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EFFECTIVNESS OF INSTRUCTIONAL MODEL BASED ON MIND BRAIN AND EDUCATION SCIENCE APPROACH

AMANDEEP KAUR

Research Scholar, Lovely Professional University and Principal, Government Senior Secondary School Gobindpura, Bathinda (Punjab) India

ABSTRACT

Education system of every country is based on certain aims and objectives hence educational policies are planned to achieve those aims and objectives through curriculum on the basis of which instructions are imparted, in school setup students continuously go through different grades and at each level they are provided information and knowledge by teachers to be evaluated at the end of session or intermittently. Every teacher follows his own system of instructional delivery. there are many teaching models based on learning theories which are available to be followed by teachers in their day to day teachings, every model of teaching s based on some learning theory prevalent at that particular time, may it be behaviourist, cognitive or constructivist. Education has constantly updated its knowledge base since its inception from behaviourist to cognitive then constructivist. The major focus of education is to develop higher order thinking, it is directly in congruence to science of human learning Mind Brain and Education (MBE) has been assigned as new science of teaching and learning (Tokhuhama, 2010) it provide ways to inculcate interdisciplinary research findings of neuroscience, psychology and developmental biology to knowledge base of educational problems. The whole world is experiencing major paradigm shift in educational theories and practices since the advent of evidence based practices and it has become essential to think beyond the boundaries of specific field in education. The process of teaching and learning is interlinked and interdependent. Successful learning is the outcome of successful teaching, so, instructional system focused on effective methods to accelerate the process of learning is required. A teacher would know how learning takes place, the role of brain and genetics along with environment, their teaching would be effective. There is large data base of knowledge on human learning, different psychological and neurological findings but an Instructional Model to sequence the events of teaching learning process is needed, in present study author has attempted to develop an instructional model based on ground theory analysis of MBE science, instructional guidelines of Tracey Tokhuhama Espinosa(2010) It outlines different physiological, neurobiological and psychological aspects of teaching and learning to make it more effective. The effectiveness of 7c's instructional model is measured with experimental design where experimental and control group has significant difference on pre test and post test scores (t=3.381).

KEYWORDS: Mind Brain Education (MBE), Teaching Learning Process, Instructional Model. Achievement Test

INTRODUCTION

Instructions are integral part of teaching and learning process every teaching activity is based on some sort of instructions to be followed. Instructional objectives and instructional delivery and assessment of instructional methods are major components of any educational system. There has been a major paradigm shift in whole educational setup with new evidence based research and findings of Mind Brain and Education (MBE) science which is projected as a interdisciplinary

or rather trans disciplinary science of human learning, it involves science which is related to learning in humans in any form, major among this are psychology, neuroscience, developmental biology, genetics and education. The research data of all the subfields filtered through the lenses of education is being gathered which is exploring new challenges and finding ways to solve various educational problems, may it be learning disabilities, motivational problems, development of thinking skills, memory retention or similar sort of teaching learning problems. Mind brain and education has started gathering its momentum in early 21st century only although 1990 has been declared as decade of brain (Brandford, 2000) when lots of research on brain has started, various researchers in this area of MBE are working on different systems of human learning and teaching major among them is Prof. Kurt Fischer of Harvard university who has pioneered in area of connecting brain research to education. International Mind Brain and Education science society (www.imbes.org)Dana foundation, Society for neuroscience along with many other universities around the world are exploring MBE. Organization of economic corporation development(OECD) has emphasized that idea behind is to make learning more effective, the brain being the important organ in learning should be explored, till now only major feeding sciences for educational theories is psychology but now other sciences has its role to play. Where various educational problems like learning disabilities such as dyslexia, dyscalculia, attention deficient hyperactivity syndrome (ADHD) is explored and suggesting interventions. International mind brain and education society (IMBES) is publishing a journal namely mind brain and education in which related interdisciplinary research studies are published from around the world.

Kurt Fischer (2008) has suggested research schools concept to link the science of human learning to educational theory and practice. New research methods are being evolved and so new theories are likely to evolve. The idea of research school is to bridge the gap between laboratories to classrooms; Teachers often lack the background knowledge needed to interpret scientific results, whereas scientists often lack an understanding of pedagogical goals. (Fischer & Hinton, 2008; Kuriloff et.al, 2009) We need to build an infrastructure that supports sustainable collaboration between researchers and teachers and creates a strong research foundation for education. Evidence based neuroscience based findings of human learning would be helpful in improving educational practices (Stern, 2005)

Instruction is a plan of teaching and learning activities based on certain learning objectives in mind, In teaching the use of model is very old, Socrates, the Greek Philosopher used his own model of question answer (dialect), Indian ancient teacher developed their own model of teaching to affect the desirable changes in the behaviour of the learners. Teaching is a social phenomenon which involves interaction of students with teacher as well as with the surrounding environment (Yano, 2013).

Several model of teaching have been developed in the last two decades in the western countries. These models prescribe different approaches to instructional process to bring changes in the behaviour of the learners. The common implication of these facts is that teacher should use different strategies of teaching which match the objective of teaching on and students learning styles and personality dimensions. The instructions should be designed by making use of prevalent theories and theoretical knowledge into different models of teaching which can be readily used by teachers in schools as well as school settings. In the present era Neuroscience in education which brings the learning system of brain forward (Christoff, 2008) often called brain based learning i.e. how brain takes, processes, interprets information; makes connection, stores (like making connection, coding, constructing matrix), and remembers the messages (Greenleaf, 2003).It is student cantered learning that utilizes the whole brain and recognizes that not all students learn in the same way. It is also an active process where students are actively engaged in constructing their own knowledge in a variety of learning

situations and contexts (Caine & Caine, 2005).Brain based learning involves accepting the rules of how the brain processes, and then organizing instruction bearing these rules in mind to achieve meaningful learning, It is a set of principles and a base of knowledge and skills through which we can make better decisions about the learning process. Although neuroscience does not directly deal with teaching but successful learning is the result of success in teaching (Goswami, 2004).

Many researchers who does not support the direct application of brain research findings into classroom practices as they consider it as too early to apply the basic research into education rather they support an multidisciplinary endeavour where flow of information from brain research to psychology to education should occur (Bruer J.T, 1997),they would agree with the new field of Mind Brain and Education(MBE) science which is one such endeavour to bridge the gap in neuroscience psychology and education. Mind brain and Education is developing as science of human learning, when most of brain research on learning takes places which provide database to several neuromyths too prevalent like left and right brain activation and learning styles etc. (Lindell, K. & Kidd, E. 2013)

Mind Brain and Education Science suggest the best practices based on evidences to inform the educational process it is also called the new brain based teaching by Tokuhama (2010) who in a study in the development of standards in the new academic field of mind brain and education science through ground theory supported by meta-analysis of the entire literature available in the field under study proposed 10 instructional guidelines after defining 22 different principals and 12 tenets in the field of Mind Brain and Education Science. These principles and Tenets were used as a base to develop the 7C's instructional model.

OBJECTIVE OF THE STUDY

The main objective of the study is to develop an instructional model based on mind brain and education guidelines and to measure its effectiveness in terms of thinking skills of learners.

METHODS

Development of Instructional model comes under the preview of instructional system design ADDIE(Analysis, design, development, implement and evaluation) model was used as framework to outline different phases of developmental process.

Step 1: Analysis

Need analysis of instructional model was completed by using survey and sending its links to different teachers in different Schools

Step 2: Design

Brief outline of Model was prepared on the basis of MBE science approach, content of the model is matched with brain targeted teaching model to establish construct validity and suggestion of experts are also taken in account.

Step 3: Develop:

This model was developed further by taking suggestions from different teaching professionals (N=37) lesson units are prepared and instructional manual is designed.

Step 4: Implement

The model is to be implemented in the secondary classrooms with experimental and control group (N=68).

Step 5: Evaluation

The evaluation of instructional Model to be done in terms of its effectiveness on achievement test of high order thinking skills in science.

Instructional Model Based on MBE Science Approach

Teaching is an activity which is designed and performed for multiple objective in term of changes in pupil behaviour, pupil on the other hand have multidimensional Personalities having different learning styles. Contemporary conceptions of instructional strategies acknowledge that the goals of schooling are complex and multifaceted, and that teachers need many approaches to meet varied learner outcomes for diverse populations of students. A single method is no longer adequate. Effective teachers select varied instructional strategies that accomplish varied learner outcomes that are both behavioural and cognitive.

In this study, researcher surveys current literature to identify foundational instructional strategies that are supported by MBE science to devise an instructional model in life sciences. Instructional Characteristics are linked with the physiological system such as sleep, nutritional status, health status and stress which impacts learning. Other psychological Characteristics are that mind and brain is social, feelings and emotions have its role to play in learning, and immediate feedback enhances learning, priming of brain, learning in social contexts is best. There are different memory system and importance of brain plasticity.(Immordino,2007) Several model of teaching have been developed in the last two decades in the western countries BCSE 5E is very popular instructional model for science teaching five phase of this are engage, elaborate, explain, explore and evaluation and this has been proved to be highly effective by research. Hence, this is clear that instruction delivered in a systematic sequence has positive impact on learning. Similarly, Mariale Hardiman's Brain Targeted Teaching model has five phases which highlight the importance of emotional climate and brain learning principals in teaching (Hardiman, 2012). The purposed model in the present study has inculcated all the principles of MBE to bring forth a systematic sequence of instructional process to develop high order thinking among learners**.**

Table 1: Principles of Mind Brain and Education outlined by Tokuhama (2010)

Principle 1: Each brain is unique and uniquely organized.
Principle 2: All brains are not equally good at everything.
Principle 3: The brain is a complex, dynamic system and is changed daily by experiences.
Principle 4: The search for meaning is innate in human nature.
Principle 5: Brains have a high degree of plasticity and develop throughout the lifespan.
Principle 7: The search for meaning occurs through pattern recognition (i.e., the brain's continual comparison between what it senses and what it already knows).
Principle 8: Emotions are critical to detecting patterns, to decision-making and to learning.
Principle 9: Learning is enhanced by challenge and inhibited by threat. Principle 10: Brains seek novelty.
Principle 11: Human learning involves both focused attention and peripheral perception.

Principle 12: The brain conceptually processes parts and wholes simultaneously.
Principle 13: The brain depends on interactions from other people to make sense of social situations.
Principle 14: Feedback is important to learning.
Principle 15: Learning is a constructivist process, and the ability to learn goes through developmental stages as an individual matures.
Principle 16: Learning involves conscious and unconscious processes.
Principle 17: Learning engages the entire physiology
Principle 18: Different memory systems (short term, working, long term, emotional, spatial, rote) receive and process information in different ways, and can be retrieved through different neural pathways.
Principle 19: The brain remembers best when facts and skills are embedded in natural contexts.
Principle 20: Learning relies on memory and attention.
Principle 21: Neuroeducation principles apply to all ages.
Principle 22: Use it or lose it.

Table 2: The Core Tenets of Mind, Brain, and Education: The Science of Teaching And Learning Are the Following (Traceytokhuhama, 2010)

Tenet 1: Motivation Impacts How Teachers Teach, and How Students Learn
Tenet 2: Stress impacts learning.
Tenet 3: Anxiety
Tenet 5: Voices
Tenet 6: Faces
Tenet7:Movement
Tenet 8: Humor
Tenet 9: Nutrition
Tenet 10: Sleep
Tenet 11: Learning Styles
Tenet 12: Differentiation

7 C'S INSTRUCTIONAL MODEL

During the last 100 years, a major accomplishment of psychology has been the development of a science of learning aimed at understanding how people learn. In attempting to apply the science of learning, a central challenge of psychology and education is the development of a science of instruction aimed at understanding how to present material in ways that help people learn.

Connect to the Learner

Assessment of Learner's physical and psychological well being is to be done at the start of session. Nutritional status impacts learning hence value of good nutrition is to be communicated to the parents and children. Sleep deprivation and stress also effect human learning. Every human brain is unique hence learning styles could be different although so

assessment of students in all these terms should be done. Teacher should be aware of the needs of their students and appropriate interventions could be provided.

Create Learning Environment

Role of positive emotions and stress free environment, proper seating arrangements and light etc. along with voice, proper eye contact with all learners. Emotional climate should be taken care of by the teacher for planning good learning environment. Students should be made aware of different memory systems that how any information is stored in different memory regions and if they could store the information for later

Classify the Objectives

Human brain learns well the information is provided in certain contexts and easily understandable, classifying the objectives well before the actual content is to be delivered is of importance it would help in students to understand their own thinking how much they know and how they could relate this to their already known information.

Communicate the Information

After the objectives are clear then whole information is to be delivered using novel way as far as possible so that information being presented is not monotonous, division of content in small chunks and systematic flow should be maintained, use of concept maps, advance organizers and different teaching models could be used, teacher should ensure attention of the students should be maintained as average attention span of human brain is 30-40 minutes so every possible effort should be done to give important information delivered in this time period, voice of the teacher should be proper and non threading, humour could be added to avoid boredom, teacher should not stand at a single point, movement is necessary so student could feel attentive in the class.

Cognitive Processing

After delivery of information the sometime should be provided to process the information in students' minds, some developing questions could be asked to make them think about the subject matter and students should be encouraged to ask questions if they have any related to the content. Concept maps could be framed to help student learn the information easily in understandable terms. Repetition and rehearsal of the content delivered should be performed so that information provided is stored in long term memory from short term memory system.

Cognitive Stimulation

Once the content is delivered and processing of the content is done students should be stimulated to think metacognitive activities like, make them design some assignment and relate the information to real life events, frame problems, design problem solving strategies. Short role plays and other activities to be organized related to subject content be given to stimulate their thinking.

Comprehensive Evaluation

Comprehensive and continuous evaluation of learning is to be done and appropriate remedial measure be designed in terms of extra instructional hours be assigned. Remedial measures for those who still need special attention and time should be given extra time where they can ask for clarification of doubts and for evaluation of learning comprehensive tools should be used to evaluate learning these may be both formative and summative Assessment and evaluation rubrics

could be designed where students overall performance should be rated, not only in terms of achievement on tests scores rather participation in learning process as a whole could be assessed.

DISCUSSIONS

A mixed method research method is used in this study, both qualitative and quantitative research methods are used, development of instructional model is a qualitative study where 7c's instructional model is designed on the basis of principles and research findings of mind brain and education science approach. the lessons were prepared based on instructional model 14 lessons on life processes for 10^{th} standard science were prepared and an achievement test to access high order thinking skills was prepared, out of total 35 items after item analysis 24 items were selected with Cronbach's alpha=0.798 the test is said to be reliable. The model was implemented in a government senior secondary school's 10^{th} standard classroom (N=68) where two groups are formed i.e. experimental (N=37) and control group (N=31). Pre test was administered and instructional model based lessons were delivered on life processes total 14 lessons were delivered to experimental group while control group was instructed in regular traditional method a post test was administered to both the groups after 3 weeks intervention.

H0 (null hypothesis): There is no significant difference between experimental and control group on pre test and post test of high order thinking skill achievement test.

Descriptive statistical analysis was done mean of pre test for control group is (M=8.4194) and experimental group (M=8.1622) with t value=.311and p value=.757 which means there is no difference between experimental group and control group on pre test scores. While post test scores shows the Mean of control group(M=9.0323) and experimental group mean is (M=11.8649) with t value =3.381and p value=.001 which signifies there is significant difference that exists among control and experimental group on post test scores, Paired sample t test was administered to compare both groups t value (t=1.161) for control group and experimental group(t=7.009)although there is significant difference exists in both cases but for experimental group high t value denotes higher difference. Hence, null hypothesis stated above was rejected and it is accepted that 7c's instructional model based instructions has significant effect on high order thinking skills.

SUMMARY

Instructional model based instructional delivery is found to be effective on higher order thinking achievement test of science. Due to constraint of time the intervention was for 3 weeks only which could be extended and further assessment of instructional model can be done in separate study. This study includes only science subject other subjects could also be instructed by this method in further future studies.

Table 3: Independent Group Statistics of Control and Experiment Group

Paired Samples Statistics							
		N	Mean	Std. Deviation	Std. Error Mean		
Control	Pre test	31	8.4194	3.60346	.64720	1.161	.255
	Post test	31	9.0323	3.57290	.64171		
Experiment	Pre test	37	8.1622	3.21898	.52920	7.009	.001**
	Post test	37	11.8649	3.32634	.54685		
Combined	Pre test	68	8.2794	3.37615	.40942	5.502	.001**
	Post test	68	10.5735	3.69879	.44854		

Table 4: Paired Sample Statistics of Control and Experiment Group

	Group	N	Mean	Std. Deviation	Std. Error Mean	t-value	p-value
Pre test	Control	31	8.4194	3.60346	.64720	.311	.757
	Experiment	37	8.1622	3.21898	.52920		
Post test	Control	31	9.0323	3.57290	.64171	3.381	.001**
	Experiment	37	11.8649	3.32634	.54685		

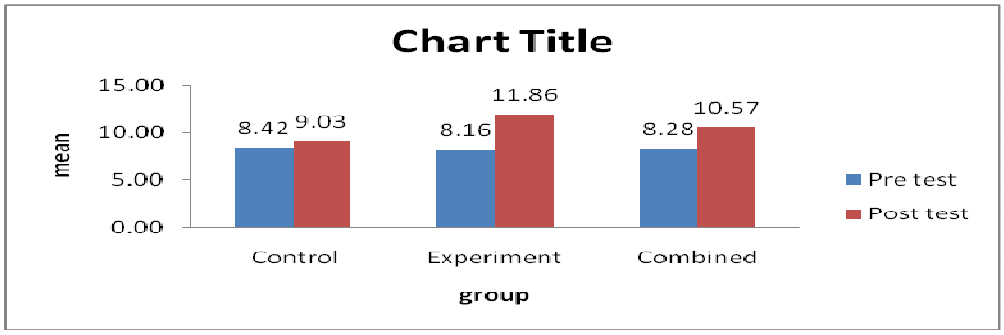

Chart 1: Distribution of Mean of Control and Experimental Group

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