INCULCATION OF TEACHING-LEARNING PROCESS THROUGH CONSTRUCTIVIST APPROACH IN CHEMISTRY OF ATOMIC STRUCTURE CONCEPTS AT SCHOOLING

RAMPRAKASH PRAJAPATI & RASHMI SINGHAI
Chemistry department (DESM) Regional Institute of Education Bhopal, India (462016)

ABSTRACT

Atomic structure is most challenging concept for a chemistry to teach and students to grasp. Also, it is very significant in understanding many linked concepts throughout the study of chemistry. The purpose of this study was to know the impact of constructivist approach on atomic structure teaching in classroom and to know the experience of the students and teachers for the same. We want to know how to apply constructivist approach in classroom teaching to get desired learning outcomes on ninth grade students, understanding of atomic structure concepts. According to national focus group on teaching of science position paper (2006) science is dynamic, expanding body of knowledge covering ever new domains of experience. The progresses of science are marked not only by an accumulation of facts, but by the emergence of scientific method and the scientific attitude ,process and products are one of the important aspects of nature of science process leads to the development of products, and the products can be verified through process. Nature of science develops ones attitude toward science and science learning. Chemistry is future oriented and a disciplined way of seeking new knowledge for deeper understanding. It is a part of school education and it plays one of the pivotal roles for children's intellectual and personal development, which will help individual for a better life. In schools, chemistry prepares the children to understand basic chemical compositions, structure and other concepts along with process skills and its application. For this purpose ninth grade learners of a chemistry course (Atomic Structure topic) taught by the same teacher in DMS School, RIE, Bhopal, were enrolled in the study. The classes were randomly assigned as two groups .Learners in the first (control) group were instructed by traditionally designed chemistry instruction whereas learners in the second (experimental) group were taught by the instruction based on constructivist approach model. Atomic structure concepts, achievement test were administered to both groups as a pre-test and post-test in order to assess their understanding of concepts related to atomic structure. The results indicated that instruction based on constructivist approach caused significantly better acquisition of scientific conceptions related to atomic structure. Using constructivist approach teaching and learning process have brought excellent improvements in the learner's and teachers.

KEYWORDS: Constructivist approach, Traditionally Designed Chemistry Instruction, Control groups, Experimental groups, Atomic structure concepts.

INTRODUCTION:

One of the main aims of science education is to make a meaningful understanding of science concepts. This kind of learning can take place only when the learner relates the new information to his already existing knowledge. Knowledge cannot be transmitted to the learners mind from a textbook or by the teacher; instead, learners construct their knowledge by making links between their ideas and new concepts through experience they acquire in school or daily life. Learning science is a complex and slow process. Learners have difficulty in understanding most of the concepts in chemistry such as atomic structure, mole concepts solution and matter in our surrounding etc. Often learners have difficulty about the natural phenomena before coming to the classroom and these difficulties prevent meaningful learning. Therefore, instruction should focus on learner's ideas. Learners should be encouraged to think, ask questions, test ideas and explain phenomena. These can be achieved by instruction based teaching-

learning process. From this knowledge cannot be transferred into the learners instead learners be given space to meaning from the words of information, visual images, problem solving, reasoning, critical thinking and active use of knowledge are goals of learning. Teacher should consider what learners think about concepts and formulae lessons and then plan, instruction on the basis of learners' needs and interests. Atomic structure is one of the basic topics in chemistry. Since, it is an abstract concept which cannot be applied to everyday life; many learners are not able to comprehend this topic. They cannot relate microscopic world to macroscopic world. Understanding for atomic structure topic is important in chemistry in order to comprehend the nature of the particle of atom by using the physical and chemical properties, relation between particle of atom (proton, electron and neutron), the concepts of atoms and their model, the Dalton concept of atom, Thomson, Rutherford and Neils Boher model related to atom , the isotops, isobar, isoneutrons, isoelectronic and terms of $2n^2$. Practical knowledge and school knowledge are becoming mutually exclusive; many learners see little connection between what they learn in the science classroom with real life. Moreover, the traditional teaching method in which of teacher as information-giver to passive students appears outdated. They emphasize the learning of answers more than the exploration of questions, memory at the expense of critical thought, bits and pieces of information instead of understanding in context. In addition, they fail to encourage learners to work together, to share ideas and information with each other, or to use modern instruments to extend their intellectual capabilities. One solution for this problem is to prepare learners to become good adaptive learners. That is, learners should be able to apply what they learn in school to the various situations in real-life. Obviously, the traditional teacher-as- information giver, textbook guided classroom has failed to bring about the desired outcome of producing thinking learners. An alternative is to change the focus of the classroom from teacher-centered to learner-centered using a constructivist approach. With the emphasis on the learner, we see that learning is an active process occurring within and influenced by the learner as much as by the instructor and the school. From this perspective, learning outcomes do not depend on what the teacher presents. Rather, they are an interactive result of what information is in countered and how the learner processes it based on perceived notions and existing personal knowledge.

Constructivism is defined as a set of beliefs about knowledge that begins with the assumption that reality exists but cannot be known as a set of truth (Tobin et al, 1994). Constructivists believes that objective knowledge cannot exist, rather all of us are involved in constructing our own words, part of which we take as being shared by others. Constructivist believes in truth but not in a truth that has been constructed by somebody. It maintains that individuals create or construct their own new understandings or knowledge through the interaction of what they already know and believe and the ideas, events, and activities with which they come in contact. Knowledge is acquired through involvement with content instead of imitation or repetition. Constructivism is not accepting what you are told but your prior knowledge about what you are taught and your perceptions about it. The new idea is not imposed on the learner. The learner is actively re-structuring his past and present experiences. Learners' active involvement is emphasized in constructivism; the knowledge is then rooted into their memory.There is an external world made up of objects and events, which we want learners to learn about. However learners as well as scientists can never fully know reality. They can form approximations of reality, but never a true picture of it. Absolute truth is not possible. What we can aim for is to build useful ideas about the world that are viable and can be used to understand and explain nature? Viable knowledge can be applied to further our purposes and the quality of life.

All learning takes place in the brain of the learner, which is constructed as connections are made

With previously made constructions (Yager, 1991). Learners actively take knowledge, connect it to previously assimilated knowledge and make it theirs by constructing their own interpretation (Cheek, 1992). Learning cycle which is an inquiry- based teaching model is useful to teachers in designing curriculum materials and instructional strategies in science. The model is derived from constructivist ideas of the nature of science, and the developmental theory of Jean Piaget (Piaget, 1970) and developed by Robert Karplus. The learning cycle of Karplus has three phases. These are exploration, term introduction and concept application. Over the years the learning cycle is revised and added several phases. So, 5E learning cycle is formed. It consists of the following phases: engagement, exploration, explanation, elaboration and evaluation. The 5E learning cycle has been shown to be an extremely

effective approach to learning (Lawson 1995; Guzzetti et al. 1993).For this reason, in the present study we aimed to examine the effectiveness of atomic structure concepts" instruction based on 5E learning cycle model and attitudes toward science as a school subject. Learners' attitudes, feelings and perceptions of science are also important for science achievement. The present study examines the contribution of learners' science process skills to their understanding of atomic structure concepts.

OBJECTIVE OF THE STUDY:

1. To identify particle of atom by using the physical and chemical properties.
2. To state the relation between particle of atom (proton, electron and neutron).
3. To clarify the concepts of atoms and their models.
4. To give examples for atom and their particle in everyday life.
5. To explain the Dalton concept of atom, Thomson, Rutherford and Neils Boher model related to atom.
6. To clarify the Isotops, isobar, isoneutrons and isoelectronic terms and $2n^2$.

METHODOLOGY:

Teaching and learning is an interactive process that engaged the learners in constructing knowledge. In the elaboration part, learners applied the newly learned concepts into new situations. Evaluation and assessment of learners' knowledge is made through the instruction. In the evaluation phase students are asked several questions. So, the teacher had an idea whether the learners gained the necessary concepts or not. During, the PAC-programme/2019-20, at DMS, School, RIE, Bhopal an attempt was made to develop on instruction based teaching-learning strategy in atomic structure concept at school level for class ninth and try out the validity of the same. The promotion of skill for construction of understanding enabling teaching-learning process was carried out as:

1. For teaching-learning using instruction based process at school level, atomic structure topic was selected to teach class IX learners in DMS ,RIE, Bhopal and was decided to prepare test questionnaires and test was included two parts. First part consisted of two tier questions and evaluated learner's knowledge of atomic structure. Each question had two parts: a response section which learners were asked to mark only one of two possible answers and a reason section in which explains the answer in the previous part of the questions. Second part consisted of multiple choice questions. Each questions in this part had one correct answer and four distracters. There were 20 items totally in the test.
2. As per decision taken in the first step, frame work of atomic structure topic was prepared using class IX and test questions were prepared using NCERT text book. Planning for implementation of test items on atomic structure was made for learners of class IX, DMS, RIE, Bhopal.
3. Pre-test of 30 marks for 45 minutes durations was conducted. The pre-test was conducted followed by the presentation of topic. Learners were made to think logically so that they understand the concept clearly. Thought provoking questions were put at every point of the topic which made the students to think and search the solution for the questions. After the presentation, the learners were evaluated with the help of post-test. The pre-test and post-test were compared as result. A tremendous change in the learning aspect was found, the learners were also asked to, rate various skill like about atomic structure, contents clarity of the topic, impact of the instruction based teaching-learning process and topic wise evaluation was done.
4. The same tool was used in pre-test and post –test to measure the gain. SSPS was used for data analysis.
5. The result obtained was compiled and evaluation on the atomic structure was done as per the suggestions and feedback collected by the learners and teachers.

RESULTS AND DISCUSSIONS:

1. Analysis of data suggested that the experimental group was significantly higher than the control group in achievement of mean score on atomic structure after the intervention of constructivist approach.

2. There was a significant increase in post-test mean score of the experimental group in the achievement in the following domains of atomic structure after using constructivist approach (Knowledge, understanding and application). It was evident from the study that there is a good

gain score in all learning domains and highest gain is seen in application domain of learning. This indicates that constructivist approach is effective in enhancing applying abilities of the learner.

3. There was a significant increase in post-test mean score of the experimental group in the achievement in the following domains of atomic structure after using constructivist approach - the particle of atom and their physical and chemical properties, relation between particle of atom (proton, electron and neutron), the concepts of atoms and their model, the Dalton concept of atom, Thomson, Rutherford and Neils Boher model related to atom , the Isotopes, isobar, isoneutrons, isoelectronic and terms of $2n^2$.

This answers the research question which led this study:

1. Constructivist approach is an effective solution to problems in understanding of atomic structure concept.
2. Constructivist approach is effective in enhancing various domains of learning significantly.

3 .There is a significant increase in the learning different areas of atomic structure concept with 5E model.

CONCLUSIONS

Atomic structure study concludes that one way to make sense of how students learn through constructivism. Based on the data analyses results, it can be concluded that learners had difficulty in understanding atomic structure units. But by using instruction based (5E model) teaching-learning strategies, better acquisition of scientific concepts was observed. Because, of instruction based (5E model) teaching-learning process focused on learners ideas, encouraged learners to think about situations and use their knowledge and share their ideas. Hence, advance questioning, activates relevant prior knowledge and promotes meaningful learning. This also causes learner's to have more positive attitudes towards chemistry at school level. In short, this study showed that 5E learning cycle model is an effective teaching strategy. On the contrary, traditional instruction does not seem effective in developing learners' understanding of atomic structure concepts. 5E learning cycle model can provide teachers with many insights into how learners can learn about and appreciate science. By using this teaching strategy, better acquisition of scientific concepts could be observed.

IMPLICATIONS

1. Implementing 5E model in teacher training both preservice and inservice would be a worthwhile suggestion from this study.

2. Present study is delimited to atomic structure and hence further researcher can be carried out in field of 5E model applied to various other units of chemistry.

3. Development and validation of learning material for implementation of constructivist approach.

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Corresponding Author Dr. Ramprakash Prajapati Associate Professor of Chemistry, RIE ,Bhopal