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CONSTRUCTIVISM: AN INNOVATIVE TEACHING METHOD IN BIOLOGICAL SCIENCE TO DEVELOP SCIENCE PROCESS SKILLS AND SCIENCE CURIOSITY AMONG SECONDARY SCHOOL STUDENTS

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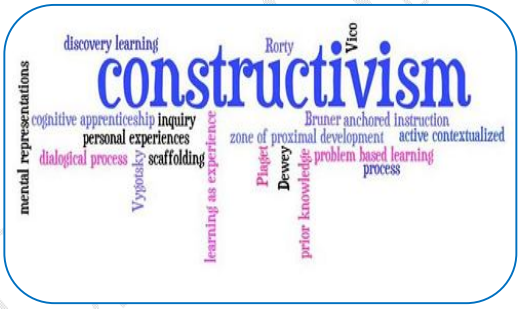
ABSTRACT :

Constructivist approach has been a new revolution in conceptions of teaching and learning. The term Constructivism refers to an idea that individual, through their interaction with the environment, constructs their own knowledge and meaning. The present paper explains the importance of constructivism in developing science process skills and science curiosity in Biological science among secondary school students.



KEYWORDS : *Constructivism, Science process skills, Science curiosity.*

INTRODUCTION

'Constructivism' the term refers to the idea that individuals, through their interaction with the environment, construct their own knowledge and meaning [Fosnot,1996;Staffe and Gale,1995].

Constructivism is an epistemology, a learning theory which offers an explanation of the nature of knowledge and how human beings learn. It maintains that individuals create or construct their own new understandings or knowledge through interactions of what they already know and believe and ideas , events and activities with which they come in contact.

Constructivist learning is based on student's active participation where they are "constructing" their own knowledge by testing ideas and approaches based on their prior knowledge and experience , applying these to new situations and integrating the new knowledge gained with pre-existing intellectual constructs.

"The central principles of this approach are that learners can only make sense of new situations in terms of their existing understanding. Learning involves an active process in which learner's construct meaning by linking new ideas with their existing knowledge."[Nayor & Keogh] The Biological Science Curriculum Study (BSCS),a team whose principal investigator is Roger Bybee developed an instruction called the five "Es". They are Engage, Explore, Explain, Elaborate and Evaluate.

The Constructivist approach revolutionises a new vision of the learner as an active sense-maker and suggests new method of instruction. It facilitates presentations of materials in a constructivist way and engages students in an active explorative learning. The new approach allows the learners to have more control over their own learning, to think analytically, critically and to work collaboratively. Constructivist approach is an effort at educational reform and particularly a revolutionary vision of instructional stratagies. Research on instructional strategies, particularly in the areas of cognitive processing, teacher effects, and teaching of cognitive strategies, suggests specific instructional principles than can be of great use to create constructive learning environment in the classroom[Rosenshine,1996].

In contrast, constructivist or student-centred learning poses a question to the students, who then work together in small groups to discover one or more solutions. Students play an active role in carrying out experiments and reaching their own conclusions. Teachers assist the students in developing new insights and connecting them with previous knowledge, but leave the discovery and discussion to the student groups. Questions are posed to the class and students learn to work together to discuss and reach agreement on their own answers, which are then shared with the entire class.

Therefore the teaching –learning approach also influences to a greater extent in transacting the content to be learned. These type of approaches definitely increases the curiosity to know new and new things ,also children develops the skills, sense experiences, attitude towards science and finally they try to lead a systematic and scientific way of life.

Constructivist approach can also be used in online learning. For example, tools such as discussion forums, wikis and blogs can enable learners to actively construct knowledge. A contrast between the traditional classroom and the constructivist classroom is illustrated below:

The Traditional Classroom

- Begins with parts of the whole–Emphasizes basic skills
- Strict adherence to fixed curriculum
- Textbooks and workbooks
- Instructor gives/students receive
- Instructor assumes directive, authoritative role
- Assessment via testing / correct answers
- Knowledge is inert
- Students work individually

The constructivist Classroom

- Begin with the whole – expanding to parts
- Pursuit of student questions / interests
- Primary Sources / manipulative materials
- Learning is interaction – building on what students already know
- Instructor interacts / negotiates with students
- Assessment via student works, observations, points of view, tests. Process is as important as product
- Knowledge is dynamic / change with experiences
- Students work in groups Source : Thirteen Ed Online (2004)

Because existing knowledge schemata are explicitly acknowledged as a starting point for new learning, constructivist approaches tend to validate individual and cultural differences and diversity.

ROLE OF TEACHERS

In the constructivist classroom, the teacher's role is to prompt and facilitate discussion. Thus, the teacher's main focus should be on guiding students by asking questions that will lead them to develop their own conclusions on the subject. A teacher is not an authority. She/he does not lecture. She/he is a facilitator or guide. She helps the learners. The facilitator has to create proper environment in the class so that the students are motivated, challenged and think deeply to arrive at his/her own conclusions.

Parker J. Palmer (1997) suggests that good teachers join self, subject, and students in the fabric of life because they teach from an integral and undivided self, they manifest in their own lives, and evoke in their students, a capacity for connectedness". Various educators and cognitive psychologists have applied constructivism to the development of learning environments. The teacher acts as a facilitator of the educational context. The teacher provides opportunities for observation, interaction of students with each other and with the teacher through questioning techniques, modifying the environment, and support during conflicts and planning and creating curriculum.

SCIENCE PROCESS SKILLS

Science process skills are central to the acquisition of scientific knowledge which is useful in solving problems in society. Scientific process skills have started to gain more importance in these secondary science education programmes.

SIX BASIC PROCESS SKILLS

The science process skills form the foundation for scientific methods. There are six basic science process skills:

- Observation
- Communication
- Classification
- Comparison
- Inference
- Prediction

These basic skills are integrated together when scientists design and carry out experiments or in everyday life when we all carry out fair test experiments. All the six basic skills are important individually as well as when they are integrated together. The six basic skills can be put in a logical order of increasing sophistication, although even the youngest students will use all of the skills alongside one another at various times.

SCIENCE CURIOSITY

Advancement in science and technology have been influenced considerably by man's natural curiosity. Kreitler, Kreitler and Zigler(1974) have indicated that curiosity not only facilitates cognitive functioning in general but also facilitates the use of intellectual potential in particular.

Curiosity does not have a unique definition. However, Maw and Maw's definition of curiosity has been frequently cited in the literature. Maw and Maw (1962) indicated that a child is said to exhibit curiosity to the degree that he:

1.reacts positively to new, incongruous or mysterious elements in the environment by moving towards them, by exploring them or by manipulating them.
2.exhibits a need or a desire to know more about himself and /or his environment.
3.scans his surroundings seeking new experience and
4.persists in examining and exploring stimuli to know more about them.

A high degree of curiosity in a given area is generally considered to be advantageous for achievement in that area. It is due to curiosity that the scientists, philosophers and artists find out new facts which ultimately lead to the new creations. Curiosity leads to divergence in perception, thinking and behaviour. Schools must face the challenges of awakening a lifelong intellectual curiosity in studies so that they can grow into the full creative use of their minds to better meet the demands and challenges of the future.

OBJECTIVES OF THE STUDY

Major Objective:

To compare the effectiveness of constructivist approach and traditional approach of teaching biological science with respect to science process skills, science curiosity among secondary school students.

Minor Objectives:

1. To develop Constructivist approach based lessons in Biological science for a selected unit of VIII standard.

2. To find out the difference between the experimental group and control group (pre-test) in terms of science curiosity among the students.
3. To find out the difference between the experimental group and control group (pre-test) in terms of science process skills among the students.
4. To find out the difference between the experimental group and control group (post-test) in terms of science curiosity among the students.
5. To find out the difference between the experimental group and control group (pos-test) in terms of science process skills among the students.

HYPOTHESES OF THE STUDY

Major Hypothesis:

There is no significant difference between the effectiveness of constructivist approach and traditional approach of teaching biological science with respect to science process skills, science curiosity among secondary school students.

Minor Hypotheses:

1. There is no significant difference found in developing Constructivist approach based lessons in science for a selected unit of VIII standard.
2. There is no significant difference found between the experimental group and control group (pre-test) in terms of science curiosity among the students.
3. There is no significant difference found between the experimental group and control group (pre-test) in terms of science process skills among the students.
4. There is no significant difference found between the experimental group and control group (post-test) in terms of science curiosity among the students.
5. There is no significant difference found between the experimental group and control group (pos-test) in terms of science process skills among the students.

METHODOLOGY IN BRIEF

Method adopted for the study

The investigator adopted Experimental method for the present study. Pre.test-Post.test parallel group design were consider.

Sample for the study

The study is based on the purposeful sampling method and to be conducted on a sample of 200 students of standard VIII selected from two secondary schools in Raichur district.

TOOLS USED IN THE STUDY

For the present study following tools are used,

1. A lesson plan for teaching Biological Science based on Constructivist Method.
2. Science Curiosity Scale.
3. Test of Process skills in Biological Science.

STATISTICAL TECHNIQUES USED

The following statistical techniques were used for analysis.

1. Test of significance of difference between means.[t-test]
2. Analysis of variance.[F-test]

PROCEDURE

Experimental method was adopted for conducting the study. The effectiveness of Constructivists based on BSCS (The biological science curriculum study, a team whose principal investigator is Roger Bybee developed an instructional manual called the five 'Es" They are Engage, Explore, Explain, Elaborate and Evaluate.

The effectiveness of Constructivism in teaching biological science was tested by experimental method by selecting a sample of 200 Students (100 students in the experimental group and 100 students in the control group). The topic "Food and its components" of VIII Std was selected for the study. The control group was taught by the Traditional method and the experimental group was taught using the Constructivist method. Standardized test of Science Curiosity and Standardized test Science Process Skills were administered to the Traditional group and constructivist group. The Pre-test and Post-test scores obtained were compared to determine the effectiveness of Constructivist approach in teaching biological Science over traditional method of teaching for developing Science Process Skills and Science curiosity of Secondary School Students.

Analytical discussion (Findings)

Hpothesis-1

1.There is no significant difference found between the experimental group and control group (post-test) in terms of science curiosity among the students.

Table-1 [t-test]

Group	No, of students	Mean	S.D	t-value	Level of significance
Experimental group	100	10.72	3.31	9.786	0.05
Control group	100	6.86	2.13		

Table-2 ANOVA[F-test]

	Sumof squares	df	Mean square	F-value	LOS
Between groups	54381.627	35	1553.761	26.903	0.05
Within groups	3696.333	64	57.755		
Total	58077.960	99			

Statistical analysis of data of Table-1 and Table-2 revealed that obtained t-value and F-values are greater than table t-value and table F-value at 0.05 Level of Significance. Hence the Null hypothesis is rejected and the alternative hypothesis is accepted. The difference is in favour of post-test Science curiosity of Experimental group. It can be concluded that the Experimental group is highly curious to control group with regard to post-test Science curiosity.

Hpothesis-2

2. There is no significant difference found between the experimental group and control group (pos-test) in terms of science process skills among the students.

Table-3 [t-test]

Group	No.of students	Mean	S.D	t-value	Level of significance
Experimental group	100	17.98	1.99	17.78	0.05
Control group	100	10.72	3.56		

Table-4 [ANOVA[F-test]]

	Sumof squares	df	Mean square	F-value	Level of significance
Between groups	142.764	13	10.982	3.054	0.05
Within groups	309.276	86	3.596		
Total	452.040	99			

Statistical analysis of data of Table-3 and Table-4 revealed that obtained t-value and F-value are greater than table t-value and table F-value at 0.05 LOS, hence the Null hypothesis is rejected and the alternative hypothesis is accepted. The difference is in favour of post-test Science process skills of Experimental group. It can be concluded that the Experimental group is superior to control group with regard to post-test Science process skills.

RESULT

The results of the study support the value of constructivist approach. It was found that the students who were taught through Constructivist approach of teaching had performed better than those who were taught through Traditional method. The constructivist class has a higher score, students involve in discussion and interaction, social aspect is primary strength of constructivist model.

CONCLUSION

To conclude, it can be said that constructivist pedagogy is a very effective means of science teaching. However, the success of this pedagogy presupposes that the teachers should not only be well-trained in a constructivist approach, but they should also be dedicated enough to follow its requirements patiently. The data collected from this study certainly supports the benefits generally attributed to constructivist approach of teaching.

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