DEVELOPMENT OF AN INSTRUCTIONAL DESIGN BASED ON BRAIN-COMPATIBLE INSTRUCTIONAL MODEL FOR ENHANCING ACADEMIC ACHIEVEMENT IN MATHEMATICS

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Abstract

Education should be a process of encouraging the young minds to chase their dreams in their own unique way. This can be made possible only by training them to think for themselves. A learner must be given the opportunity to be an active participant in the learning process by choosing the appropriate method that best suits them. This can be made possible by developing a Brain –compatible teaching Model, designed to best suit the learning needs of the students in the best possible way. The stages in this model were planned based on Kovalik's Highly Effective Teaching Model, incorporating the principles of Brain based learning and the theories of multiple intelligences. Inspired from various researches undertaken in this area, an instructional design of Brain-compatible Instructional Model is developed in Mathematics, the most stressful subject as considered by most of the students.

Introduction

Mathematics, the Queen of all sciences, even with its abstract nature, has a wide range of application in all the aspects of life. Mathematics is a powerful tool for equipping students to become effective decision makers. Mathematics education will help the child to acquire the major skills related to holistic education. Mathematics is powerful as it is a language that helps one to concisely capture the essence of complex phenomena. Creativity involved in Mathematics learning is mainly seen in using Mathematics to invent structures and to solve problems. Inspite of its usefulness, the abstract nature of the subject induce fear and anxiety in the minds of the learners. This fear drives away the learners from imbibing the subject deeply. The way the subject is taught as a discipline following rigid way of teaching, create an aversion towards the subject. This need to be overcome considering the application leeway of the subject and this can be made possible only through the integration of suitable teaching strategies incorporating fascinating activities and techniques based on multiple intelligences.

Instructional Models are guidelines or sets of strategies to organize suitable pedagogical scenarios to achieve instructional goals. Brain-Compatible Instructional model focuses on the teaching process based on neuroscience to attain brain-compatible learning. Brain-compatible learning is a term coined by educators to refer to the use of brain based learning in educational settings. It refers to the set of principles in neuroscience that may guide the educational decisions. Hence, Brain-compatible instruction refers to the instructional process that aims at brain compatible learning.

Need and Significance of the study

Mathematics is explicitly and implicitly present in various fields of society. It has a role to play in many fields such as medicine, digital encryption, communication technology, modeling real life phenomena, predicting phenomena, organization of business and so on. But the society lacks awareness about the indispensability of Mathematics and also has a tendency to ignore the subject. In the present scenario, acknowledging publicly the deep seated fear of this subject is found to be fashionable.

Since time immemorial, Mathematics is considered as an integral part of curriculum. This enables a child to think and communicate quantitatively, solve problems, and also to recognize situations where their aptitude can be applied and use appropriate technology. Despite of all these, the achievement of students in Mathematics is found far from satisfactory.

Research studies revealed that lack of interest and motivation in learning Mathematics as well as the low level of achievement in Mathematics may be due to ineffective and stressful learning environment. Studies have shown that most Mathematics teachers use rigid style of instruction. Their teaching methods involve closed questions and they hardly ever encourage discussion among the students. Furthermore, they rarely give variety of learning experiences and feedback. This kind of environment blocks the development of higher order thinking skills especially reflective thinking of students which are highly essential for developing professional and challenging skills of our future citizens.

The present system of Mathematics education blindly imposes ideas upon young minds instead of teaching them to think for themselves. The main purpose of education should be to prepare the learner to think better. Hence, it is necessary that the child should be given an opportunity to be an active participant in the learning process through the choice of proper method that best suits them. This would help him to acquire the content meaningfully.

Recently, the findings of brain research demonstrate the importance of not limiting education to simply the mind or cognitive aspects of a student. Kovalik and Olsen (2002) state that "the brain research provides a very compelling endorsement of the power of collaboration to increase learning, improve the quality of products, and make work/learning environment more pleasant and productive" (p. 1.18). When different parts of the brain are engaged, there is higher chance learning will take place. The more areas of the brain are engaged, the higher the chances of long-term memory learning (Kovalik & Olsen, 2002, p. 4.2).

Recent researches on brain compatible learning environment reported that Brain-compatible learning can address learning in a variety of ways. Highly Effective Teaching Model is a brain compatible instructional model conceptualized by Susan Kovalik based on the philosophy of how students learn. Highly Effective Teaching Model is a "comprehensive model that translates the biology of learning into practical classroom and school strategies" (Sorensen, Denmark, Murchu & Doghair; 2006). This benefits the learners as they learn through hands on experiences, first hand information, sensory-rich field study experiences, engaging activities, and meaningful topics. A kid is an active learner by manipulating things around in his own way and the concepts they formed during the younger stages are so concrete that they will remember it lifelong. This happens as they are having a direct experience and they understand the concept according to how their brain processes it. So, here, the learning happens in par with how brain learns.

Statement of the problem

Mathematics has a wide range of application real world situations. But it is neglected due to the abstract nature it possess. The rules and regulations that aid the mathematics teaching is what hinders the meaningful mathematics learning. Considering this problem, the investigator decided to adopt a teaching strategy in which the learner can be provided with a risk free environment where he can enjoy learning without fear and anxiety. This teaching strategy would help the students to understand the abstract concepts of Mathematics by involving various techniques and activities based on multiple intelligences enabling them to attain a holistic development. Therefore the investigator developed a design on Brain-Compatible instructional model; a framework for developing a lesson transcript that incorporates the principles of brain based learning so that it enhances the possibility of learning. It can be considered as the science of creating detailed specification for the development, implementation and evaluation of situations.

Some of the researches questions that the investigator needs to resolve through this study are

1. How can we provide a risk free learning environment to enhance the effectiveness of Mathematics learning?

2. How can we implement Brain-compatible Instructional Model in actual classroom practices?

These research questions are planned to be resolved through the study entitled as

"Development of an Instructional Design based on Brain-Compatible Instructional Model for Enhancing Academic Achievement in Mathematics"

Definition of the Key Terms:

a) Development

Development: Development means the process of developing something new. [dictionary.cambridge.org/dictionary/british]

Operational Definition: Development means the act of developing a plan of action to be carried out.

b) Design

Design: Design means a particular plan or method.

Operational Definition: In this study, design refers to the plan of instruction to be carried out in Mathematics classroom on the basis of Highly Effective Teaching Model, a Brain-compatible Instructional Model.

c) Brain-Compatible Instruction Model

Brain-Compatible Instruction Model: An instructional model based on brain based teaching learning strategies focusing on Kovalik's Highly Effective Teaching Model incorporating brain based learning principles and theories of multiple intelligences.

d) Academic Achievement in Mathematics

Academic Achievement in Mathematics: Academic Achievement means performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments (www.oxfordbibliographies.com).

Operational definition: In this study, academic achievement in Mathematics refers to developing an interest in Mathematics learning in the classroom that results in attaining their educational goals

Objectives of the Study

The objective of the study is:

 To develop an Instructional Design based on Brain-Compatible Instructional Model in Mathematics

Method adopted for the Study

The present study is aimed at developing a design based on Brain-Compatible Instructional model in Mathematics. The method adopted for the study is a thorough analysis of

a) The principles of Brain-based learning

b) Theories on Multiple intelligences

c) Susan Kovalik's Highy Effective Teaching Model

Development of an Instructional Design based on Brain-Compatible Instructional Model

The investigator developed the design on Brain-Compatible Instructional Model based on Kovalik's Highly Effective Teaching Model considering the principles of brain based learning and theories of multiple intelligences.

The design is developed by keeping in mind all the six learning principles of the HET model based on the brain research (Bodybrain partnership, Intelligence is a function of experience, Multiple intelligences to solve problems and produce products, Pattern seeking, Program building, Temperament) including the ten elements to create a body brain-compatible environment through which the objectives can be achieved. The ten bodybrain compatible elements are absence of threat/ nurturing reflective thinking, sensory rich "Being There" experiences, Meaningful content, Enriched environment, movement to enhance learning, choices, adequate time, collaboration, immediate feedback and mastery / application. Along with these the principles of brain based learning.

The instructional design developed based proceeds through six phases named as Ice breaking phase, Digging up phase, Activating Phase, Inquiring Phase, Cherishing Phase and Applying Phase.

The different phases of the design on Brain-compatible Instructional Design based on Highly Effective Teaching Model are explained below.

Ice Breaking Phase

Ice breaking means to initiate social interchanges and conversation or it can be termed as to relax a tense or unduly formal atmosphere or social situation.

One of the ten elements of HET / ITI model is a threat free environment. It emphasize on a safe learning environment to share, learn and explore and to collaborate with the other learners. In this phase, the investigator helps the students enter the topic through some strategies such as games, puzzles, video or music and thus grab the interest of the students. Through this session, a state of readiness is created in the mind of the learners and they will free safe and interesting.

Digging Up Phase

In this phase, the teacher provides opportunities for the students to explore the concepts they need to learn. Through activities that include role play, group work, games and puzzle, the concept to be taught are made familiar to the students. Here the students are made to identify the need for learning the topic or understand a problem that leads to the need for learning the concept.

Here, the teacher organizes the environment in such a way that the pupils can collaborate their senses so as to obtain a sensory-rich experience and thereby enhance their multiple intelligences. As this phase includes activities such as role play and games, the element of 'movement to enhance learning' in addition to 'sensory rich being there experience' is also considered here.

Activating Phase

By activating, the investigator refers to stimulating. So in this phase, the pupils are made to organize and construct the concepts they explored, by activating an element of interest.

The students could be provided with varied experiences to help them generalize or organize the concepts. They could be provided with an enriched environment in which necessary movements, videos, music and activities related to the topics, involving multiple intelligences through which they can get mastery over the concepts.

Inquiring Phase

The students are presented with a problem, based on the concepts, so that they can use the concepts they have learned in the previous phases. Thus the investigator tries to inquire on the pupil's understanding that they acquired from the previous stages.

Here, in this phase, the investigator includes games, animations, power point presentations and some online interactive sessions to present the problem and thus inquire on the pupil's understanding. Thus the mastery they gained on the concept they acquired from the previous sessions are inquired in this session.

Cherishing Phase

This phase mainly emphasis the element 'choices' in the Integrated Thematic Instruction. The investigator tries to provide activities for them to cherish the knowledge they have acquired by allowing them to think deeply and broadly. Here, the investigator present the pupils with varied activities from which they could choose according to their interest.

As each student differs in their interest, they are given opportunities to demonstrate their understanding through multiple intelligences, higher level thinking and so on. Thus they will be encouraged to cherish what they have understood from the previous sessions through strategies such as mind or concept mapping, real life problem situations, poem writing and so on. Thus this phase can be considered as a phase that integrates various disciplines such as writing skills, creativity, analyzing skill and so on.

Applying Phase

In this phase, the investigator provides opportunities for the students to choose their own way to expand or apply their acquired knowledge. This acts as a follow up section for the concepts they have learnt in the previous phases.

In this phase also, the investigator gives importance to the 'choices' element of the Highly Effective Teaching Model. The investigator provides activities where they could apply their acquired knowledge that enhances creativity and higher order thinking and gives the pupils to choose between various activities as per their interest.

Educational Relevance

Brain-compatible Instructional Model developed based on Susan Kovalik's Highly Effective Teaching model provides a brain compatible learning environment which incorporates a variety of activities including physical activities in a stress free environment. It provides opportunity to address as many different learning styles as possible by using the theory of multiple intelligences and incorporating brain based learning principles. This design would be an effective approach for inculcating interest in learning in a threat free environment, making learning interesting and thus effective. By developing interest in the subject and getting opportunity to learn in their own style will help the students to enhance their academic achievement in Mathematics.

Conclusion

The instructional design on Brain-compatible Instruction Model opens up many avenues for more studies that would help the learners to enhance academic achievement in a meaningful manner. It would inspire the teachers to carry out their teaching in a brain-compatible way. It would also help the curriculum planners to design new curriculum in favour of Brain-compatible Instructional Model and thus making the process of learning interesting.

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