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DEVELOPMENT OF SKILL FOR UNDERSTANDING OF TEACHING-LEARNING PROCESS USING 5E CYCLE IN CHEMISTRY OF ACID-BASE CONCEPTS AT SECONDARY LEVEL

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ABSTRACT
The main purpose of this study was to know the effectiveness of 5E learning cycle model based on constructivist approach over traditionally designed Chemistry instructutions on tenth grade students', understanding of acid-base concepts. According to NCF-2005 teacher should act as a facilitator and not as a transformer of content where learner's can think,realize,analyse and develop their own way of learning which should be something beyond the text books .For this purpose thirty nine tenth grade students of a chemistry course(Acids and Bases topic) taught by the same teacher in DMS School RIE Bhopal, were enrolled in the study. The classes were randomly assigned as two groups .Students in the first (control) group were instructed by traditionally designed chemistry instruction whereas students in the second (experimental) group were taught by the instruction based on 5E learning cycle model. Acid-Base 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 acid-base. The results indicated that instruction based on constructivist approach caused significantly better acquisition of scientific conceptions related to acid-base. Using constructivist approach teaching and learning process have brought excellent improvements in the learner's and teachers. Students in both groups showed statistically equal development in attitude toward chemistry as a school subject.

INTRODUCTION

The major aim of science teaching is to promote the understanding of the concept being taught with a view to applying the knowledge of such understanding to real life situations. Inspite of the much focus on teaching strategies in science, students' performance in science subjects continued to record a persistent and depressing downward trend. Studies show that students are unable to successfully integrate or contrast memorized facts and formulate with real-life applications outside the science classroom. Practical knowledge and school knowledge are becoming mutually exclusive; many students 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 students 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 students to become good adaptive learners. That is, students should be able to apply what they learn in school to the various

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situations in real-life. Obviously, the traditional teacher-as- in formation giver, textbook guided classroom has failed to bring about the desired outcome of
producing thinking students. An alternative is to change the focus of the classroom from teacher-centered to student-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 student 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. Students' active involvement is emphasized in constructivism; the knowledge is then rooted into their memory. Von Glasersfeld (1993) argues that constructivism is a way of knowing that recognizes the real world as a source of knowledge. There is an external world made up of objects and events, which we want students to learn about. However students as well as scientists can never fully know reality. They can form approximations of freality, 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. This notion implies that reality is dependent upon the mind for its existence, hence knowledge is constructed by the mind rather than being a facsimile of reality.

Constructivism is not really a new concept. It has its roots in various disciplines such as education, psychology, philosophy and the history of science. John Dewey, Jean Piaget, Edmund Husser and Thomas Kuhn are only handful of theorists whose work impacts constructivist thought. As its name implies, constructivism emphasizes building or constructing the knowledge. All learning takes place in the brain of the learner, which is constructed as connections are made
with previously made constructions. Giambatista Vico commented in a treatise in 1710 that "one only knows something if one can explain it." (Yager, 1991). Immanual Kant further elaborated this idea by asserting that human beings are not passive recipients of information. 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 acid- base concepts" instruction based on 5E learning cycle model and attitudes toward science as a school subject. Students'

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attitudes, feelings and perceptions of science are also important for science achievement. This study investigates also the effect of treatment on students' attitudes toward chemistry. Chang (2002) and Parker (2000) stated in their studies that the type of instruction affected students' attitudes toward science as a school subject Students' attitudes, feelings and perceptions of science play an important role for their science achievement and their selection of career related to science in the future. In this study, science process skills that are important for understanding scientific concepts are also investigated. In science education, Lazarowitz (2002) indicated that learning science requires high cognitive skills. The present study examines the contribution of students' science process skills to their understanding of acids-bases concepts.

OBJECTIVE OF THE STUDY:

1. To identify an acid and a base by using the physical and chemical properties.
2. To state the relation between acids and bases.
3. To clarify the strength of acid solutions increases with the amount of H+ ions in the solutions and base solutions increases with the amount of OH- ions in the solution.
4. To give examples for acidic and basic substances in everyday life.
5. To explain that solutions with a pH less than 7 are acids and a solution with a pH more than 7 are bases.
6. To state that strength of an acid increases with a decrease in pH and of a base increases with a increase in pH.
7. To show that acids change blue litmus paper to red and bases change red litmus paper to blue.
8. To clarify that a solution with a pH = 7 is neither an acid nor a base but a neutral solution.
9. To identify that a acid-base reactions are neutralization reactions.

SIGNIFICANCE OF THE STUDY

Students are unable to successfully integrate memorized facts and formulate with real life application in chemistry concepts. The concept "Acid-Base" is one of them. This is because it's abstract nature. Also teaching methods of acid-base concept play very important role. The old methods used in science curriculum do not develop student interest in the subject matter. The old methods also do not empower students to become deep thinkers who are capable of making new discoveries and solving complex problems. Constructivism is a theory that gives hope to the development of the deep understanding of the sciences in students of all ages. In the constructivist approach, students construct their knowledge by making links between their ideas and new concepts through experience they acquire in school or daily life. Learning cycle instructional technique based on the constructivist approach an result in greater achievement in science, better retention of concepts, improved attitudes toward science and science learning, improved reasoning ability, and superior process skills than would be the case with traditional instructional approaches (Abraham & Renner, 1986; Raghubir, 1979; Renner, Abraham & Birnie,1985). This study deals with 5E learning cycle model, and its effectiveness. It tries to compare instruction based 5E learning cycle model with traditional chemistry instruction. Therefore this study will provide some information about the instruction based on 5E learning cycle model, its application into the classroom situation.

METHODOLOGY:

Instruction based teaching -learning process is student centered in that learners make use of subject matter for interaction and healthy engagement, classroom environment encourages discussions and negotiation of idea. This gives opportunity to students revise their structure and see other students ideas. In this way, the teacher may realize learner's difficulty and focus on activities to change them with scientifically correct explanation. Therefore; the teachers also should be more sensitive to children's prior knowledge. . Since learning is a social process, students worked in groups with their friends. So interaction is maximized through this way. In the learning process, students also made hands-on and minds- on activities. They participated actively in instruction. In this strategy, in the first phase of cycle called "engagement", students are asked several questions. Here the purpose of teacher was to

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activate students' prior knowledge. In the exploration phase, the teacher asked a question for students to explore the phenomena by themselves. In two phases, teacher let the students to discuss with their friends. In this learning environment, students tried to make connections between the new concepts and the existing ones. The main advantage of the constructivist instruction was that the students derived the scientific facts after long discussions with their peers; scientific facts were not narrated by the teacher as in the traditional instruction. Discussion was mostly used through all phases to increase student- student and also student-teacher interaction. Since students cannot discover all important ideas on their own, social interaction is a vital part of their educational excursion. Students benefit from discussions with teachers and interactions with peers who can help them to acquire new concepts. Further, students received information that has been organized by others, so long as it is meaningful to their way of thinking and knowing. In this way, the teacher also created a learning environment where students could use their prior knowledge and become aware of their already existing conceptions. During discussion with their peers, the students tried to make a connection between their existing knowledge and the new concept. They analyzed, interpreted, and predicted information. By this way they constructed knowledge actively, instead of receive it from the teacher passively. Teaching and learning was an interactive process that engaged the learners in constructing knowledge. In the elaboration part, students applied the newly learned concepts into new situations. Evaluation and assessment of students' knowledge is made through the instruction. In the evaluation phase students are asked several questions. So, the teacher had an idea whether the students gained the necessary concepts or not. During, the PAC-programme/2016-17, at DMS, School, RIE, Bhopal an attempt was made to develop on instruction based teaching-learning strategy in Acids and Bases concept at school level for class tenth 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, Acids, Bases topic was selected to teach class X students 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 Acids and Bases. Each question had two parts: a response section which students 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 15 items totally in the test.
2. As per decision taken in the first step, frame work of Acids and Bases topic was prepared using class X and test questions were prepared using NCERT text book. Planning for implementation of test items on Acids and Bases was made for students of class X, DMS, RIE, Bhopal.
3. Pre-test of 20 marks for 45 minutes durations was conducted. The pre-test was conducted followed by the presentation of topic. Students 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 students 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 students were also asked to, rate various skill like about Acids and Bases, contents clarity of the topic, impact of the instruction based teaching-learning process and topic wise evaluation was done.
4. The result obtained was compiled and evaluation on the Acids and Bases was done as per the suggestions and feedback collected by the students and teachers.

RESULTS AND DISCISSIONS:

The result of the pre-test and post-test was complied which shown in graph no. 1 & 2. The scale of evaluation of topic (Acids and Bases) also shows the percentage improvement of the topic taught using the instructions based teaching-learning process (5E

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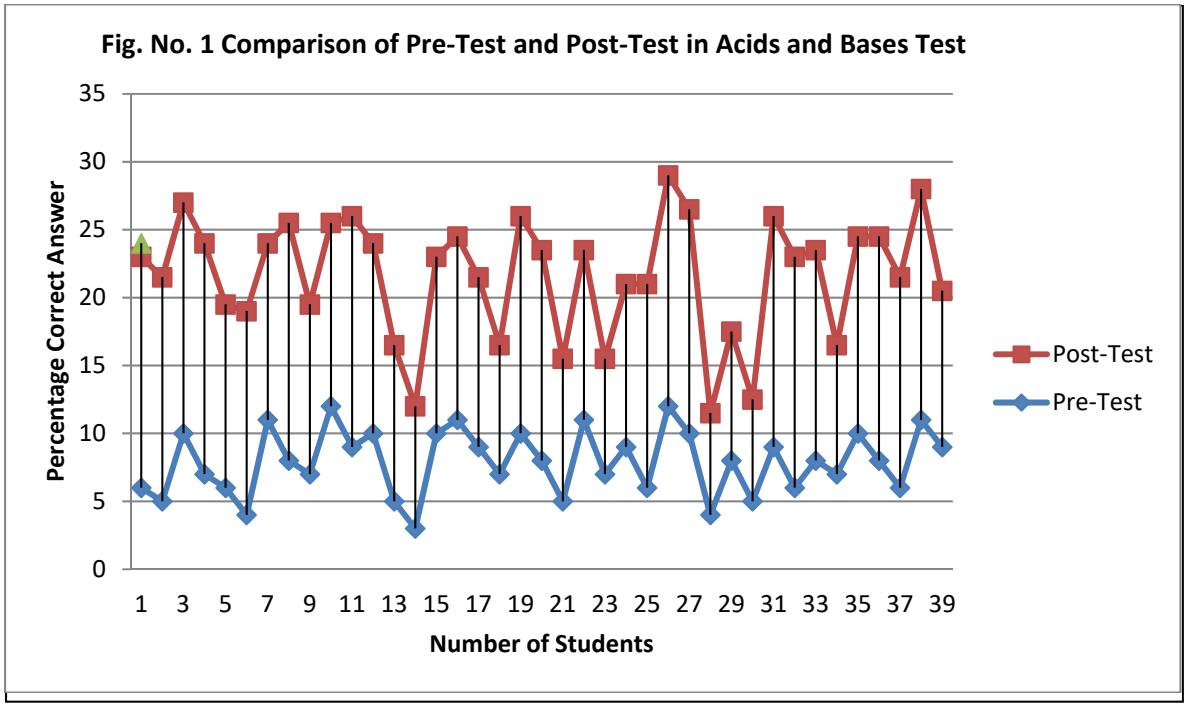
cycle). The feedback obtained from the student's shows that the implementation of instruction based process skills made excellent and positive impact on their learning process. All the learners have shown an increase of 33% to 86% in the marks of post-test. It shows the success of instruction based (5E cycle) learning process support.

In the light of the results obtained from analysis, it can be concluded that traditional instruction is less effective than instruction based on 5E learning cycle model. There may be some reasons. The traditional instruction was teacher-centered that is the teacher transferred their thoughts and meanings to the passive students. The teacher provided information without considering students' prior knowledge and checked whether students have acquired it or not. Lecture method is generally used by the teacher in instruction. She wrote important notes to the board and distributed work sheets to the students to complete. During instruction students listened to their teacher, took notes, studied their textbooks and completed the worksheets. The students were not given any opportunity to develop their thinking, reasoning and communication skills. They only received the teacher's truth while she lecturing. They were not given opportunity to use problem-solving skills in other situations. Since the teacher instructed the lecture, students in first (control) group did not have so many chances to discuss or share ideas with each other. There was no interaction between teacher and students, and students and students in first (control) group. They didn't become more confident in their understanding of science.



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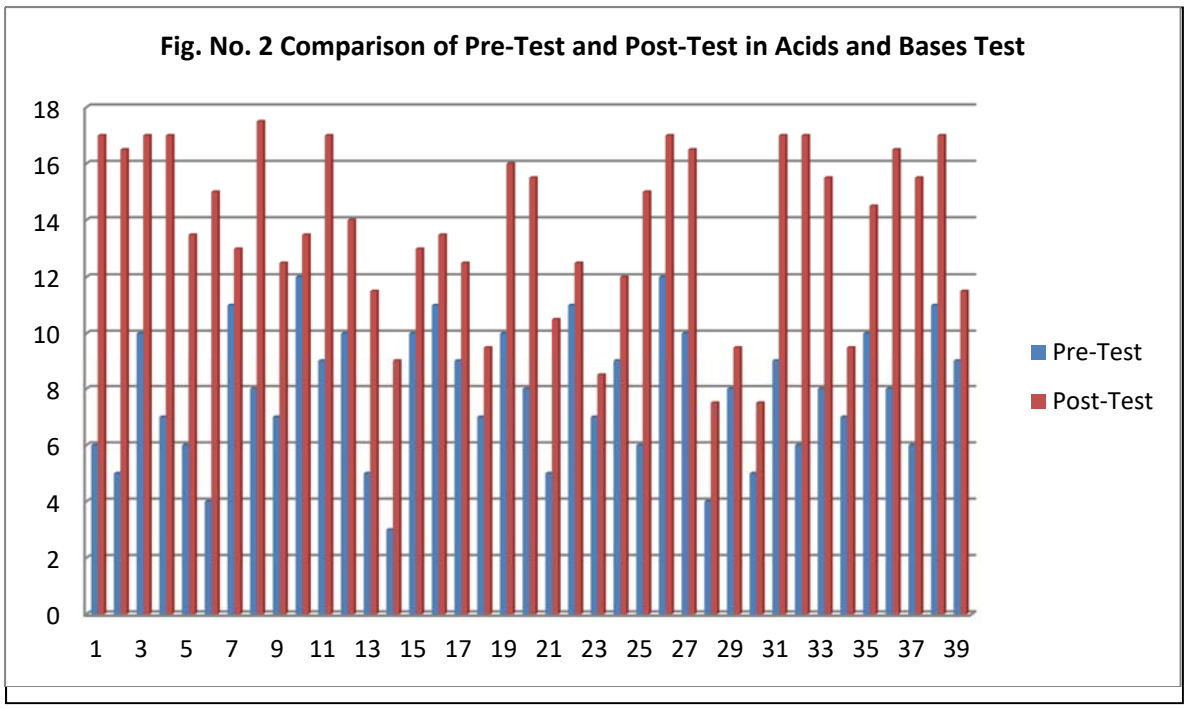

On the other hand, in 5E learning cycle based instruction students were actively involved in the learning process and constructed their own knowledge. This might be caused the difference in the concept test scores in traditional instruction versus 5E learning cycle instruction. Teacher who engages students in thinking, questioning, testing ideas, explaining, and representing ideas. The teacher should have good subject- matter knowledge and be flexible in their teaching methods. Otherwise, they tend to use the traditional way of teaching). So, it can be concluded that the second (experimental) group in this study were provided for meaningful learning to be occur. After the results are assessed, it is seen that there is a significant mean difference between the first (control) and second (experimental) group. Both groups of students increased their understanding in the acid-base concept as expected, but the improvement is greater in the experimental group.

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 students' understanding of acid-base concepts. 5E learning cycle model can provide teachers with many insights into how students can learn about and appreciate science. By using this teaching strategy, better acquisition of scientific concepts could be observed. 5E learning cycle model is useful not only improving achievement but also they help students construct their views about science and develop thinking ability advance questioning activates relevant prior knowledge and promotes meaningful learning.

CONCLUSIONS

Acids and Bases which is studied in this study includes that one way to make sense of how students learn is through constructivism. Learning is regarded as an active process hereby students construct personal

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meaning of the subject matter through their interactions with the physical and social world. It is the student who makes sense out of the experiences. The learning process is facilitated by the skilled teacher who engages students in thinking, questioning, testing ideas, explaining, and representing ideas. The teacher should have good subject- matter knowledge and be flexible in their teaching methods. Otherwise, they tend to use the traditional way of teaching .So, it can be concluded that the experimental (second) group in this study were provided for meaningful learning to be occur. After the results are assessed, it is seen that there is a significant mean difference between the experimental (second) group and control (first) group. Both groups of students increased their understanding in the acid-base concept as expected, but the improvement is greater in the experimental group. Furthermore, this study also investigated the effect of treatment; 5E learning cycle based instruction and traditionally designed chemistry instruction, on students' attitudes towards chemistry as a school subject. In order to have more positive attitude, 5E learning cycle model can be used throughout the whole science concepts. 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 students' understanding of acid-base concepts. 5E learning cycle model can provide teachers with many insights into how students can learn about and appreciate science. By using this teaching strategy, better acquisition of scientific concepts could be observed. 5E learning cycle model is useful not only improving achievement but also they help students construct their views about science and develop thinking ability.

IMPLICATIONS

In the light of the findings of the present study the following implications could be offered:

1. Since its abstractive nature learning chemistry is difficult. Prospective teachers should be given opportunities to apply their understandings about 5E learning cycle model based on constructivist approach on high school students. Universities and schools should work together to create more fully developed constructivist teachers.

2. Teachers should use instructional techniques that promote students' understanding such as: 5E learning cycle based instruction since traditional instruction is less effective than 5E learning cycle based instruction. The role of the teacher is facilitate safe, guided or open inquiry experiences and questioning so students uncover their misconceptions about the concept. And also, in universities, teacher education programs especially methods of science courses should include some topics related to 5E learning cycle approach.

3. Teachers should create disequilibrium with students' existing conceptions, so that, they will have to rethink and try to reconstruct understanding.

4. Teachers should be trained about the usage and importance of 5E Learning Cycle based on constructivist approach and they must plan the instructional activities accordingly. Curriculum programs should be based on the constructivist perspective.

5. Teachers should be aware of students' attitudes towards chemistry as a school subject. They must know that attitudes affect the students' achievement and should seek to improve students' attitudes.

RECOMMENDATIONS

Based on the results of this study, the followings recommendations are made for further:

1. A study can be conducted for different grade levels and different science courses to investigate the effectiveness of the 5E learning cycle model.

2. Further studies can be carried out to investigate the effectiveness of 5E learning cycle approach in understanding science concepts in different schools. So, more accurate results can be obtained.

3. This study can be conducted with larger sample size out in order to obtain more accurate results.

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Theme and subtheme-Constructivist approaches in facilitating learning of science

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