

A STUDY ON THE EFFECTIVENESS OF BRAIN-BASED- LEARNING OF STUDENTS OF SECONDARY LEVEL ON THEIR ACADEMIC ACHIEVEMENT IN BIOLOGY, STUDY HABITS AND STRESS

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ABSTRACT

The challenges of the millennium teachers across the globe are numerous. To address them teachers need to be well equipped and should have special tools in her covets. The broad aim of this paper is to deliberate upon innovative teaching methodology i.e., brain-based learning to the academic community and give insights on how an innovative approach can address the global educational challenges and how the classrooms can be converted into interactive challenging learning environments. This study focused on effectiveness of brain-based learning on academic achievement, study habits and stress of students at the secondary level. The researcher used Quasi- Experimental method and the design adopted is factorial design- the pre-test, post test quasi-experimental design. The research asserts that brain- based learning as self-perpetuating neurocognitive approaches towards, unadulterated joys of learning which results in ‘learning celebrations’. Hence the researcher recommends the intensive application of this approach for the effective classroom transactions. Further, the researcher advocates the academicians and educators to familiarize this approach across the globe for the betterment of the learner community.

KEYWORDS: Brain-Based- Learning, Academic Achievement, Study Habits & Stress

INTRODUCTION

Teaching is a system of interpersonal interaction between teacher, learner and learning environment. To develop an effective teaching learning process, there are many factors involved which are directly or indirectly related to the learners. Research is the soul progress in teaching and learning situations. In today’s context the teaching and learning process is not simple as learners are exposed to wide experiences and opportunities. Hence to unleash the power and potential of the learners, a robust, fully functioning learning environment is more critical than ever before.

The 21st century challenges demands a change in the roles of teachers, a modified learning environments and classrooms in which learning is more challenging but stress free and friendly environment where learning is more joyful and leads to internalization process. So it is obvious that the learners are at less advantage and will not achieve the wholesome aim of education i.e., all round development of personality if we adopt conventional approaches. Hence researchers and academicians are forced to think of new strategies and revise educational formula to adapt to the changing demands of the learners. Therefore this study is located within the canvas of effectiveness of brain-based- learning of students of secondary level on their academic achievement in biology, study habits and stress.

THE CONTEXT OF THE STUDY

Brain-based learning emerged in the 1980s as a whole new breed of science was quietly developing. By the 1990s it had explored in to dozens of mind boggling sub discipline.

Brain-based learning is a comprehensive approach to instruction using current research from neuroscience. This information has helped to determine how human learning actually occurs. Using the latest neural research, educational techniques that are brain friendly provide a biologically driven framework for creating effective instruction. The brain-based learning is a neuro-cognitive approach towards learning. The brain is the most complex and unique organ we possess. It contains about one hundred billion cells.

“Brain Based education is the purposeful engagement of strategies that apply to how the brain works in the context of education. Eric Jensen (2005)^[1] According to Andrea Spears and Leslie Wilson (2008) Brain Based Learning is a comprehensive approach to instructions based on how current research in neuroscience suggests our brain learns naturally”^[2] “Brain Based Learning is a comprehensive approach to learning based on Neuroscience”. Jensen (June 12, 2008)^[3] Brain-based education emphasizes how the brain learns naturally and is based on what currently know about the actual structure and function of the human brain at varying developmental stages. According to Jensen (1998) brain- based learning is an interdisciplinary answer to the question of, “What is the most effective way of the brain’s learning mechanism?” [4] (Ozden and Gultekin, 2008).Caine and Caine [5] (2002) define brain-based learning as “recognition of the brain’s codes for a meaningful learning and adjusting the teaching process in relation to those codes.” The principles of brain-based learning provide a theoretical framework for effective learning and teaching process, seeking the best conditions in which learning takes place in the brain.

Brain-based learning is learning in accordance with the way in which the brain is naturally designed to learn. It is a multi-disciplinary approach that is built on the fundamental question, "what is good for the brain"? It crosses and draws from multiple disciplines such as chemistry, neurology, psychology, sociology, genetics, biology and computational neurobiology. It is a way of thinking about learning or it is learning with the brain in mind or teaching with the brain in mind^[6].In short, this learning approach is based on the structure and function of the brain. Brain-based learning is concerned with fully understanding the ways in which the brain operates and utilizing this knowledge in maximizing learning potential. Teaching children using brain-based learning methods can be beneficial to students and their developing brains. Thus the researchers undertaken proposed to study the effectiveness of Brain-based learning as a teaching strategy on some of the very important concerns of student’s i.e. academic achievement, study habits and stress.

THE PRINCIPLES OF BRAIN-BASED LEARNING ON TEACHING:

As a result of research on the brain, the following 12 basic principles are determined as the essential structure stones of brain based learning (Caine and Caine, 1994; 1997; Caine, Caine and Crowell, 1999). [7]

- Brain is a parallel operator and it can perform several activities at once.
- Learning is a physiological event and the brain is an organ which is working according to physiological rules.
- Brain tries to give meanings to all the experiences which it receives.
- The search for meaning occurs through patterning.

- Senses have an important place in patterning.
- The brain processes parts and the whole simultaneously.
- Learning involves both Focused Attention and Peripheral Perception
- The learning consists of intentional and inadvertent processes.
- There are two kinds of memory. They are spatial memory system and learning by memorizing heaps system. People have a natural spatial mind that can memorize without experiences and rehearsal.
- Facts and abilities are learned well when they are stored in spatial mind.
- Learning increases with the activities that force the brain.
- Each brain is unique. Teaching should be programmed in a way that the students express their visual, auditory and emotional choices.

There are interactive teaching elements that emerge from the principles of brain-based learning [8] (Caine and Caine, 1999). These are as follows:

- **Orchestrated Immersion:** Orchestrated immersion is the idea that immersing students into a learning environment will help them to absorb the material more fully than they would from a lecture or book.
- **Relaxed Alertness:** An environment of relaxed alertness would be one where children have no fear of repercussions even if they are wrong. This would be a classroom where all answers are acceptable and open discussion that includes brainstorming or using educated guessing is encouraged.
- **Active Processing:** Active processing would be analyzing situations in a variety of ways in order to gain knowledge. Students would use all of their senses and experiences to connect to the material they have to learn.

In the present study, the researcher incorporated all these principles in the different stages of the teaching-learning process. The brain-based learning involves different stages in the teaching learning process like, [5] pre-exposure, preparation,

Initiation and acquisition, elaboration, incubation and memory encoding, verification and confidence check, celebration and integration. Each of the lessons that are developed is specially tuned with the principles of brain-based learning.

The pre-exposure and the preparation phase take care of the principles like; Brain is a parallel operator, Learning is a physiological event and the brain is an organ which is working according to physiological rules, Brain tries to give meanings to the data's that have arrived there and Brain perceives the parts and the whole at the same time.

The initiation and acquisition phase leaves scope for the following principles; Learning includes the information which is taken from both focused directly and additional stimulations, The learning consists of intentional and inadvertent processes, There are two kinds of memory. They are spatial memory system and learning by memorizing heaps system, learning increases with the activities that force the brain, Each brain is unique.

The incubation and memory encoding phase operates with the principles like; Learning includes the information which is taken from both focused directly and additional stimulations, The learning consists of intentional and inadvertent processes, There are two kinds of memory, They are spatial memory system and learning by memorizing heaps system, Facts and abilities are learned well when they are stored in spatial mind.

The verification and confidence check & celebration and integration phases incorporate the principles; Giving meaning becomes by the way of patterning, Senses have an important place in patterning. The learning of the person is affected by the senses as expectation, tendency, prejudice and social interaction, Brain perceives the parts and the whole at the same time.

There are several researches from neuroscience showing the natural functioning of the brain and attempts are made to connect it with the educational practices. Literature is replete with data and research on the functional details of the brain but there is no substantial attempts made to understand the application of brain-research in the field of education. Thus the review of literature shows clearly the need of studies focusing on this edge.

This paper presents the effectiveness of brain- based learning as an instructional strategy in the academic achievements of secondary level students. In addition an effort has also been taken to understand how it affects the study habits and stress levels of the students.

RATIONALE OF THE STUDY

The past two decades witnessed that the students entering the classroom are much different from those who have come before. Today's students are demanding a change in the classroom because of their ability to gather information faster than any other generation. To unleash the power and potential of this new generation, a robust, fully functioning learning environment is more critical than ever before. Converging educational and neurocognitive evidence over the past 30 years indicates that this intermediate step may be syntactic processing, and reveals new strategies which improve the proficiency of the learning environment. With some foundational knowledge about the physiology of the human brain, supported by neurocognitive principles of how the brain learns and cognitive translations of what those brain-friendly strategies look like in the classrooms, teachers are armed with an astonishing arsenal of tools for reaching and teaching all children.

It has been observed that teaching methods and resources used by a teacher can contribute significantly to learning. Hence an innovative practice can set up a knowledge centre in the educational institutions. New methods of teachings are of vital importance to the future developments of the students' academic and personal developments. The innovative methods of teaching takes hold of the traditional system more powerful and dominating, moreover it prepares the learners according to the demands of the global world. An important component in the effective teaching model is the ability to respond positively and proactively to differences among students.

The challenges in education are to determine what makes an enriched classroom environment. Brain research validates that learning should be individually specific and is a natural function of the brain. An analysis of the body of empirical work on this topic shows that this area is one of the most remarkable and fertile areas of theory, research and practice. A careful review of the earlier works carried out in the field indicate that there is not much work that has been done in this area of study. A further analysis revealed that here very little work has been done in India. Hence the investigator realized that any meaningful attempt in this regard will help teachers as well as students to keep them abreast

with the research outcomes.

Review of literature in the Indian context shows that there is dearth of any kind of research on brain-based learning or neurocognitive approaches in the academic forefront. There are some articles written on the importance of brain-research and very few research studies in the area of brain-based learning where are at the international level comparatively more studies have taken place. So the literature clearly shows the need to take up a research study, focusing on its effectiveness in some of the important educational concerns. This is envisaged in the purview of the proposed research study.

REVIEW OF LITERATURE

In any study, review of related literature is of vital importance. According to Best, (1997) —A familiarity with literature in any problem area helps the students to discover what is already known, what others have attempted to find out and what methods of attack have been promising or disappointing and what problems remain to be solved (Best and Kahn, 1986:9). In the present study the researchers analyzed the related literature of all the variables both in the Indian context and also in the international context to get an in-depth understanding of the present problem.

Studies Conducted in India

- **Studies on Brain-Based Learning**

Sylvester,-Robert (2000) studied on applying biological research to classroom management. Lock and Prigge (2002) developed a system of steps for creating a brain based learning environment that was commonly implemented. Baby Mary (2005), conducted a study on the effectiveness of brain –based learning on the academic achievement in biology of VIII standard students. Jacob and Baby Mary (2005) identified brain-based learning as a learner based instructional strategy. They have analyzed the core principles of brain-based learning and the instructional strategies that can be used in a learner centered education. According to Jensen (2008) brain based learning was related to teaching strategies and principles from an understanding of how the brain functions and learning with the brain in mind. The latest research on brain based learning theory drew from multiple disciplines such as Chemistry, Biology, Genetics and Neurology (Jensen, 2008). Brain Based Education considered how the brain learns best and encouraged educators to take this information into consideration as they planned teaching strategies with the goal of more effectively motivating of all types of learners. Kaur (2013) studied the effectiveness of brain based learning strategies on enhancement of life skills among primary school students with internal and external locus of control.

Thus the Indian literature shows brain-based learning as a paradigm shift which benefits the students in their academic as well as personal accomplishments. The literature also shows the lack of identifiable studies in brain-based learning in Indian context.

- **Studies on Study Habits**

Thomas M. Sawyer (1981) studied Indian students' study habits and attitudes. Saxena (1987) conducted a study on self-concept, study habits and school attitude as correlates of Socio – economic status and cultural setting in different divisions and failures of high school students of Kanpur district. Ngailiantum (1988) conducted an investigation into the attitude and study habits related to achievement in Mathematics of class IX students in shilling. Singh (1990) conducted a study of academic achievement of Secondary School students in relation of their study habits and their attitude and

education. Deb and Goewal (1990) conducted a study on relationship between the selected study habits and academic achievement of the final year B.Sc students in the Punjab Agricultural University. Kulshethra (1992) conducted a study on the effect of school environment on adjustment, study habits and achievement of high school student. Shejalal (1998) conducted an investigation into the study habits of college students. Singh Chauhan, Studied study habits of scheduled tribe students, scheduled tribe students (No. = 300) attending grade X at Indian school. Peese Hema, (2008) conducted a study on the self-esteem of B.Ed students in relation to their hemisphericity and study habits. Mukesh Kumar Rajan Dixit (2010) carried out an investigation into study habits & personality related to achievement in English & Hindi medium students.

The analysis of Indian literature on study habits shows that there are sizable numbers of studies conducted in the area of study habits majorly in relation to other variables like self-concept, attitudes and academic achievements, adjustments etc. Hence it is very evident that the variable study habit is of great relevance to optimum educational setting.

- **Research on Stress**

Sharma and Dang (1977) reported that high trait anxiety persons experience greater elevation of state anxiety in situations threatening their self-concept. Ranganathan (1988) studied stress among school children and its' relationship and academic performance. Padmasri (1992) conducted a study on the stressful life events in the school system and educational development in children.

In a study on stress in medical students, Supe (1998) found that academic factors were greater perceived than all other factors as causes of stress, followed by physical and social factors and the emotional factors. Thus it is very evident from the literature that the variable stress is of great interest to the researchers and was focusing on the stressful events in the school, academic factors which causes stress to school children.

STUDIES CONDUCTED ABROAD

- **Studies Related to Brain Based Learning**

Sylvester (2000) opined that education must begin relying more on biology than social and behavioral science. Seng and Alan(2000) studied on the spatial visualization ability and learning style preference of low achieving students Weiss,-Ruth-Palombo (2000) discusses brain research and how new imaging technologies allow scientists to explore how human brains process memory, emotion, attention, patterning, motivation, and context and also explains how brain research is being used to revise learning theories. Boyd,-Michael (2000) presented a paper at the annual meeting of the American Educational Research Association on brain hemispheric consensus and the quality of investment decisions. Wilson,-Frank- (2000) discusses cognitive scientists' and psycholinguists' theories of the origins of consciousness and linguistic expression.

Mc Quillen (2000) focused on the structural and functional relationship of the brain and language. Marcia, (2000) studied recent advances in neuroscience and made attempts on engaging the brain, to influence learning. Videsott, Gerda (2010) studied the human brain's ability to represent and to process several languages. Molfese, Victoria (2010) studied Executive Function Skills of 6-8 year olds brain and behavioral evidence and its implications for school achievement. (2010) conducted a study on naturalistic language exposure and applied a model-free analysis for hemodynamic-response data.

Oztekin, (2009) [8]worked on the working memory retrieval: contributions of the left prefrontal cortex, the left

posterior parietal cortex, and the hippocampus. Ramey Paule, (1998) conducted seven-year study of 39 Alachua Country students from kindergarten to sixth grade indicates that both brain structure and environment is related to the acquisition of skills critical for learning to read.

Caine, R. and Caine (1994) defined the concept "brain- based learning". Brain- based learning is concerned with fully understanding the ways in which the brain operates and utilizing this knowledge in maximizing learning potential. Caine, & Caine, (1994) studied on reinventing schools through brain-based learning. This work challenges educators to move beyond a narrow simplistic approach to teaching and learning towards educational practices that integrate current knowledge with effective classroom practices. Joseph Ledoux, (2000) conducted a study regarding emotion circuits in the Brain. Thomas Insel and Russell D. Fernald, (2002) carried out a study regarding the social information processing in the brain. Parker, (2002) attempt to draw all brain mechanisms that underlie our mental life including cognitive function; such as perception, attention and short-term memory.

Clyde Winters, (2002) studied tremendous interest in applying Brain Based Learning on neurobiological learning in the instruction of students with learning disabilities. Pinkerton David carried out a project in "using brain -based learning techniques in high school science in 1994. Duman (2006) carried out research on the effect of brain-based instruction to improve on students' academic achievement in social studies instruction. Debbie Craig (2007) studied on the application of brain-based learning principles to athletic training education. Joydeep (2009) carried out a research in measuring second language proficiency with EEG synchronization. Jennifer Andrew (2009) studied neural correlates of direct and reflected self-appraisals in adolescents and adults. Molfese, Victoria (2010) reported on executive function skills of 6-8 year olds: brain and behavioral evidence and implications for school achievement.

Norris David (2010) studied functional connectivity between regions involved in learning words of a new language. Videsott, and Barbel; (2010) studied neural correlates of language proficiency in multilingual word production.

Jensen,-Eric Seng (2000) studied spatial visualization ability and learning style preference of low achieving students. Schaverien and Mark; (2000) studied on the Biological basis for Generative Learning in Technology-and-Science and its implications for technology-and-science education. Hence literature review reveals the growing interest to understand the brain- functions and to link it with the various behavioral aspects of students.

- **Studies on Study Habits**

Lisa Powell and Jenny Williams (2002) carried out a study on study habits and the Level of Alcohol Use among College Students. Marisa Lisa Benson, (2008) student study habits and their effectiveness in an integrated statics and dynamics class. Ruth Bugas, Jasmin. Acuña(2009) conducted a research on Study Habits and Attitudes of MCHS. This study was conducted to find out the study skills of Miriam College High School (MCHS) students and to serve as basis for a proposed Study Skills Program. A total of 144 fourth year students who came from the Grade School unit of MC in school year 2007-2008 participated in the study. Tafli, Keskinilic (2009) worked on student perceptions about the studying habits and achievement. De la Fuentea, and Maria Cardelle-Elawarb, (2009) conducted research on action–emotion style and study habits: Effects of individual differences on learning and academic performance of undergraduate students.

Abdullahi (2010) carried out a comparative study of Kwara state secondary school students' study habits in

English language: implication for counseling. Carlo Magno (2010) studied Predicting Grades in Mathematics and English through Study Habits. Donald chin (2010) reported the results of a survey of the study habits of CS1 students. In this survey, students were asked how much time they spent on course- related activities such as reading the textbook, working on problems outside class, using online learning tools, and consulting with their instructor. Orimogunje Tunde1, Oloruntegbe Kunle and Gazi Mahabubul Alam (2010) carried out an investigation into students' study habit in volumetric analysis in the senior secondary provision: A case study in Ondo State, Nigeria.

Oyedeji. carried out research on perseverance, study habits and self-concept as predictors of students' performance in secondary school mathematics in Nigeria. Marcus Cred el and Nathan R. Kuncel (2011) studied Study Habits, Skills, and Attitudes: Harry Blumner and Herbert Richards. (2011) worked on Study Habits and Academic Achievement of Engineering Students. Omotere Tope (2011) studied the effects of study habit on the academic performance of students. Maricris Acido (2011) conducted research on High School Students' Reasoning Skills and their Study Habits and Attitude towards Learning.

Bailey and On wuegbuzi, studied the role of study habits in foreign language courses. Corbin – Sicoli M. L. studied continuity and change in personality, vocational orientation and study habits and attitudes of college students. Gade and others studied the study habits and attitudes of American Indian students- Implication for counselors. Lammers, Onwuegbuzie, studied academic success as a function of the gender, class, age, study habits and employment of college students. Hogen, studied the study habits of adult college students. The study habits of adult college students over age 25 were compared to a group of younger students at the University of Wisconsin, Green bay.

A thorough analysis of the researches in the area of study habits reveals that it is an important factor to consider in the academic context. Researches carried out by Oyedeji, Omotere, Elawarb shows that study habit is an important predictive factor in the academic performance. Hence the literature very clearly indicates the importance of a healthy and positive study habits.

- **Studies Related to Stress**

Several researches have attempted to study stress in students in relation to a no. of variables. The salient findings of these researches have been summarized below:

Gaudry and Speilberger (1971) found that, there is evidence that, anxiety finds to be associated with lower grades and higher dropout rate. Mc Grath (1976) defined stress from a psychological point of view which is an interaction between the individual resources and environmental demands. Spielberger (1979) found that students with high test anxiety find to blame themselves for their poor performance, while low anxious students did not. Petzel and Riddle (1981) maintained that a poor or an overachieved academic performance can serve as a precursor to stress, subsequent depression, and suicidal tendencies. In a meta-analysis of 562 studies, Hembree (1988) found that test anxiety routinely caused poor performance. For students in school and colleges, test anxiety and distress constitute the near universal experiences because of the high test consciousness pervading the modern educational system (Hemphrey, 1988). Many adolescents are at risk to become vulnerable to diverse behavior and emotional difficulties and can develop maladaptive patterns in a bid to alleviate or adjust to effects of stress (Silhereisen and Noack, 1988) Peck (1989) has suggested that suicidal indication as a coping strategy is prevalent among adolescents faced by high stress levels. Sharma and Sud (1990) in a study of 7,679 high school male and female students from Asian and five Euro American cultural reported differences in the levels and pattern

so of test anxiety in all cultures.

Compas and Wager (1991) have noted a significant increase in stress levels encountered by adolescent girls as compared to boys. Family disruption is also a contributing factor to adolescent stress (Lester, 1991). Fear of failure is found to be an important component of test anxiety by test anxiety theorists. (Seipp, 1991) Research has also shown a positive relationship between suicidal tendencies in youth with increasing levels of stress (Simons, Mc Mohon and Armstrong, 1991) Flenry, Stempenson, Hanson and Harge (1993) reported that serious suicide attempts seem to be higher among students who experiences considerable academic success and less serious suicide attempts more indicative of students who are failing at school.

Adms, Oreholser and Sprito (1994) have reported that suicide attempts among adolescent do tend to increase as stress level increase. In a study of 484 students in 9th – 12th grades, Phelps and Karvis (1994) noted that adolescent stressors emanate mainly from parental and peer conflicts, grades, academic concerns and extra- curricular activities. Van Ellen, Freebern and Pressky (1997) concluded from their study that students' beliefs about examination stress preparation are also important in their reaction examination stress. Shimada (1998) noted specific stressors and stress responses among elementary and junior high school students. Ross, Niebling and Heckert (1999) determined common sources of stress among college students (100 under graduates).

Wiley (2000) reported that the consequences of stress can take the form of behavioral characteristics like Disturbing the interpersonal relationships or decrease in the work performance. Ranjita Misra, Michelle McKean (2000) College Students' Academic Stress and its relation to their Anxiety, Time Management, And Leisure Satisfaction. Kyricou (2001) defined teacher stress as a teacher's experience in relation to the negative and unpleasant emotions. Brian Masciadrelli (2001) carried out research on academic stress and father involvement among university student fathers. Ekta Sharma and Jaswal (2001) conducted research on parental aspirations and attitudes as determinants of academic stress among adolescents. Laura Womble (2002) studied the impact of stress factors on college student's academic performance. Ranjita Misra and Linda. Castillo (2004) conducted a research on academic Stress among College Students: Comparison of American and International Students. Rebecca and Vivien (2006) studied the relationship between Academic Stress and Suicidal Ideation: Testing for Depression as a Mediator Using Multiple Regression. Huan, Yeo, Ang and Chong (2006) investigated the role of optimism together with greater emphasis on student's perception of academic stress.

María Vigil (2007) Stress Perception, Stressful experiences and Stress Management Strategies -A Comparative Case Study of Swedish and Peruvian Teacher Students. Gelban (2007) conducted a study to determine the prevalence rates and severity of depression, anxiety and stress among Saudi adolescent boys. Joseph Agolla and Henry Ongori (2009) carried out an assessment of academic stress among undergraduate students: The case of University of Botswana. Scott Wilks (2009) examined the relationship between academic stress and perceived resilience among social work students, and to identify social support as a protective factor of resilience on this relationship. Ying Ming Lin & Farn Shing Chen (2009) conducted a research on academic stress inventory of students at universities and colleges of technology Jocelyn Howard (2010) carried out a Research Informed Approach to Stress Rule Selection for English for Academic Purposes (EAP) Programmes. Sulaiman, (2010) assessed the validity and reliability for a newly developed Stress in Academic Life Scale (SALS) for pharmacy undergraduates. Aqsa Akbar, Waheed Akhter (2011) carried out research on faculty Stress at Higher Education. Glenn Calaguas M. (2011) studied the College Academic Stress: Differences along Gender

Lines. This study examined the perception of academic stress among college students in a state college in the Philippines highlighting gender differences.

Review of literature on stress shows that the variable stress is one of the important factors which adversely affect the student community. Many researches show its effect on academic performance, self-concept resilience etc. Studies conducted by Hanson and Harge (1993) and Adms, Oreholser and Sprito (1994) have reported that suicide attempts among adolescent do tend to increase as stress level increase. Hence it is very well noted that academic performance and stress form a cyclic chain of cause and effect relationship and the main stressors emanate mainly from parental and peer conflicts, grades, academic concerns and extra- curricular activities. Hence the literature indicates the requirement of practices that can reduce the stress levels of students and transform academics in to a pleasurable and enjoyable activity.

METHODOLOGY

Quasi-Experimental method was selected for the study. The design adopted was factorial design. The pre-test, post test quasi-experimental design: O1 X O2O3X O4

Where O1 and O3 are pre-test scores, O2 and O4 are post-test scores.

Experimental group constituted students which are selected randomly and they underwent experimental treatment namely brain based learning strategy. the investigator taught 25 lessons through brain based learning strategies. The same number of lessons taught through lecture method in the control group simultaneously.

TREATMENT

The researchers designed appropriate learning and teaching strategy based on the three basic teaching strategies of brain-based learning, namely ‘orchestrated immersion’, ‘relaxed alertness’, and ‘active processing’. The lesson transcripts designed were incorporated the 12 basic principles of brain-based learning. The treatment hours spread over 25 lesson transcripts each of 40 minutes duration. The overall treatment period consists of 18 hours including the testing periods.

OBJECTIVES OF THE STUDY

The specific objectives of the study were as follows:

- To develop an instructional package based on brain–based learning
- To compare experimental and control groups on pre-test scores of the following vari
 - Academic Achievement
 - Stress
 - Study Habits of students
- To compare experimental and control groups on post-test scores of the following variables:
 - Academic Achievement
 - Stress
 - Study Habits of students

HYPOTHESES OF THE STUDY

The hypotheses formulated in the study were:

- There is no significant difference between experimental and control groups on pre- test scores of the following variables:
 - Academic Achievement
 - Stress
 - Study Habits of students
- There is no significant difference between the experimental and control groups on post-test scores of the following variables:
 - Academic Achievement
 - Stress
 - Study Habits of students

VARIABLES OF THE STUDY

Independent Variables:

- **Treatment Variable:**

Brain-based Learning strategies in the experimental group and the lecture method in the control group

- **Dependent Variables:**

- Academic Achievement
- Study Habits of students.
- Stress in terms of (i) Examination stress, (ii) Achievement stress and (iii) Social stress of students.

- **Control Variables:**

- Intelligence
- Age
- Teacher-related variables such as teaching style, teacher behaviour and personality.
- Time and length of instruction.

OPERATIONAL DEFINITIONS

Brain-Based Learning: Brain-based learning is the learning in accordance with the way in which the brain is naturally designed to learn. Brain-Based learning is a comprehensive approach to instruction based on how current research

in neuroscience suggests our brain learns naturally. It is the purposeful engagement of strategies based on neuroscience.

Academic Achievement: Academic Achievement refers to the total scores obtained by an individual as measured on the test constructed by the researcher in the selected topics from the subject of Biology of secondary level

Study Habits: For the purpose of the preset study, study habits has been operationally defined as the tendency of a student to study when the opportunity of study is given and the way of studying in test taking skills text book study, time management, nutritional aspects of the study, note taking skills, concentration and memory analytical thinking and problem solving and vocabulary skills.

Each of the dimensions is defined as follows:

- **Test-taking skills:** It refers to skills that are not related to subject matter knowledge. It includes the individual's own attitude, anticipation and approach in taking a test.
- **Text book study:** It implies independent scrutinized study of the text book done by the individual.
- **Time Management:** It refers to a set of practices that include planning, prioritizing, goal setting, scheduling that help in getting more value out of students' time with the aim of improving the quality of students' life.
- **Nutritional Aspects of study:** It refers to good eating habits which help the individual in concentrating and studying the content matter without any interference of health deficiency.
- **Note taking skills:** It refers to taking notes during a lecture or discussion and processing /annotating /rewriting these notes and reading in a systematic way.
- **Concentration and Memory:** Concentration refers to fixation of attention on studies by keeping distracting thoughts away by the individual and memory refers to the act or an instance of remembering and recollection by the individual.
- **Analytical Thinking and Problem-solving:** Analytical thinking refers to developing the capacity to think in a thoughtful, discerning way to solve problems, analyze data and recall and use information by the individual and problem-solving refers to the thought processes involved in solving a problem by the individual.
- **Vocabulary skills:** It refers to the ability of an individual to use words appropriately to different situations and is the mastery of knowing more and more words.

STRESS: It is defined as a reaction to any event in which environmental demands, internal demands or both tax or exceeds the adaptive resources of a student.

SECONDARY LEVEL: The Indian education system can be broadly classified into three levels, primary or elementary, secondary and tertiary levels. The secondary level includes the grades 8-10 which also called as standard VIII, standard IX standard X. This includes basically learners within the age group of 12 -15 years. India has primarily 3 boards of school education depends on the certifying body and the syllabi viz. Central board of secondary education (CBSE), State boards (SSC) and Indian Council for Secondary Education (ICSC).

SAMPLE: The study was carried out on a sample of 240 students from 4 schools in which two were private-aidedⁱ 120 students and two were private-unaidedⁱⁱ 120 students. Three stage sampling technique was used to select

the sample in which at the first stage, stratified random sampling was used for selecting private-aided and private un aided schools. At the second stage, through simple random sampling (lottery method) schools were assigned to the experimental and control groups and at the third stage, the sampling technique used was incidental sampling in order to select students.

TOOLS: The following tools were used in the study

- Achievement Test in Biology (Researcher-made)

The investigators prepared an achievement test based on the selected units which were taught by brain-based learning and textbook oriented method.

- Study Habits Inventory Scale (Ferris, 2001)

Study Habits Inventory is a readymade tool prepared by Ferris (2001). The internal consistency and reliability of the tool is 0.90. Study Habits Inventory contains 60 items and consists of 8 dimensions

Dimensions	No. of Items
Test-taking skills	10
Text-book study	10
Time –management	07
Nutritional aspect of the study	05
Note-taking skills	10
Concentration and Memory	09
Analytical Thinking and Problem Solving	08
Vocabulary skills	05

- Stress (D’souza, 2007)

The stress scale comprises of 16 items measuring achievement stress, 18 items relating to examination stress and 13 items pertaining to social stress. In all, the inventory to measure stress contains 47 items. The items of the scale are ordered in such a way that no set pattern of the three subscales is clearly evident. This was essential to ensure that the purpose of the scale is not revealed so as to obtain the students’ own, unbiased, genuine and true opinion on the sources of stress that rank highest for them and the extent to which they encountered these stressful experiences. The stress scale included 24 negatively worded items and 23 positively worded items

INSTRUCTIONAL MATERIAL

- Lessons based on Brain-Based learning
- Lessons based on lecture method.

TECHNIQUES OF ANALYSIS OF THE DATA

t-test, ANOVA, ANCOVA (if necessary) were used for the analysis of the data.

SCOPE AND DELIMITATIONS OF THE STUDY

This research was very much confined to the students of secondary level and did not include those studying at any

other level of education in school or college. The sample consists of students studying through the state board not on central or international boards. The study conducted only in the subject Biology, not considered any other science or arts subjects. The variable academic achievement studied with respect to their academic achievement in the subject Biology not the overall academic achievement. The academic achievement with respect to the achievement gain under each objective was not under the scope of this study.

The sample included both aided and un-aided schools of the state board. Schools situated in Greater Mumbai only included for the study. However the schools coming under the jurisdiction of Thane as well as navi-mumbai were excluded. The study was carried out in English medium schools and excluded the other media of instruction such as Marathi, Hindi.

The study habits of the students includes various dimensions like Test-taking skills, Text book study, Time Management, Nutritional Aspects of study, Note taking skills, Concentration and Memory, Analytical Thinking and Problem-solving, Vocabulary skills. The present study took study habits as a whole and not included its dimensions.

The researcher included stress as a variable; it has not studied the possible stressors on the students. The study included the brain-based learning as a teaching learning strategy; it never included any other Brain-compatible strategies like experiential learning multiple intelligence, constructivist approach etc.

RESULT AND DISCUSSION

▪ Comparison of Pre-Test Scores on Academic Achievement of Experimental and Control Groups

The null hypothesis states that there is no significant difference in the pre-test scores on academic achievement of students of experimental and control groups.

The technique used for testing this hypothesis is t-test. The obtained t ratio is 0.64, which is less than 1.96 and hence it is not significant at 0.05 level. Hence the null hypothesis is accepted.

Conclusion: There is no significant difference in the pre-test scores on academic achievement of experimental and control group.

▪ Comparison of Pre-Test Scores on stress of Experimental and Control Groups

The null hypothesis states that there is no significant difference in the pre-test scores on stress of experimental and control groups.

The obtained t ratio is 0.75 which is less than 1.96 and hence is not significant.

Hence null hypothesis is accepted at 0.05 level.

Conclusion: There is no significant difference in the pre-test scores on stress of experimental and control groups.

▪ Comparison of Pre-Test Scores on academic stress of Experimental and Control Groups

The null hypothesis states that there is no significant difference in the pre-test scores on academic stress of experimental and control groups.

The obtained t ratio is 3.29 which is greater than 2.58 and hence is significant at 0.01 level. Hence null hypothesis is rejected.

Conclusion: There is a significant difference in the pre-test scores on academic stress of experimental and control groups.

The pre-test scores on academic stress of experimental and control group is found to be highly significant ($t=3.29$). The pre-test scores of academic stress of the control group is significantly greater than that of the experimental group.

Since as per the finding it was found that the t-ratio of the experimental group on the pre-test is significantly greater than that of the control group, it implies that, the experimental and the control groups have been unequal initially on academic stress. In order to remove these initial differences on pre-test scores on academic stress of the two groups, it was necessary to apply the technique of ANCOVA. Hence the application of the technique of ANCOVA to remove the initial differences in the academic stress of the experimental and the control groups and then compare the post- test scores of academic stress of these groups.

▪ **Comparison of Pre-Test Scores on examination stress of Experimental and Control Groups**

The pre-test scores on examination stress of experimental and control groups are found to be not significant.

The obtained t ratio is 0.78 which is less than 1.96, it is clear that the control group and experimental group do not differ on the examination stress.

Conclusion: Since the tabulated t-ratio is less than 1.96, it can be concluded that the experimental and control group do not differ on pre-test scores on the examination stress at 0.05 level.

▪ **Comparison of Pre-Test Scores on social stress of Experimental and Control Groups**

The obtained t- ratio 1.58 for the pre-test scores on social stress is less than 1.96 hence it is not significant at 0.05 level.

Conclusion: There is no significant difference in the pre-test scores on social stress of experimental and control groups.

▪ **Comparison of Pre-Test Scores on study habits of Experimental and Control Groups**

The hypothesis states that there is no significant difference in the pre-test scores on study habits of experimental and control groups.

The t- ratio obtained for the pre-test scores on study habits is 1.90 which is less than 1.96. Hence it is not significant at 0.05 level. Hence the null hypothesis is accepted. **Conclusion:** There is no significant difference in the pre-test scores of study habits of experimental and control groups.

▪ **Comparison of Post-Test Scores on Academic Achievement of Experimental and Control Groups**

The null hypothesis states that there is no significant difference in the post-test scores on academic achievement of students of experimental and control groups.

The technique used for testing this hypothesis is t-test. The obtained t-ratio is 29.29, which is greater than 2.58 and hence it is significant at 0.01 level. Hence the null hypothesis is rejected.

Conclusion: There is a significant difference in the post-test scores on academic achievement of experimental and control group. The post-test score of the experimental group is significantly greater than that of the control group.

▪ **Comparison of Post-Test Scores on Stress of Experimental and Control Groups**

The null hypothesis states that there is no significant difference in the post-test scores on stress of experimental and control groups.

The obtained t ratio 20.61 is greater than 2.58 and hence is significant at 0.01 level. Hence null hypothesis is rejected.

Conclusion: There is a significant difference in the post-test scores on stress of experimental and control groups. The post test scores on the stress of the experimental group is significantly differs from that of the control group.

▪ **Comparison of Post-Test Scores on Academic Stress of Experimental and Control Groups**

The obtained t-ratio 17.02 is greater than 2.58 and hence is significant at 0.01 level. Hence the null hypothesis is rejected.

Conclusion: There is a significant difference in the post-test scores on academic stress of experimental and control groups. The post test scores on the academic stress of the experimental group is significantly differs from that of the control groups.

▪ **Comparison of Post-Test Scores on Examination Stress of Experimental and Control Groups**

The obtained t ratio 14.07 is greater than 2.58 and hence it is significant at 0.01 level. Hence the null hypothesis is rejected.

Conclusion: There is a significant difference in the post-test scores on examination stress of the experimental and control groups. The post-test scores of the examination stress of the experimental group is differ significantly from that of control groups.

▪ **Comparison of Post-Test Scores on social stress of Experimental and Control Groups**

The t- ratio obtained is 12.24 for the post-test scores on social stress of experimental and control groups. This is greater than 2.58 hence it is significant at 0.01 level. Hence the null hypothesis is rejected.

Conclusion: There is a significant difference in the post-test scores on social stress of experimental and control groups. The post test scores on the social stress of the experimental group is significantly different from that of control group.

▪ **Comparison of Post-Test Scores on study habits of Experimental and Control Groups**

The hypothesis states that there is no significant difference in the post-test scores on study habits of experimental and control groups.

The t- value obtained for the post-test scores on study habits is 20.61 which is greater than 2.58. Hence it is significant at 0.01 level. Hence the null hypothesis is rejected.

Conclusion: There is a significant difference in the post-test scores of study habits of experimental and control

groups. The post-test score of the experimental group is significantly greater than that of the control group.

CONCLUSIONS OF THE STUDY

Education is a light that shows the mankind the right direction to surge. The purpose of education is not just making a student literate but adds rationale thinking, knowledge ability and self sufficiency. A willingness to change brings progress in any field. Creativity can be developed and innovation benefits both students and teachers. The researcher found that the teaching would be highly effective if the teachers start using the principles of brain research in their classrooms.

The findings of the study have a major bearing on the curriculum planners to explore new dimensions to keep students as well as teachers abreast with new explosions in research. The brain-based learning as a teaching strategy it brings the shift from teaching to learning, student - centered approach, construction of learning environments, active learning and learning strategies. It also provides scope for self-organized and self-directed learning along with interactive and collaborative learning and learning become authentic and situated learning.

The use of brain-based learning strategies in educational institutions has the potential not only to improve education, but also to empower people, strengthen governance and galvanize the effort to achieve the human development goal for the country. The research finding supports that it develops dynamic interaction and more teacher-pupil collaboration, which leaves scope for better stress management options, which is a burning issue in the education sector. The findings of the research brought advantages of a holistic view of the classroom, taking the physical and affective dimensions of learners into account if their cognitive side is to function optimally. Within this perspective, the incorporation of brain-based learning and hemispheric dominance is an effective way to broaden both the goals and the range of tools at disposal for teaching in the Indian context.

The following are the conclusions of the study:

- There is an effect of the brain-based learning on academic achievement in biology of secondary level students. The post test scores of the experimental group are found to be significantly greater than that of the control group. The effect size was found to be very high in the case of academic achievement.
- There is a significant effect of brain-based learning on total stress. A significant variation is found in the stress levels of students from the experimental groups. The post test scores on total stress is significantly less than that of the control group. The difference could observe in the academic stress, examination stress and also in the social stress of students from the experimental groups. Thus the treatment is very effective in reducing the stress factor of the students.
- There is a significant effect of brain-based learning on study habits of students. The post test scores on study habits of students from the experimental groups are significantly higher than that of the control group. The treatment is found to be effective in improving the study habits of students. The effect size for study habits is found very high.

Thus brain-based learning is effective in improving the academic achievement in Biology, reducing the stress levels of students and thereby enables better study habits among students. The possible reasons are as follows: The treatment i.e, Brain-Based Learning operates according to the principles of brain research. So it stimulates optimal learning

among the learners. The learning occurs in a relaxed environment and it ensures the maximum involvement of the senses and the learner is entirely immersed in the learning situation. So it results in the concrete and meaningful learning of the subject matter which will stimulate the short-term as well as long term memory of the learner and it delays the learning plateau too.

Since the learning environment provides scope for the registration and verification of the learning, it fosters better study habits among the students. Brain-based learning assists the students in planning, prioritizing, goal setting, and also ensures free interaction, discussion and processing /annotating /rewriting and reading in systematic ways which necessitate better study habits among students.

Teaching occupies a central position in the developments of a country; good education its concern. The teacher, the taught and the locale where teaching takes place are the integers that attract our attention. Moreover the brain-based learning gives immediate response to the learner it takes out the stress to a greater extent. Since the treatment has the potential to foster better study habits, it brings out the maximum learning output for the students. It also provides immense scope for pooling of ideas and collective brain-functioning, gives better association and accommodation of content matter. Moreover it gives the impact of collective as well as individualistic learning. So it gives a therapeutic effect to the learner by curbing unnecessary anxieties on studies. However the study found that the treatment brain-based learning is effective in improving the academic achievement, reducing the stress and enhancing the study habits among students.

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- Private Aided Schools are run by the funds provided by the government and management.
 - Private Un-Aided Schools are run by the funds provided by the trust or management completely.