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Role of Concept Formation Teaching Model on Conceptual Change

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Absract

Pakistan is a developing country and the basic aim of science education in Pakistan is to improve quality of instruction (Education Sector Reform, Action Plan 2001-2005). The quality of teaching science at the secondary level in Pakistan has been questioned frequently. It is generally believed that the methods used in teaching science are outdated and not conducive to the development of clear understanding of scientific phenomena among students.

The science teacher must have the desire to teach his subject as effectively as possible for realizing the stipulated purposes of teaching science. One of the purposes of teaching Chemistry is to provide a base to explore new things. This exploration is possible when the students have clear concepts. Concept clarification is based on appropriate teaching method. A method is not merely a devise adopted for communicating certain items of information to students. It links the teacher and his pupil into an organic relationship with the constant mutual interaction. The quality of students' life may rise by applying good methods and bad methods may debase it. Good methods play a great role in the development of concepts.

Hence concepts must be formed properly at the initial stage. If concepts are not properly developed the knowledge remains vague and inadequate to cope with a problematic situation. So there is a need to explore other new teaching methods and models besides traditional methods for clarification of concepts. Therefore, the researcher developed concept formation teaching model on the basis of direct instruction approach.

Key Words: Advance Organizer, Guided Discovery, Elaboration, Guided Practice, Inductive Reasoning, Deductive Reasoning, Experiential Learning

Introduction

Quality of education is based on the quality of instruction in the classroom. The teacher is the most critical factor in implementing the educational reforms at grass root level. It is generally recognized that academic qualifications, knowledge of the subject matter, competence and skill of teaching affect teaching-learning process. Hence, there is a need to use appropriate methods of teaching in order to present the concepts in an effective way.

Whatever the teaching method is to be used, the important thing is changing the child into an intelligent scientific thinker. The wise and efficient teacher utilizes all the students' capacities, abilities, habits, skills, knowledge and ideas etc. He/she can use any method that is more effective for developing the concepts. The effective teacher stimulates the thinking and reasoning power of the pupil for developing problem-solving ability and capacity of personal achievement to explore new ideas and concepts.

The school has to develop the students conceptually. Meaning knowledge has generality and applicability. The students require clear and comprehensive concepts about the topics they are studying, and the relationships among these concepts. So, it becomes easier for learners to acquire new information and to organize it within their broader concept structures (Hudgins *et al*., 1983).

Conceptual Change

Concepts improve the ability to learn subject matter in a meaningful way with clear conceptual idea. A student has much better opportunity to learn and remember particular information about it than one who must try to process and store incoming information without any conceptual hooks to hang all the details (Hudgins *et al.*, 1983).

A concept is the basic unit of all types of learning. From birth till death, man learn new concepts and use old concepts in new situations of their daily life to construct new ones. Individuals differ in their level of concept formation on the basis of their age, intelligence and experience (Chauhan, 1989).

Davis (2001) defined conceptual change as "learning that changes an existing conception" (i.e., belief, idea, or way of thinking). It is not merely accumulating new facts or learning a new skill, in it, a fundamental change or even replacement of an existing conception is done and as a result, the conceptual framework is formulated. On the basis of that conceptual framework, students solve problems, explain phenomena and function in their world.

It is very difficult to change learner preconceptions because learners rely on these existing notions to understand and they may not easily change their ideas and adopt a new way of thinking. Thus, simply presenting a new concept or telling the learners that their views are inaccurate will not result in conceptual change. Teaching for conceptual change requires an active role of learners by which reorganization of their knowledge is possible. Cognitive conflict strategies are effective tools for conceptual change instruction. These strategies involve creating situations where learners' existing conceptions about particular phenomena or topics are made explicit and then directly challenged to create a cognitive conflict or disequilibrium. The common goal is to create necessary conditions for conceptual change i.e. learners must become dissatisfied with their current conceptions and accept an alternative notion as intelligible, plausible and fruitful (Davis, 2001).

The student of conceptual change instruction depends not only on the complexity of the concept itself but also on the character and upbringing of the student that involves his entire personality; his general, cultural and personal belief systems; his acquired and inherited intellect; his ability to follow and think through arguments and his personal attitude towards undergoing conceptual change. Initially the student has to become dissatisfied with his own preconceptions. He has to be able to logically follow and understand the new theory and find that it does a better job than his preconceptions in explaining the situation. At last, the student will need to find the new theory fruitful in the sense that he can apply it to other situation and solve new problems (Zirbel).

Concept Teaching

Concept teaching approaches are process oriented which aimed at teaching students to think questions and discover rather than to solely memorize by encouraging their inductive thinking so as the students move from particular facts to generalization. Appropriate and solid concepts are constructed through the inventive act of concept formation.

Teaching for conceptual change is not an easy process. It is more time-consuming than traditional teaching methods. It requires a supportive classroom environment in which students feel confident in expressing and discussing their ideas. The possession of well-developed facilitation skills and a thorough understanding of the topic is the basic requirement of the teachers of conceptual change instruction (Davis, 2001).

The concept teaching tests the students' understanding of the concept and its attributes. A concept lesson concludes with the teacher asking students to analyze their thinking patterns, strategies and decisions in order to develop more effective thinking skills and to help students integrate the new concepts into existing knowledge.

On a practical level, Posner *et al*. (1982) listed four conditions that foster accommodation in student thinking:

1. There must be dissatisfaction with existing conceptions
2. A new conception must be intelligible
3. A new conception must appear initially plausible
4. A new concept should suggest the possibility of a fruitful research program

Teachers who give consideration to these four conditions are encouraged to take deliberate steps to create classroom interactions that produce these conditions. Students organize their lives around views that they hold about phenomena, so some conceptual changes that teachers want to change may be highly resistant to change and potentially threatening to students. To become more effective in nurturing conceptual change, teachers should seek to understand students' preconceptions (Suping, 2003).

Concept Formation

In concept formation, important features are to integrate ideas by the recognition that some objects or events belong together while others do not. Once the objects or events have been grouped according to a particular categorization scheme, a label is given to the group. The end result of concept formation activities is the connections among the common characteristics of a concept.

In concept formation, opportunities are provided to the students to explore new ideas by making connections and see relationships between different types of information. This model develops and refines the students' abilities to recall and differentiate key ideas, see common characteristics and identify relationships, formulate concepts and generalizations, explain how they organize data and present evidence to support their organization of the data.

The process of concept formation cannot be merely reduced to associations, attention, conception, judgments and determining tendencies, even though all these functions are indispensable for this synthesis. The most essential feature of this process is the functional use of signs or words that directs students' activity for solving the problems.

Concept formation is based on two tools i.e. definition and word. Definition is for specification of important characteristics of the concept which is the basis of integration and differentiation (everything is not encompassed by the concept). The word is a

cognitive trigger for the concept by which the concept is stored in the memory and referenced later.

Direct Teaching and Concept Formation

Direct teaching is also known as Explicit Teaching. It is a systematic method which is based on the presentation of material in small steps and checking the students' understanding through active and successful participation of all students (Conway, 1997).

According to Sadker and Sadker (2003), basis of direct teaching is structured lesson in which presentation of new information is followed by student practice and teacher feedback. In it, the teacher's role is the strong leader who structures the classroom and sequences subject matter to achieve the pre-determined goals.

Direct teaching requires a masterful command of the subject by knowing more than the facts about content. Direct teaching is a systematic way of planning, communicating and delivering the subject matter in the classroom. One does not become proficient at this, or any skill without practice and relevant feedback.

Direct teaching is particularly helpful for imparting new and complex information in small bits. It works well for development of concepts in more clear and easy way. The highly structured learning environment is set by the teacher in which students are careful listeners and keen observers. Modern researchers indicate that direct teaching is one of the most effective instructional models for concept formation that brings the students to high achievement.

Principles of Concept Formation

Principles of concept formation teaching model are:

1 Use of Advance Organizer

David Ausubel introduced advance organizers. He describes them as something to be used in advance of learning itself that enhances the organizational strength of the cognitive structure (Phoenix, 2006). It is a method of bridging and linking old information with something new. An advance organizer is information presented prior to learning and used by the learner to organize and interpret new incoming information (Mayer, 2003).

2 Use of Guided Discovery

The process in which teachers introduce new materials, explore centers or areas of the classroom and prepare children for various aspects of the curriculum is guided discovery. It is a whole-class lesson where controlling and coordinating the learning experience is in the hands of teachers. In the presentation portion of the lesson, the

teacher provides something for students to examine and guide students to discover details through the use of guiding questions and instruction.

3 Use of Elaboration

It is a process whereby the learner expands upon the information given to them during a lecture, reading assignment etc. It is an act of empowerment, addition of extra material, refinement and expansion of previous knowledge.

4 Use of Guided Practice

The guided practice is related to the teaching and overt behaviour in which student's first attempts with new learning are guided for accuracy and successful learning. Teachers must closely monitor the student performance during the instruction. Mistakes need to be corrected if seen by the teacher (Combs, 2008).

5 Use of Inductive Reasoning

First particular cases or examples are dealt with and then laws are derived from them. By this, child is led to discover truth for himself. The child acquires first hand information by actual observation of lots of material and leads to rules, definitions and principles. So after getting this information, child is able to give reasons for generalizations, principles and rules.

6 Use of Deductive Reasoning

General laws are first stated and particular cases are taken as examples to prove them. Child gets ready made knowledge and makes use of knowledge acquired by others. By using deductive reasoning, a child is able to get more perfect comprehension of principles or generalizations.

7 Use of Experiential Learning

The experiential learning is inductive, learner centred and activity oriented. Personalized reflection about an experience and the formulation of plans to apply that learned concepts to other contexts are critical factors in effective experiential learning (Saskatoon Public Schools, n.d.).

Concept Formation Teaching Model

Researcher adopted direct teaching (Sadker and Sadker, 2003) for developing concept formation teaching model and extracted these steps by reviewing the literature. Researcher modified direct teaching, principles of concept formation (Huitt, 2003), books

and lesson plan format used in different schools, colleges and universities. The researcher has identified following steps in lesson planning for effective teaching:

1 Instructional Objectives

Objectives of lesson plan of concept formation teaching model are based on Taxonomy of Educational Objectives proposed by B.S. Bloom and his associates (1956). These instructional objectives are comprehensive, consistent, attainable, suitable to subject matter, valid, clearly stated, measurable and testable, guided to action and evaluate-able.

2 Previous Knowledge

During the lesson, previous knowledge is checked by using some activity and questions by simple statements, moving around the room and voice inflation including a discussion about previously covered content.

3 Introduction

A lesson is introduced when students emotionally and mentally prepare to digest new information. Introduction deals with student's existing ideas and conceptions. Information is presented in an organized manner by using appropriate devices, techniques or activities to link previous knowledge to current lesson.

4 Presentation

a) Statements

Concepts and principles are explained with the help of easy, clear and meaningful words. These concepts and principles are given by using inter-related, relevant and continuous statements and appropriate vocabulary. Vague words or phrases are not used.

b) Explanation

Concepts are defined as advance organizers. Concepts and principles are explained with the help of activity, experiment if require and possible, explaining links, discussion and appropriate examples (simple, relevant to the content and up to the interest and mental level of students) through appropriate media i.e. teaching aids and use of student's ideas or responses for furthering the lesson. In this phase, both inductive and deductive methods are used. Logical sequence of concepts and skills are presented in categories in an organized manner i.e. simple to complex. Students get opportunities to elaborate new information by connecting new information to something already known and by looking for similarities and differences among concepts (guided discovery). Important points are stated several times in different ways during the presentation of information. Opportunities are provided to the students for repetition of learning. Schedules are also made for periodic review of previously learned concepts and skills.

c) Use of Board

Good, legible, neat, appropriate and adequate words of the contents are written on the board.

d) Getting Student's Attention

Pupils' attention is secured and maintained by varying stimuli like gesture, movement, changing interacting styles, deliberate silence and non-verbal cues.

e) Students Participation

Pupils' participation is encouraged by verbal and non verbal reinforcers (positive reinforcement and negative reinforcement) and students' ideas. Students are encouraged to participate in the class room, respond to the teachers, give their own ideas and react to other ideas.

f) Speed of Presentation

Appropriate speed of presentation of ideas is maintained throughout the lesson that matches with the rate of pupils' understanding and proper budgeting of time.

g) Question Technique

Appropriate questions i.e. well structured and well-stated questions are used to foster pupils' participation in the lesson. Critical awareness is brought out by probing questions i.e. prompting, seeking further information, refocusing and redirection.

5 Closure/Conclusions

Main points of the lesson are consolidated at the end of the lesson. Present lesson is linked with the previous lesson and also with the next lesson. Opportunities are also provided for applying present knowledge in the classroom and at home.

6 Generalization

Opportunities are provided for the establishment of certain formulas, principles or laws. Students are encouraged to draw the conclusions themselves. If students' generalization is incomplete or irrelevant, the teacher provides the guidance for clarifying the concepts.

7 Evaluation

Evaluation is done by checking pupils' progress towards the objectives of the lesson after regular intervals. The teacher diagnoses the pupils' difficulties in understanding a concept or a principle by step-by-step questioning and by under-taking suitable remedial measures. Teacher use specific corrective feedback as needed. Opportunities are provided to the students to repeat important concepts to evaluate students' mastery on that concept. Students are evaluated on specific concepts and their critical attributes, recognition about examples and non-examples, and evaluate example and non-example in terms of their critical attributes.

8 Management of Classroom

During the lesson, the teacher recognizes both attending and non-attending behavior of the pupil. For this, attending behavior is rewarded and non-attending behavior is eliminated by giving directions to the students. The teacher uses the pupils' feeling and ideas to recognize pupils' attending and non-attending behaviors.

9 Home Task

Regular, relevant, short, challenging and innovative task about the topic according to the mental and interest level of the students is given to the students by explaining the way of working.

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