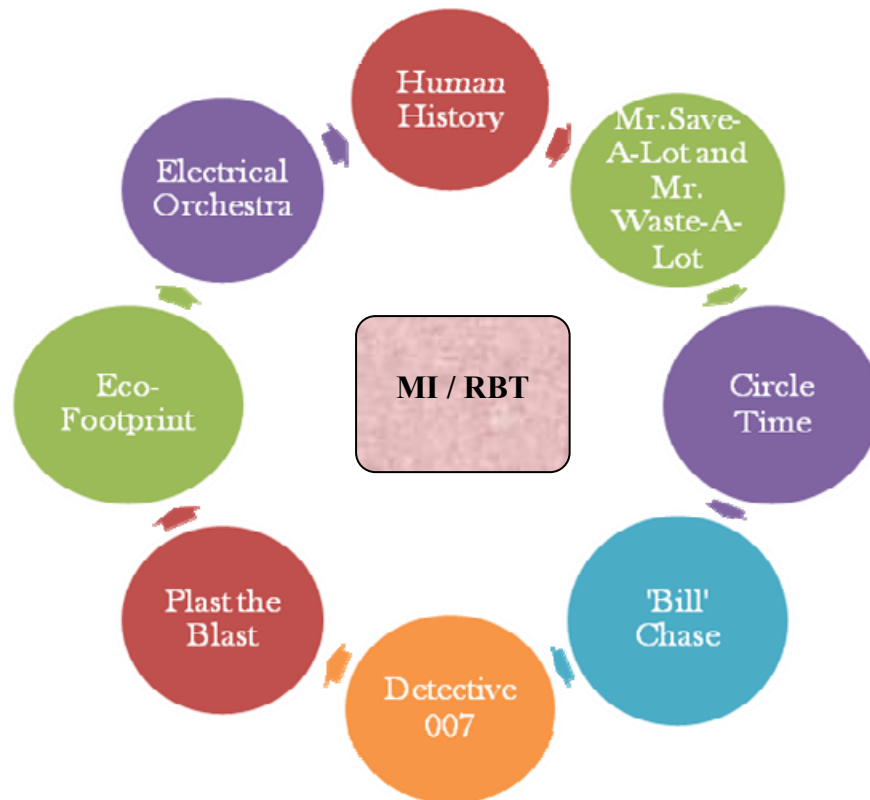
- Activities are revolved among the groups, all the groups and students are given an opportunity to perform each activity.
- Each group is given 15mins for each activity.
- The students perform either in a group or on individual basis depending on the activity given.

Educational Objectives to be catered as per Revised Bloom's Taxonomy:

• **Remember:**	• The pupil recalls kinds of energy, and sources of energy.
• **Understand:**	• The pupil distinguishes between types of energy, • The pupil identifies various renewable resources.
• **Application:**	• The pupil gives reasons of electricity power- cuts are in plenty, suggest ways to conserve energy, • The pupil analyse non- renewable resources and its feasibility
• **Analysis:**	• The pupil analyzes the cause and effect for power shortage, • The pupil analyzes the present scenario and suggest alternate sources of energy to cope up with growing demand.
• **Evaluate:**	• The pupil evaluates the feasibility of using alternate energy resources for future.
• **Create:**	• The pupil creates an alternate energy plan for a house / complex

Registration phase:

- *Human History*: The teacher makes use of pictures showing the energy sources used throughout the human history; the students ponder over the advantages and limitation of the various stages. Students record the electric inventory of all electrical home appliances; they express their feelings of the appliances in an ascending order of importance. They defend and critique the use of few electrical appliances. The aim of the activity is understanding the concept and forms of energy and be able to identify, modify and transform different aspects of the visual world.(**Visual/ Spatial**).

- *Mr. Save- a- Lot and Mr. Waste- a – Lot*: The teacher introduces a story on Mr. Save- a- Lot and Mr. Waste- a – Lot with pictures in a very creative way. The students are asked to comment on one of the character introduced in the story, further they list down the energy resources used by them in their daily life, during vacations and seasons. They compare and contrast themselves with the story and report it. The students suggests plan to save energy at home to avoid power cuts, finally they create a slogan catering to energy conservation awareness. The aim of these activities is to develop the vocabulary of the students. (**Verbal/ Linguistic**)

- *Circle Time*: The teacher provides pictures to identify renewable and non renewable resources; further students present a role play to bring out the importance and scarcity of non renewable resources. They prepare a chart of pictures highlighting features of resources. They interview a friend on the burning issue of energy consumption and conservation. The students collect advertisements on energy conservation and finally design an advertisement that depicts energy conservation. The aim of this activity is to bring awareness among the students of the scarcity of resources and measures to make optimum use of the available resources through tactile experiences. (**Bodily/ Kinesthetic**)

- *"Bill" Chase*: The students reflect on the energy used in their daily life. The teacher asks them the students to reflect and mention a quality in them that would help them in energy crisis. They make a poster of items in the emergency kit needed by them at the time of energy crisis compare the energy used by them during vacations, seasons with explanation. The teacher asks

them to rearrange the house to conserve energy with adequate reasons to it. The students debate on the rearrangements. The students are asked to create a dream house with the things they want or do not want keeping in mind the energy crisis. The aim of this activity is keen observation from each students view point. (**Intrapersonal**)

- ***Detective 007***: The students find pictures of energy appliances and discuss about their energy usage. The teacher provides the student groups who pose as detectives with a Detective data sheet and clues collecting energy evidence thereby explore, discover, propose explanation and come with their own definition and present it. The students prepare rules to control energy consumption and avoid wastage. The aim of this activity is to encourage working in groups, communication, information sharing and observation. (**Interpersonal**)

- ***Plast the Blast***: The teacher provides the student group with a graph and students interpret the graph. The students discuss the various factors contributing to it and present it creatively. The students are also given with a table that exhibits Appliance Explosion that explores the increasing number of appliances at homes over the years. The students need to differentiate between necessary and luxury items. And they prepare a graphical representation of a group on the same. The aim of this activity is to develop the ability of understanding the world through cause effect relation and reason out. (**Logical/ Mathematical**)

- ***Eco – Footprint***: The teacher introduces with a story and asks them to make simple choices in their lives; they also interpret these choices based on their lifestyle. The students list five eco-friendly products. They analyze safe and dangerous aspects of two energy resources. They develop an eco-friendly plan for their homes and finally they create a book cover on the theme "Environment" This aim of this activity is to identify choices and explore ways in reducing the impact to sustainability issues by understanding the world through environment. (**Naturalistic**)

- ***Electrical Orchestra***: The teacher conducts an Electrical Orchestra a method for making introduction of appliances and electricity fun. The students identify

the sounds and write a rap on the sound heard. They demonstrate various sounds and discuss about them. The students choose a sound to depict words on energy; they make a jingle or tongue- twister to highlight energy conservation. The students write a poem on energy conservation. The aim of this activity is to be sensitive to rhythm. (**Musical)**.

Verification phase:

- The pupil defines Energy, Kinds of energy.
- The pupil gives examples of Kinetic and Potential Energy.
- The pupil gives examples of Renewable and Non- Renewable energy source.
- The pupil differentiates/distinguishes Renewable, Non- Renewable sources, Kinetic Energy, Potential Energy.
- The pupil critiques and defends the use of various energy appliances.
- The pupil creates slogan on energy conservation.
- The pupil designs an advertisement sensitizing on energy conservation.
- The pupil creates an alternate energy usage plan for a house.
- The pupil represents graphically the increasing number of energy appliances at home.
- The pupil creates a collage of pictures and words on the theme 'Energy'.

Students Opinions:

- The teachers ask the students to share their experiences on the topic taught.
- The teacher asks the students to express their view on the methodology used to transact the topic.
- The teacher asks the students to share their views on the activities that were conducted during the process of teaching – learning.
- The students comment on the likes/ dislikes on certain activities that were used. They also express their difficulties if any encountered during the conduct of these activities.
- The students give suggestions on the activities used or even on the entire process of the teaching- learning situation.

Exit phase   (Day 3):

- The researcher administers a post-test of 50 marks for 2 hours. on unit Energy.

Transactional phase/ Entry behaviour (Day 3):
Content:
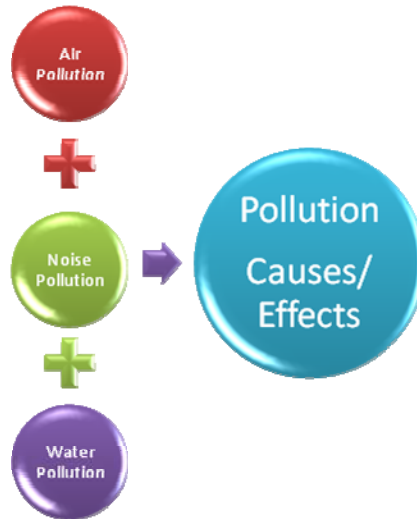
- Pollution – Meaning,
- Types of Pollution – Air, Water, Noise Pollution,
- Cause and Effect of Pollution.

Materials:

- Activity Sheets catering to the Multiple Intelligence / Revised Bloom's Taxonomy grid.
- Charts/ Newspapers/ Sketch pens/ Marker pens/ Inventory sheets, picture, cut outs specimens.
- Textbooks and reference books.

Transactional phase/ Entry behaviour (Day 3):

Teacher behaviour:

- The teacher provides general instruction to the students about the conduct of the lessons.
- The class is divided into 8 groups and activities catering to each Multiple Intelligence are given to each group.
- The activities are designed to cater to the Multiple Intelligences and Levels of thinking as per Revised Bloom's Taxonomy among the students.

Learner behaviour:
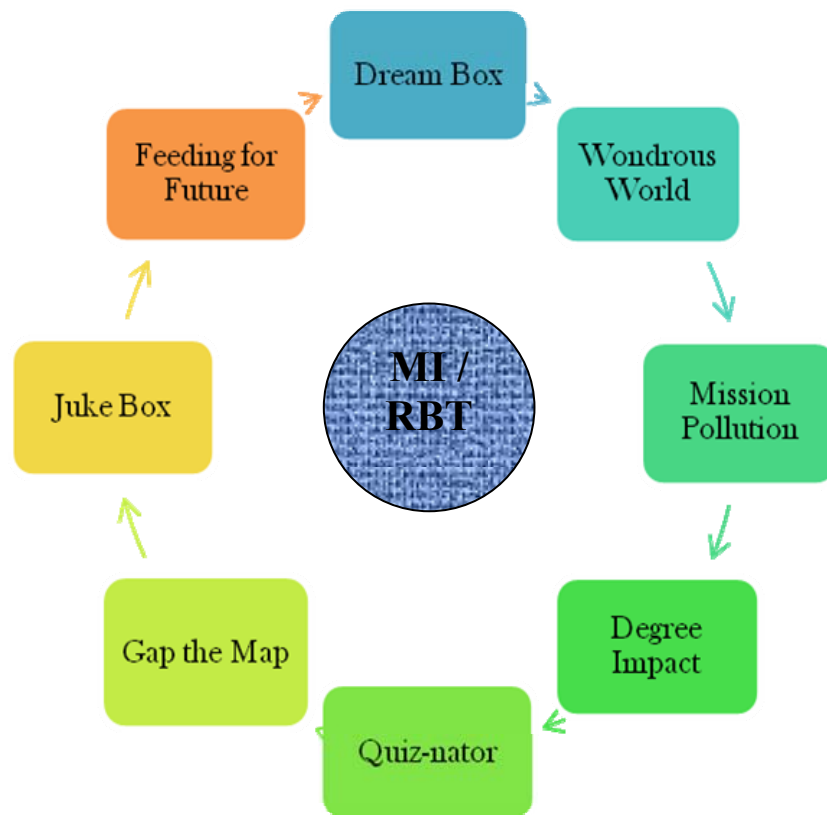
- Activities are revolved among the groups, all the group and students are given an opportunity to perform each activity.
- Each group is given 15mins for each activity.
- The students perform either in a group or on individual basis depending on the activity given.

Educational Objectives as given by Revised Bloom's Taxonomy:

• **Remember:**	• The pupil recalls pollution and types of pollution.
• **Understand:**	• The pupil classifies the different types of pollution, • The pupil explains the causes of pollution.
• **Application:**	• The pupil gives reasons for pollution hazards, • The pupil demonstrates the effects of pollution.
• **Analysis:**	• The pupil analyzes the cause and effect of pollution. • The pupil conducts a survey on the present pollution scenario.
• **Evaluate:**	• The pupil designs a pollution free environment. • The pupil debates on the effect of pollution on human life.
• **Create:**	• The pupil creates a plan for generating awareness on pollution. • The pupil constructs rules for reducing pollution.

Registration phase:

Dream Box: Students make and interpret an artwork on pollution. They present pictures captions on pollution creatively. They prepare an outline on pollution, plan suggestive measures to reduce pollution and finally prepare a booklet highlighting pollution. The aim of the activity is to comprehend pollution and types of pollution

and be able to identify, modify and transform the mind's eye of the visual world. (**Visual/ Spatial**).

Wondrous World: The teacher reads a story on pollution and students describe pollution, they make a glossary of words associated with pollution based on their understanding. They scan the newspaper articles on pollution and respond to the article. They create a slogan on pollution awareness. Words become wisdom in this activity the aim is to develop the vocabulary skills among students. (**Verbal/ Linguistic**)

Mission Pollution: The students identify the pictures and dramatize on pollution and its effects, they use signs and symbols to depict various aspects on pollution, and the students analyze and categorize different pollution effects and causes. The students develop a programme to reduce pollution and also design a cover page for their school magazine on the theme "Pollution". The aim of this activity is to bring awareness among the students on the causes and effects of pollution and sensitize the students the harmful effects of pollution through tactile experiences. (**Bodily/ Kinesthetic**)

Degree Impact: The students recall the pollution caused by them in their daily life, they discuss the cause and effect of these pollution are expressed either in pictorial or verbal form. The teacher asks them to rearrange the things in the house to reduce pollution and provide adequate reasons to it. The students debate on the rearrangements and evaluate it with a practical point of view. The students are asked to create a dream house with the things they want or do not want keeping in mind the energy crisis. The aim of this activity is keen observation from each students view point. (**Intrapersonal**)

Quiz-Inator: The students poses himself/ herself as a media reporter and interviews few teachers on pollution issues, they prepare a new broadcast/ story on it. They develop a set of 5 criteria on pollution, causes and effects and survey students. They then analyze the problems based on different perspectives of student response. The students collect advertisements from newspapers and magazine and explain them. Finally create an advertisement to ensure pollution awareness. The aim of this activity is to encourage working in groups, communication, information sharing, and observation. (**Interpersonal**)

Gap the Map: The students identify pollution level on the map and predict the effects; they make a mind map on it. They students conduct a survey in school on pollution; they interpret the results and analyze it. The students also present it graphically. The aim of this activity is to develop the ability of understanding the world through cause effect relation and reason out. (**Logical/ Mathematical**)

Feeding for Future: The student identifies the pollution in their locality. The students give examples of health hazards present there. They record two different localities and their impact on the environment. The students distinguish between village life and city life and design a pollution free environment. The students imagine and describe spending a day in the forest. This aim of this activity is to identify choices and explore ways in reducing the impact to sustainability issues by understanding the world through environment. (**Naturalistic**)

Juke Box: The students identify the different sounds and write a rap on the sound heard. They demonstrate various sounds in their daily life and discuss about them. The students write a poem on pollution, they debate its effect on human life and finally create a simple noise friendly appliance. The aim of this activity is to be sensitive to rhythm. (**Musical**)

Verification phase:
- The pupil defines Pollution and types of Pollution.
- The pupil gives examples of Air, Water and Noise Pollution.
- The pupil explains the cause and effect of Air, Water and Noise Pollution.
- The pupil prepares a questionnaire for the survey on pollution.
- The pupil creates slogan on Pollution awareness.
- The pupil prepares a booklet highlighting the causes and effect of pollution.
- The pupil creates a simple alternate noise friendly appliance.
- The pupil represents a mind map on pollution cause and effect.
- The pupil designs a dream house with limited and essential things to reduce pollution.

Students Opinions:

- The teachers ask the students to share their experiences on the topic taught.

- The teacher asks the students to express their view on the methodology used to transact the topic.

- The teacher asks the students to share their views on the activities that were conducted during the process of teaching – learning.

- The students comment on the likes/ dislikes on certain activities that were used. They also express their difficulties if any encountered during the conduct of these activities.

- The students give suggestions on the activities used or even on the entire process of the teaching- learning situation.

Exit phase (Day 4):

- The researcher administers a post-test of 50 marks for 2 hours on unit Pollution.

Transactional phase /entry behaviour (Day 4):

Teacher behaviour:

The teacher provides general instruction to the students about the conduct of the lessons.

Learner behaviour:

- The pupil participates in the classroom activities.
- The pupil writes the notes given in the class.
- The pupil prepares the verbally of what they have learnt.

Educational Objectives as given by Revised Bloom's Taxonomy:

• **Remember:**	• The pupil recalls pollution and types of pollution.
• **Understand:**	• The pupil classifies the different types of pollution, • The pupil explains the causes of pollution.
• **Application:**	• The pupil gives reasons for pollution hazards, • The pupil demonstrates the effects of pollution.
• **Analysis:**	• The pupil analyzes the cause and effect of pollution. • The pupil conducts a survey on the present pollution scenario.
• **Evaluate:**	• The pupil designs a pollution free environment. • The pupil debates on the effect of pollution on human life.
• **Create:**	• The pupil creates a plan for generating awareness on pollution. • The pupil constructs rules for reducing pollution.

Registration phase:
- The teacher explains the Meaning of Pollution,
- Teacher illustrates the Types of Pollution – Air, Water and Noise.
- Teacher explains the causes and effects of Pollution.
- The teacher uses visual aids and discusses the impact of high pollution levels on human life.

Verification phase:

- The pupil defines Pollution, types of pollution.

- The pupil gives examples of Air, Water and Noise Pollution.

- The pupil states the cause and effect of pollution.

Exit phase   (Day 5):

- The researcher made a post-test of 50 marks for 2 hours on the unit Pollution. This post-test was administered.

Statements	Very High	High	Medium	Low	Very Low
General Classroom Behaviour					
1. Positive Body Language.					
2. Consistent Focus					
3. Verbal participation					
4. Classroom Interaction					
Activity Based observations					
1. Students Confidence					
2. Clarity of Learning					
3. Individual attention/					
4. Meaningfulness of work assigned					
5. Rigorous thinking					
6. Performance orientation					
7. Students participation					
8. Group cohesiveness					
9. Group compatibility					
10. Fun and excitement					
11. Differentiated instructions					
12. Class presentation					

APPENDIX 5
LIST OF TEACHERS

S. No	Name	School	No. of Years of Teaching Experience
1	Mrs. Reena	Ryan International School	18 yrs
2	Mrs. Aditi	SGKM International	5 yrs
3	Ms. Nirmala	OLGC School	19 yrs
4	Mrs. Anuradha	RBK International	6 yrs
5	Mrs. Reshmi	St. Lawrence	15 yrs
6	Mrs. Archana	Cambridge	21 yrs
7	Ms. Christabelle	OLGC School	19 yrs
8	Ms. Nellima	St. Anthony	12 yrs
9	Ms. Susan	OLGC	16 yrs
10	Mrs. Khan	St. Joseph	15 yrs

APPENDIX 6
SCIENCE QUESTION PAPER (ENERGY)

DATE: _____   TIME: 1 ½ HR.
                                                          MARKS: 50

General Instructions:
1. Attempt all the questions. Options are provided.
2. Marks are written besides each question.

Q1. Choose the correct answer.
(1/2 X 6 = 3m)
1. Which sector of our society consumes the most energy?
   a) Transport   b) Residential   c) Industry.
2. Can energy be created or destroyed
   a) Yes   b) No.
3. Electricity consumption is measured in
   a) Kilowatt-hours   b) Volts   c) Watts.
4. Which type of electricity consumption uses the most energy
   a) Lighting   b) Heating water   c) Heating and cooling rooms.
5. Most energy conversions produce
   a) Motion   b) Heat   c) Light
6. All our energy in the world comes from
   a) Food   b) Sun   c) Inside the Earth

Q2. State whether it is True or False, if False give the correct statement
(1X2 = 2)
1. Potential energy is energy of motion._____
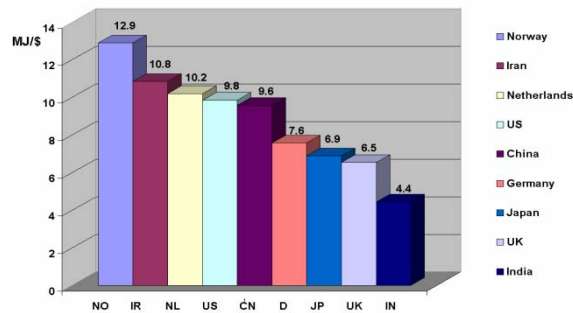2. When light hits a surface it is absorbed. _____

Q3.Name the following
(1X3= 3)
1. Energy that can be easily and quickly refilled. _____
2. Accumulation of gases in atmosphere stopping the sun's heat to go into space.
   _____.
3. Solar energy is _____ energy source.

Q4. Explain Kinetic and Potential energy sources with example.
(4)

Q5. Interpret the graph and answer the following
(1X4 = 4)

1. Which country has the highest energy consumption?
2. Which country shows the lowest energy consumption?
3. Why is there a difference between China and India energy consumption in spite of large population?
4. Suggest 2 possible solutions to handle energy crisis.

Q6. Can you give an example of Renewable and Non- Renewable energy sources and state its importance
(4)

Q7. What do you think could have happened on: (any 2)
(2X2 = 4)
   a) If there was a day of power cut.
   b) If energy was sold for money.
   c) If the sun did not rise for 10 days.

Q8. State any 2 energy sources as the 'best' sources of energy for the world and explain why you chose it.
(4m)

Q9. Comment on any 2 based on the information given below:
(2X2= 4m)
   a. Solar cookers consume 7% less energy as compared to normal pressure cookers.
   b. In a house energy is consumed simultaneously and irrationally.
   c. If non-renewable energy sources are depleted.

Q10. Answer the following in brief
(4X4 = 8)
   a) If energy consumption increases to a large extent, what might the ending be
   b) Explain how planting trees can alter the greenhouse effect and reduce global warming?

Q11. Answer the following:
(2x3= 6m)
    a. Do you think energy check is good or bad, give reasons for your response?
    b. What changes would you recommend in your family in use of electricity?
    c. What influence will limited energy sources have on our lives?

Q12. Express your views
(2X2 = 4).
    a. A slogan to sensitize energy crisis.
    b. A set of instructions to check energy consumption in our daily lives.

SCIENCE QUESTION PAPER (POLLUTION).

DATE: _____   TIME: 1 ½ HR.
                                           MARKS: 50

General Instructions:
 1. Attempt all the questions. Options are provided for some questions.
 2. Marks are written besides each question.

Q1. Fill in the blanks.   (1/2 X 4 = 2m)
 1. Cleaning of water is a process of removing _____
 2. Waste water released by houses is called _____
 3. The unwanted sound is called _____
 4. Smoke causes _____ pollution.

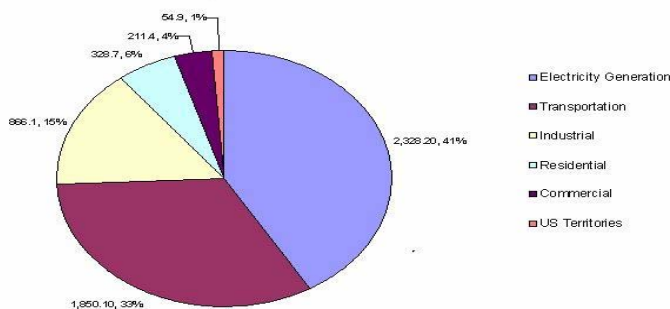Q2. Name the pollution shown in the picture (1X3 = 3)

 a)   b)   c)

 _____   _____
 _____
Q3. Define pollution (2)
Q4. Explain in your own words cause and effect of any one pollution. (3)
Q5. Interpret the graph and answer the following (1X5 = 5)

 1. Which sector produces maximum pollution?
 2. Which sector produces least pollution?
 3. What percentage of pollution is generated in residential sector?
 4. Suggest 2 possible solutions to reduce pollution at home.
 5. Name 2 sources that contribute to pollution from the transportation sector

Q6. Distinguish between Air pollution and Water pollution. (6m)

Q7. Answer any two of the If …… then… statement.. (2X2 = 4)
   a) If household waste could be recycled at home.
   b) If sounds were changed into actions.
   c) If more trees are planted.

Q8. Group the below mentioned on the basis of the pollution and state its features. (3m)
   Leaves, Grass, Litter, Oil, Chemicals, Pesticide, Animal waste, human waste, horn, factories, petroleum, Mining, Mill plants, Radioactive fallouts, construction, transport system, vehicle noise, aircraft noise.

Q9. Give Reasons for- (any 2)   (2X2= 4m)
   a) Noise pollution may gradually lead to partial deafness.
   b) Water stagnation leads to increase in health hazards.
   c) Smoke emitted from industries causes asthma.

Q10. Answer the following in brief any 4 (4X2 = 8)
   a) If pollution levels increases to a large extent, what might the ending be
   b) Which factors would you change to reduce pollution?
   c) What is the impact of pollution on ecology?
   d) Do you think pollution check is good or bad, give reasons for your response?
   e) What influence will pollution have in our lives?
   f) Which effects could have been avoided if timely pollution control measures were implemented?

Q11. Answer any two of the following: (2x3= 6m)
   a) e a list of disposable products that are used by you and how it can be replaced
   b) Frame a set of 10 questions for an interview on Pollution.
   c) Draw picture to illustrate on any one pollution and discuss the pros and cons of the same.

Q12. Express your views (2X2 = 4).
   a) A slogan/ jingle to create awareness of Pollution hazards.
   b) List 5 things you would do to for pollution – free day.

APPENDIX 8
LIST OF EXPERTS

S. No	Name	College
1.	**Dr. Vasundhara Padmanabhan**	K.J.Somaiya Comprehensive College of Education, Training and Research.
2.	**Dr. Jayashree Ramanathan**	Pillai's College of Education and Research
3.	**Dr. (Ms)** Lubna J. Mansuri	Bombay Teachers' Training College of Education.
4.	**Dr. (Mrs.) Rukmini Jamdar**	Seva Sadan College of Education
5.	**Dr. (Mrs.) Judy**	Gandhi Shikshan College of Education
6.	**Dr. (Mrs.) R. K. Shewkani**	Seva Sadan College of Education