CHAPTER I

INTRODUCTION

“I never teach my pupils. I only attempt to provide the conditions in which they learn”.

- Albert Einstein

1.1 Introduction

All living creatures are profoundly intelligent as they are endowed with a unique set of sensory mechanisms. Every living creature is therefore, designed to study, experience and evolve in the environment they are in, primarily to enhance their chance of survival. Humans, as other living beings are born to learn well and survive well but in a manner in which various objects and events around them awaken their curiosity, stimulate their creativity, develop their knowledge, enhance their inherent skills, interests and attitudes, and even influence their social behaviours and interactions. While man’s learning potential, based on the integrated use of his senses, is immense, it is no mean task to facilitate his learning process in an efficient and effective manner.

The formal educational system, spanning over thousands’ of years has undergone several changes continually to keep the learning process simple, accessible, effective, efficient and productive. Apparently this makes the educational process a very vital link between an individual, his society and the universe he lives in. Therefore it is a dynamic and living process.

In our ancient Indian system of education, the gurukula system, wherein the student learns by living with his expert-teacher in his own household during his growing up years is considered a very efficient model to impart knowledge. Held in highest regard, a guru is a visionary guide in teaching and shaping not just students’ skills but also their values and personality. Here, a guru was seen as the sole architect of a child’s destiny.

Later, during the course of time, the ancient gurukula system has transformed into the present educational system wherein the child-learner spends learning and living part-time with family members and part-time with teachers simultaneously. This system aims to provide a learning environment for a child-learner in a balanced manner.

In many developing and under-developed countries, especially, the conventional method of teaching does not employ an active and healthy interactive style of learning
between a student and his teacher. Most students with minimal teacher-student interaction find the conventional method of teaching very discouraging as it is not compliant with their brains’ natural learning process. Most teachers too conveniently assume that their role as educators is to dump arbitrary bits and pieces of information inside a student’s brain rather than facilitating a learning process to help children acquire, assimilate and process good knowledge in various subjects. Often, it involves the teacher dominating the entire teaching-learning process, thereby inhibiting the learning potential in a student.

An ideal learning set-up for a child should aim at bringing a balanced and holistic development of a student by laying particular emphasis on developing his self-analytical skills as well as his interactive-learning skills by working together such as with parents, teachers and siblings, in pairs and in groups. A classroom set-up should be to stimulate such facilitation on a small scale with a small set of students wherein the students are active participants in the learning process.

The International Commission for the Twenty-first Century, submitted in a report (Delors, 1996) to UNESCO, ‘Learning: The Treasure Within’, reflects on the four pillars of learning as 1. ‘Learning to know’ (which develops one’s thinking skills, arouses one’s curiosity, experience the pleasures of research and discovery), 2. ‘Learning to do’ (which involves acquisition of practical skills and equipping one to do the different types of work), 3. ‘Learning to be’ (which enables one to solve one’s own problems critically, analyse and make one’s decisions and also act responsibly. 4. ‘Learning to live together’ (which develops an understanding of self as well as others through dialogue and interactions, appreciating human diversity as well as similarities and existing interdependently).

1.2 Essentials for Effective Teaching – Learning Process

Henry Adams, a famous 19th century historian and teacher quoted “A teacher affects eternity, he can never tell where his influence stops”. There are several examples in history which can be mentioned as proof for this quote (Ekalavya – Dronacharya in Mahabharatha; Dr. Radhakrishnan, former President of India remembered for his teaching learning). It is very true that a teacher wields enormous power and influence in shaping the mind of a student. Therefore, inorder to teach a student in an effective manner, a teacher should be well-versed in the subject matter as well as be adequately equipped with educational resources.
A good teaching strategy should be capable of assessing the students’ inherent interests and also be able to assist them in their own creative pursuits in various fields of study. It is important to note that, for different types of subjects to be taught effectively, it is not enough to have only good teaching methods (which merely serve as a general plan of action for the teacher), but also to have a good teaching. Such a teaching approach is more likely to motivate students to learn their subjects more enthusiastically.

1.3 Learning Strategies

In addition to teaching strategies there should be focus also on good learning strategies, which will help the students to improve upon their assimilation of the subject matter, a deeper understanding of the concepts, as well as retain acquired knowledge for their suitable usage. Employing good teaching and learning strategies combined will facilitate an effective process of interaction between a teacher and a student. A national survey conducted by Indiana State University, with nearly 81,000 students, has revealed that students prefer activities that involve more interaction with teachers and peers (Yazzie-Mintz, 2010; Wachob, 2012).

Learning strategies are unique sets of well-defined instructions to carry out teaching activities in a particular subject. Such strategies are often defined after considerable amount of research and tests are carried out using available information, knowledge base of the subject and existing educational models. In fact implementing such research-based instructional strategies which involve more practical ‘hands-on’ training and learning sessions for teaching scientific subjects improved students’ academic performance (Favre, 2007; Fine, 2003).

In order for teachers to properly use such research-based instructional strategies, it is important that the educational system provides and supports them with teacher training programmes to continually develop their teaching skills. This will involve both updating their knowledge about the subject as well as learning about updated research-based teaching/learning strategies. When using research-based strategies, especially, a clear understanding about the theoretical basis for the research conducted will help a teacher to practice using them more effectively.
From ancient times man has been trying to understand human brain. The last two decades of the 20\textsuperscript{th} century were the ‘Decades of the Brain’ with landmark discoveries related to brain research on human learning. Due to advanced technology, our understanding of how human brain learns has radically developed. Even though we are in the 21\textsuperscript{st} century, our education system is still struggling to apply these brain researches to human learning in the classroom. Hence, one should understand how the human brain learns, the strategies implemented and the results of brain researches on learning principles of the brain.

An appropriate learning environment with organization of the space, daily routines and schedule of the classroom and the social and emotional atmosphere, which makes all children feel safe and comfortable, helped to become independent and confident learners. “Schools and classrooms are demanding environments because so many different personalities gather together in a confined area where they are expected to interact according to established rules of accepted emotional and social behaviour”(Sousa, 2015). This kind of social environment can be promoted through Brain-Based Learning.

1.4 Brain-Based Learning

Brain-based learning has been called a combination of brain science and common sense. Hart (1983) called the brain ‘the organ of learning’. Brain-Based learning is a comprehensive approach to instruction based on current research in neuroscience which suggests how our brain learns naturally. This type of education provides a biologically driven framework for teaching and learning, and helps explain recurring learning behaviours. It is a meta-concept that includes an eclectic mix of techniques. Currently, these techniques allow teachers to connect learning to students’ real life experiences. This form of learning also encompasses such educational concepts such as mastery learning, learning styles, multiple intelligences, cooperative learning, practical simulations, experiential learning, problem-based learning, movement education, etc.

This concept provides us to think about the structure of our brain at the stage of decision making. Thanks to the knowledge of our brain that better decisions can be made to reach much more students. In short, Brain-Based Learning is to learn with the brain in our mind (Jensen, 2000).
1.5 Academic Achievement

The academic achievement of an individual depends on the variables of cognitive, affective and social-familial fields. Intelligence is a manifestation of cognitive ability with reference to one's academic achievement. Denton (2010) found that when the teachers implemented brain-based strategies into the learning environment, the students’ success increases and they were more likely to continue utilizing those strategies in future lessons. Helping teachers better understand the connection between the environment that they provide, and students’ academic success, may lead to more effective teaching practices (Fitzsimmons and Lanphar, 2011; Wachob 2012).

One’s intelligence has a direct link with the scientific vocabulary and scientific knowledge acquired by a person. For effective science learning, one has to think creatively, reason abstractly, make inference from data and understand relationship (Philip, 2008). These factors of achievement in science have close association with intelligence. Thus, achievement in science is an indicator of cognitive ability.

1.6 Creativity

Creativity is derived from the Latin word ‘Creatus’ literally ‘to make into observance’. Creativity is manifested in the production of a creative work. Creative people view things in new ways or from different perspective also attributed to divine intervention, cognitive traits and chance and may be traits acquired at birth or taught with the application of simple techniques.

Sternberg (1985) proposed that creativity is one type of intelligence. Creative intelligence is the ability to go beyond the given data to generate novel and interesting ideas. Thus, creativity is the higher order intelligence that helps a person to translate ideas into practical accomplishments. According to Guilford, “Creativity sometimes refers to creative potential, sometimes to creative production, and sometimes to creative productivity”. Here creative potential means the personal disposition of the individual in which there are some more or less permanent qualities which help him in creative thinking. Creative thinking leads to new ideas. Creative production means the processes of productive thinking. Creative productivity means productivity according to socially confirmed forms of words, thoughts and phrases” (Sharma and Sharma, 2006, p.474).
Guilford (1967) presented the intellectual factors of creativity as:

(i) Fluency (word fluency, ideational fluency, associational fluency and expressional fluency)
(ii) Flexibility (spontaneous flexibility and adaptive flexibility)
(iii) Originality
(iv) Elaboration
(v) Redefinition
(vi) Sensitivity to problems

Creativity is a multi-dimensional (verbal and non-verbal) attribute ‘differentially’ distributed among people and includes chiefly the factors of fluency, flexibility, originality, seeing problems, inquisitiveness and persistence. Creativity is the application of knowledge and skills in new ways to achieve a valued goal. To achieve this, the learners must have four key qualities such as

- The ability to identify new problems, rather than depending on others to define them
- The ability to transfer knowledge gained in one context to other in order to solve a problem
- A belief in learning as an incremental process, in which repeated attempts will eventually lead to success
- The capacity to focus attention in the pursuit of a goal, or set of goals (Seltzer and Bentley, 1999).

1.7 Stages involved in Creativity

Wallas (1926), a forerunner in creativity theory, proposed four stages of creative thought

- **Preparation** – the stage in which the problem is investigated.
- **Incubation** – the stage in which the problem is thought about unconsciously.
- **Illumination** – the stage in which ideas come together to form a possible solution.
- **Verification** – the stage in which result is evaluated and deemed acceptable.

Creativity is important for the individual, for society and for the economy. For individuals, creativity is the central part of what is to be human. Unless we help young
people to develop their innate desire to be creative and their innate capacity to create, we fail to educate them as whole and complete individuals (Sarsani, 2005, p. xii).

Children are naturally creative but we need to nourish their creativity. Activating sensory spaces encourage them to experience new things and give opportunities to play and learn in their own way thereby making them more confident about their own creativity. The creative spirit of children should be identified and stimulated. Creativity enhances the problem solving capacity, metacognitive and critical thinking of learners. Creativity includes processes that promote planning, producing and generating original scientific contributions. So, when we analyse the achievement of a learner, it is imperative that his creative talents are also assessed.

1.8 Need for the Study

Learning is a lifelong process. All learning is undoubtedly brain-based. Every one’s brain is unique. The stress and strain of modern day living, coupled with the mammoth-sized information that has to be remembered, puts considerable pressure on the brain. This results in poor memory, subsequent tension and failure. If the knowledge that the brain takes is perceived in a threatening way as physically and psychologically, rational/logical thinking process is closed, and in the situation of war or escape, hypothalamus and pituitary glands team up in order to secrete adrenaline. This initial automatic reaction is good for escaping from danger but lessen the learning (Dwyer, 2002; Duman, 2006).

The present education system emphasizes on memorization rather than thinking but the crux of education is to develop cognitive abilities and thinking power of students. Conventionally, students receive information mainly through input given by teachers in the classrooms. The outcome of a teaching learning activity depends on how the learners perform and interact with the information. At the end of an educational activity, the development of the concepts is judged and the teaching learning process is evaluated. In general, the conventional method of teaching generates surface knowledge, entails rote-memorization of facts promotes one-way communication, lacks in interaction between students and teachers making learners passive, works by presenting content formally and orally. The performance of the learners can be improved if they are taught through a teaching method which is based on a maximum activation of innate faculties of the human brain.
A well planned and properly implemented system of education plays a significant role in laying down proper foundation of the child’s cultural, emotional, ethical, moral, intellectual, physical, social and spiritual development. National Curriculum Framework (2012) expects that teachers are encouraged to set up learning environments which appeal to children’s interests, are relevant to their day-to-day experiences and can be explored in innovative and challenging ways. Direct, hands-on experiences encourage interaction, engagement and involvement which in turn lead to improved understanding, recall and the development of mental representations. This approach supports children and young people as they move from concrete, tangible experiences to symbolic and abstract notions. As children develop their learning, dynamic learning environments provides a context for dealing with issues in depth and from multiple perspectives. If one follows this, then basic approach of teaching-learning will be changed.

Therefore an appropriate learning strategy is necessary to gear up and develop the thinking abilities of students based on the innate faculties of the human brain. The learning should make a difference in one’s skills rather than mere rote learning or memorization. One such strategy that can promote this idea is Brain-Based Learning. Lessons in a brain-based classroom are highly interactive and meaningful, which enhances the multiple intelligences. The environmental climate of a classroom includes the relationship between the students and the teacher, as well as, the relationship between the students themselves (Avant et al., 2011). These relationships or experiences evoke emotions, motivations, and physiological responses; all of which influence academic success (Barkley, 2010; Wachob, 2012).

Brain-Based Learning Strategy provides a safe and threat-free environment whereby the meaningful presentation of content prepares the learners’ brains to store, process and retrieve the information in a soothing way (Aziz-ur-Rehman et al., 2012). Brain-based research suggests that when students explain what they have learned, they use the whole brain to do it, which makes long term storage and retrieval of information more efficiently (Wilson, 2004; Chavhan, 2012). Brain-Based Learning Strategy stimulates the whole brain for effective function which results in greater academic progress, including reading comprehension, oral reading fluency, spelling, creative writing, math computation, problem solving, memory, accuracy focus and attention and higher scores of test results.
1.9 Significance of the Study

The investigator while working in a school as a teacher realised that the present learning strategy focused more on getting marks in the exams. The students became frustrated and found school work difficult because they did not have enough cognitive skills required to process information properly. It is impossible to reach every student in the classroom by using only one instructional strategy (Eggen and Kauchak, 2001). The investigator strongly felt that an awareness of modern instructional strategy is essential for the development of students. Hence a holistic and multidisciplinary approach will increase the learning potential of every child.

The review of related literature indicated that various studies conducted abroad showed that the Brain-Based Learning had a positive effect on achievement. But in India only very few researches dealt with Brain-Based Learning. The investigator was curious to know whether Brain-Based Learning has the same impact on achievement in India also. Studies conducted on creativity dealt with variables such as academic achievement, achievement motivation, critical thinking, communication skills, personality and adjustment. But the investigator did not come across any study dealt with Brain-Based Learning and creativity. So the investigator made a study combining the dependent variables (Academic Achievement and Creativity). The investigator was of the impression that the Brain-Based Learning Strategy will impart better student achievement and creativity. Therefore the investigator undertook the problem of evaluating the effect of Brain-Based Learning Strategy on academic achievement and creativity among secondary school students.

1.10 Statement of the Problem

Recognising the significance of fostering creativity and improving academic achievement among secondary school students, the investigator attempted to find out the effect of Brain-Based Learning Strategy on academic achievement and creativity. Hence, the present problem is entitled as “The Effect of Brain-Based Learning Strategy on Academic Achievement and Creativity among Secondary School Students”.

1.11 Operational Definition of the Key Terms

The key terms in the title of the study are defined as detailed below.

Effect

According to Webster’s New World Dictionary (2003), the meaning of the word ‘effect’ is influence. The investigator had made an attempt to study the effect of Brain-Based Learning Strategy on the students in terms of academic achievement and creativity.
Brain-Based Learning

According to Jensen (2014), “Brain-Based Learning is all about: knowing how our brain works, then using that to foster better student outcomes”. In this study, the term ‘Brain-Based Learning’ refers to an instructional approach of using a group of practical strategies that are driven by sound principles derived from brain research.

Strategy

According to Webster’s Third New International Dictionary (2002), in the systematic approach to teaching and learning, strategy is concerned with the way in which the content is presented in the instructional environment. In this study, the ‘strategy’ refers to an eclectic mix of Brain-Based Learning Strategies. The Brain-Based Learning strategies used in the present study are KWL (What you Know, What you Want to know and What you Learned), Thematic Instruction, Concept mapping, Graphic organizer, Project Based Learning, Expository learning, Mind Mapping, Reciprocal teaching, 4 MAT (4 Mode Application Techniques) model, Real life dilemma, Cooperative learning (Think–Pair-Share and Round Robin Brainstorming), Case Based Learning, Problem solving and Role play.

Academic Achievement

According to the New Lexicon Webster's Dictionary (1990), achievement is something carried out successfully, the act of achieving. In the present study, achievement refers to academic achievement in science of secondary school students.

Creativity

Torrance (1965) defined creativity as “the process of sensing problems or gaps in information, forming ideas of hypotheses, testing, and modifying these hypotheses, and communicating the results. This process may lead to any one of many kinds of products-verbal and nonverbal, concrete and abstract”. In the present study it denotes various aspects of divergent thinking ability estimated through its accepted characteristics, viz., measures of fluency, flexibility, originality, elaboration and redefinition and sensitivity to problems.

Secondary School Students

The term ‘secondary school students’ is used to refer students attending in any one of the educational standards VIII, IX, and X. For the present study IX alone was considered as representative of the three standards.
1.12 Variables

The variables of the present study are explained below

Independent Variable

The independent variable of the study is Brain-Based Learning Strategy.

The other variables considered for the study are gender, locale and type of school.

Dependent Variable

The dependent variables of the study are the Academic Achievement and Creativity.

1.13 Objectives of the Study

The major objectives of the study were to:

1. Prepare Brain-Based Learning lesson transcripts for teaching the unit ‘Addiction and Healthy Lifestyle’ for the secondary school students.

2. Construct and validate an achievement test and test of creativity for the secondary school students.

3. Find out the effect of experimental group (Brain-Based Learning Strategy) and control group (Conventional Method) on academic achievement and creativity of secondary school students.

4. Compare the effect of experimental group and control group on academic achievement and creativity with respect to gender, locality and type of school.

5. Examine the relationship between the academic achievement and creativity of experimental group and control group.

6. Estimate the effect size of Brain-Based Learning Strategy on academic achievement and creativity.

1.14 Hypotheses of the Study

1. There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample and also with respect to gender, locality and type of school at the pre test level.

2. There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample and also with respect to gender, locality and type of school at the post test level.
3. There is no significant difference between the pre test and the post test of the experimental and control groups in terms of achievement scores for the total sample and also with respect to gender, locality and type of school.

4. There is no significant difference between the experimental group and the control group in terms of achievement scores for the total sample and also with respect to gender, locality and type of school at the adjusted post test level.

5. There is no significant difference between the experimental group and the control group in terms of creativity scores for the total sample and also with respect to gender, locality and type of school at the pre test level.

6. There is no significant difference between the experimental group and the control group in terms of creativity scores for the total sample and also with respect to gender, locality and type of school at the post test level.

7. There is no significant difference between the pre test and the post test of the experimental and control groups in terms of creativity scores for the total sample and also with respect to gender, locality and type of school.

8. There is no significant difference between the experimental group and the control group in terms of creativity scores creativity for the total sample and also with respect to gender, locality and type of school at the adjusted post test level.

9. There is no significant relationship between academic achievement and creativity of experimental and control groups for the total sample and also with respect to gender, locality and type of school.

1.15 Scope of the Study

“Learning takes place through interactions with the environment around nature, things and people, both through actions and through language. The physical activity of moving, exploring and doing things, on one's own, with one’s peers or in the company of adults, and using language- to read, to express or ask, to listen and to interact -are the key processes through which learning occurs. The context in which learning takes place is thus of direct cognitive significance” (National Curriculum Framework, 2005). One of the main problems faced by the teacher is to challenge the active learners. The present study has been specially envisaged to study “The effect of Brain-Based Learning Strategy on academic achievement and creativity among secondary school students”.
In short, the results of the study would be of immense value in understanding the relative merits of strategies. It would definitely help the teachers and students to create robust and well designed sound learning strategies pedagogically. The findings would ensure the students to be resilient, resourceful and lifelong learners. Thus it enhances learners’ cognitive achievement. It is also presumed that the findings of the study will promote the use of effective and innovative instructional strategies. This will help the students to structure their schemata of conceptual knowledge making them better and creative learners. The investigator hopes that the study would be beneficial to improve curriculum transaction and evaluation.

1.16 Delimitations and Limitations of the Study

The experimental studies in general have limitations and delimitations due to many factors. It is the responsibility of the investigator to see that the study is conducted with maximum care in order to be reliable.

Delimitations

1. The investigator could not implement all the Brain-Based Learning Strategies. It does not include other strategies like Semantic maps, Collaborative learning, SQ3R chart etc.

2. The study was confined to only four schools in Coimbatore district.

3. Only IX standard students were considered for the study.

4. The study was carried out in schools affiliated to State board and not with any other boards like CBSE, ICSE, IGCSE.

5. The learning strategy was conducted for teaching science subject only.

6. Only one unit ‘Addiction and Healthy Lifestyle’ was chosen for the study.

7. Only two variables namely academic achievement and creativity were taken for the study.

8. The sample selected for the study was limited to 156 students only because of insurmountable practical difficulties while conducting the experimental study.
Limitations of the Study

Maximum effort had been taken to make the study precise, and successful.

Despite the delimitations, utmost care was taken by the investigator to carry out the research in order to make the study a reliable and an objective one. It is hoped that the results of the present study would help researchers, teachers and learners to open up new vistas in education.

1.17 Organisation of the Report

The research study is reported in five chapters as per the details given below:

Chapter - I – The introductory chapter starts with introduction, need, significance, justifying the selection of the topic, states the topic, defines the terms involved in the statement, mentions the variables, objectives, hypotheses, scope, delimitations and limitations of the study.

Chapter - II – Gives an account on the theoretical overview of Brain-Based Learning and studies connected with the problem.

Chapter - III – Discusses the method adopted for the study, variables of the study, population of the study, sample selected for the study, tools used for the study and the statistical techniques used.

Chapter - IV – Gives the details regarding the analysis of the data, the results and their interpretations.

Chapter –V – Reports the finding in a consolidated form gives recommendations and implications of the present study and guidelines for future research.

Following these five chapters, were given a detailed Bibliography and Appendices.