



A STUDY ON THE EFFECT OF CONSTRUCTIVISM IN TEACHING BIOLOGICAL SCIENCE TO SECONDARY STUDENTS ACHIEVEMENT

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Abstract

Constructivism is a learning theory that states that one constructs knowledge and understanding of one's environment through experiences. The present paper discusses about how an attempt is made to prepare a lesson plan for science teachers based on 5E's model (one of the model of constructivism) on the topic "Food and its components". This sample lesson plan will facilitate the science teachers in the implementation of constructivist approach in their classroom among these students than the traditional approach.

Keywords: Constructivism, Biological Science, Achievement



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INTRODUCTION

In the 21st century, we have seen rapid changes in science and technology, as well as in the living standards of communities. Expectations of people have also increased. As life conditions have changed, peoples' needs and views of the world are also subject to change. The on-going need for education is obligatory, yet the idea that changes are possible only through education has not kept pace. Nonetheless, new developments are seen in every field, including some in education. Countries that do attempt to keep pace with the rapidly changing world are updating their curricula in science education, from the earliest years of primary school to the highest levels of education. Science education curriculum was revised in 2004 under new constructivist theories reshaped by the Ministry of National Education in 2000. This curriculum was constructed within the scope of constructivist theory and has been applied (Bozdoan and Altuncekcic, 2007).

CONSTRUCTIVISM

'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." [Naylor & 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 revolution offers 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 as such is an effort at educational reform and particularly a revolutionary vision of instructional strategies. Research on instructional strategies, particularly in the areas of cognitive processing, teacher effects, and teaching of cognitive strategies, suggests specific instructional principles that 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 method also influences to a greater extent in transacting the content to be learned. This type of methods definitely increases the curiosity to know new

and new things. Children develop the skills, sense experiences, attitude towards science and finally they try to lead a systematic and scientific analysis, what they come across.

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 is a facilitator or guide. She/he 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.

STATEMENT OF THE PROBLEM

“A Study on the effect of Constructivism in teaching Biological science to Secondary Students Achievement”

OBJECTIVES OF THE STUDY

1. To study the effectiveness of constructivist approach on the academic achievement in science.
2. To study the effectiveness of constructivist approach on the academic achievement in science with respect to gender.

HYPOTHESES OF THE STUDY

1. There is no significant difference found between the effectiveness of constructivist approach on the academic achievement in science
2. There is no significant difference found between the effectiveness of constructivist approach on the academic achievement in science with respect to gender.

Sample for the study

The study is based on the purposeful sampling method and 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 approach.
2. Academic Achievement test in Biological Science.[Based on the lesson plan]

STATISTICAL TECHNIQUES USED

1. Test of significance of difference between means.[t-test]

5E Model, developed by Roger Bybee. Bybee is among the innovators of BSCS (Biological Science Curriculum Study)

Constructivism is the philosophy of learning that proposes learners need to build their own understanding of new ideas. Much has been written about constructivism by leaders in the fields of learning theory and cognition. Scholars such as Jean Piaget, Eleanor Duckworth, George Hein, and Howard Gardener have explored these ideas in depth. BSCS, lead by Bybee, developed an instructional model for constructivism, called the "Five Es" (Akar, 2005). The 5E Learning Cycle involves learning something new, or attempting to understand something familiar in greater depth. It is not a linear process. In trying to make sense of things, students use both their prior experience and the first-hand knowledge gained from new Explorations (Newby, 2004).

The BSCS 5E Instructional Model, or the 5Es, consists of the following phases:

Engaging, Exploring, Explaining, Elaborating, and Evaluating. Each phase has a specific function and contributes to the teacher's coherent instruction, as well as the learners' formulation of a better understanding of scientific and technological knowledge, attitudes, and skills (Bybee, 2006).

1- Engagement phase: At this stage, teacher should stimulate students to draws their attention, involving in the learning process and make connections between past and present learning experiences through varied interesting and meaningful activities; where raised questions concerning the pre-defined problem at this stage, have the students reveal their ideas and beliefs, compare students' ideas, let them work individually or in cooperative groups, then the students should become mentally engaged in the concept, process, or skill to be learned.

2- Exploration phase: At this stage, the student will interact with new experiences that arouse many questions that may be difficult to answer, and then by doing activities and try to find an answer to these questions that will lead him/her to discover relationships that were not known to him before. The teacher's role will be guidance, encouragement, and training to enhance continuing such activities until the clear image of scientific concept become apparent.

3- Explanation phase: At this stage, the student will benefit from the results of the previous two phases where he can correct his misconception, and the teacher's role is to collecting formation from students to help them in organizing and summarizing and process mentally until the concepts, operations, and skills become understandable and clear; then student, at this stage reach the new ideas offered by teacher and has the ability to re-formulated these ideas in a scientific manner, and the teacher start to draw and connect the student's interpretations with these experiences to make sure that the student is able to interpret the exploratory experiments using scientific terms correctly.

4- Elaboration phase: At this stage, teachers challenge and extend students' conceptual understanding and skills. Through new experiences, the students develop deeper and broader understanding, more information, and adequate skills. Students apply their understanding of the concept by conducting additional activities.

5- Evaluation phase: At this stage, students receive feedback on the adequacy of their explanations and abilities, informal evaluation can occur from the beginning of the instructional sequence. It is an on-going diagnostic process that allows the teacher to determine if the learner has attained understanding of concepts and knowledge. Evaluation and assessment can occur at all points along the continuum of the instructional process.

There are many advantages of (5E's) instructional model like that; it takes into account Individual differences, introduce progress in knowledge and science as a way of research where the student follows the learning from micro to macro, motivate student to use his mental processes, and show attention to focus on the development of multi-thinking skills, based on thrill and excitement to attract attention, also depends on the explanation and interpretation, discussion and collaborative learning, and also depends on the detailed expansionist thinking, makes learning meaningful and helps edit understanding error, and finally provides the student with many different ways of evaluation (Zaitoun, 2003; Ahmed, 2006).

Finally, one of the most important goal of education in general is learning retention, which mean the continued process of experiences and skills that students can be restored after a period of time and practice them in new situations, this is an indication of the quality of the used teaching strategy and the diversity of learning styles, which enhances and raises student interest and gives him/her a chance to share with his/her all senses and aims to satisfy their needs and motivations, and this will lead to retention of concepts and retrieve it when needed (Alsaid, 2013). Biological science subjects considered to be one of the most courses need to keep learning because its knowledge and concepts built on each other as an accumulative science, and that's what current study trying to achieve by applying (5E's) instructional model as constructivist approach to see its impact on the achievement and its impact on learning retention.

IMPLEMENTATION OF 5E's MODEL OF CONSTRUCTIVISM IN BIOLOGICAL SCIENCE CLASSROOM

The researcher make an attempt to develop a systematic frame work of lesson plan on 5E model for eighth standard students on the topic “**Food and its components**” as follows:

Content Area: Biological Science

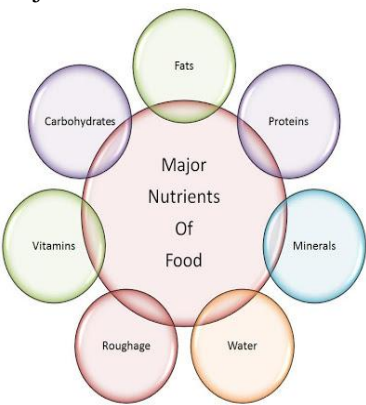
Grade level : VIII

Topic : Food and its constituents

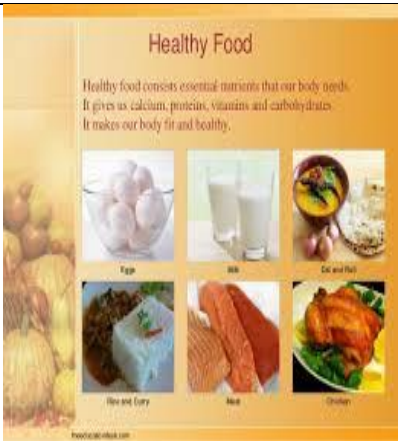
Objectives:

1. Students will describe the importance of food.
2. Students will classify food into various groups based on its predominant constituents.
3. Students will understand and state the importance of the constituents of food like carbohydrates, lipids, proteins, Vitamins and minerals.
4. Students justify that they do not get all essential elements from just one type of food.
5. Students appreciate the importance of balanced diet.

Key Idea: Students will get acquainted with different constituents of food and their significance in the daily life.

		<p>mean by necessary food material?</p> <p>Q: What are nutrients?</p>	<p>required by our body to keep our self healthy.</p> <p>A:Nutrients are components of food which are needed by our body.OR Substances found in food items and are needed to keep our body fit , healthy and active.</p>
<p>2.Elaborate</p>	<p>2.Major nutrients</p> <p>Major nutrients MIND MAP</p> 	<p>Teacher Shows the mind map of nutrients</p> <p>Teacher Discuss with the students about the major nutrients</p> <p>Q: Name the major nutrients in our food.</p>	<p>They observe the map</p> <p>They interact with the teacher</p> <p>A:The major nutrients in our food are carbohydrates, proteins, fats, vitamins and minerals. In addition, food also contains dietary fibers(roughage) and water.</p> <p>They collect information as carbohydrates,fats,proteins are essential nutrients and roughage and water as non-essential nutrients.</p>

<p>3. Explain</p>	<p>3.FOOD CLASSIFIATION GROUPS</p>	<p>Teacher Provides information about essential and non essential nutrients</p> <p>Teacher asks to give more information about food groups with the help of classification map.</p> <p>Q:Classify the food groups</p>	<p>They interact with teacher to construct the knowledge about the food groups</p> <p>A; Based on their function foods are classified into three groups. They are i]Energy giving foods ii]Body building foods Iii]Protective foods</p>
<p>4.Explore</p>	<p>Functions of food</p>	<p>Q: List the functions of food</p>	<p>A: 1.Foods gives us energy to do our daily activities. 2. It promotes growth and</p>

	 <p>Healthy Food</p> <p>Healthy food consists essential nutrients that our body needs. It gives us calcium, proteins, vitamins and carbohydrates. It makes our body fit and healthy.</p> <p>Egg, Milk, Rice and Wheat, Wheat and Curry, Fish, Chicken</p>	<p>development of our body.</p> <p>3. It protects the body against diseases.</p> <p>4. It helps body to carry out different functions.</p> <p>5. It repairs our worn and torn body parts.</p> <p>6. It helps our body to have the proper rest [helps for good sleep].</p> <p>Q: which nutrients are energy givers?</p> <p>A: Carbohydrates and lipids are energy givers.</p> <p>Q: Name the nutrients which are called as body builders.</p> <p>A: Proteins are the body builders.</p> <p>Q: Protective foods are included under which nutrients?</p> <p>A: Vitamins and Minerals are protective foods</p>	
<p>5. Evaluate</p>	<p>Food ,Importance/functions of food ,Major nutrients of food</p>	<p>1. What is food?</p> <p>2. Why do we need food?</p> <p>3. Name the major constituents of food.</p> <p>Activity: collect the different pictures of food items</p> <p>Project: Prepare your family food chart [information of one week and all the food items to be included like breakfast, lunch, snacks and dinner etc.,]</p>	<p>They will answer</p> <p>They do the activity/project</p>

ANALYTICAL DISCUSSION (Findings)

Hypothesis-I

There is no significant difference found between the effectiveness of constructivist approach on the academic achievement in science.[post-test]

Table-1

Group	No, of students	Mean	S.D	t-value	Level of significance
Experimental group	100	35.22	6.82	26.785	0.05
Control group	100	14.56	3.59		

Statistical analysis of data of Table-1 revealed that obtained t-value is greater than table t-value at 0.05 LOS. The difference is in favour of post-test achievement of Experimental group. It can be concluded that the Experimental group is superior to control group with regard to post-test achievement.

Hypothesis-II

There is no significant difference found between the effectiveness of constructivist approach on the academic achievement in science with respect to gender.[Post-test]

Table-2

Group	No, of students	Mean	S.D	t-value	Level of significance
Experimental Group Boys	44	37.50	6.01	24.456	0.05
Control Group Girls	46	14.29	3.70		

Statistical analysis of data of Table-2 revealed that obtained t-value is greater than table t-value at 0.05 Level of significance. The difference is in favour of post-test achievement of Experimental group boys. It can be concluded that the Experimental group boys are scored higher than control group girls with regard to post-test achievement.

Table-3

Group	No, of students	Mean	S.D	t-value	Level of significance
Experimental Group Girls	56	32.31	6.74	15.516	0.05
Control Group Boys	54	14.86	3.48		

Statistical analysis of data of Table-3 revealed that obtained t-value is greater than table t-value at 0.05 Level of significance. The difference is in favour of post-test achievement of Experimental group girls. It can be concluded that the Experimental group girls are scored higher than control group boys with regard to post-test achievement.

Result:

It was found that the students who were taught through Constructivist method of teaching had performed better than those who were taught through Traditional method.

CONCLUSION

The main purpose of education is to influence the development of an individual to produce personal qualities of physical, social, intellectual and emotional readiness to meet the complex life situations. Teaching learning thus becomes a goal-oriented activity in which priority may be given to changes like acquisition of knowledge, skills, development of creativity, curiosity, development of understanding and application of theories and laws to a particular situation.

Although Constructivism is not a theory of teaching, it suggests taking a radically different approach to instruction from that used in most schools. Children should be able to apply the learning acquired from classroom to real life situations. Children must have opportunities for free exploration and should be given chances to participate actively in the learning activity and to process information through first-hand experiences. The active participation enables the students to acquire an ability to use the reasoning power and to make their own discoveries. Moreover, outcomes of learning become more meaningful when classroom activities are learner involving and interacting. It is assumed that a study of this type will be useful to collect necessary data to develop innovative model in Biological Science to make the teaching learning process more interesting and meaningful. Clearly, the constructivist approach opens new avenue for teaching and learning.

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