Research Paper Education

# Biological Science Inquiry Model: A Process of Study

* Dr. Mujibul Hasan Siddiqui

* Department of Education, Aligarh Muslim University, Aligarh Uttar Pradesh

**ABSTRACT**

*The root of the BSCS approach is to make the teaching process for the students to process information with the help of various techniques as used by the biologist in their research work. In this area, the research biologists try to identify different problems and apply a specific methodology for solving the problems. BSCS makes emphasis on the content and process. Joseph J. Schwab said that "the problems created by growing human populations, by depletion of resources, by pollution, by regional developments and the like all require intelligent government or community action. These are, in part at least, biological, ecological problems and every citizen should have some awareness of their background". Further, he stated that "the essence then of a teaching of science as inquiry, would be to show some of the conclusions of science in the framework of the way they arise and are tested. This would mean to tell the student about the ideas posed and the experiments performed to indicate the data. Thus found, and to follow the interpretation by which these data were converted into scientific knowledge".There are several techniques which are applied in teaching of science as inquiry by BSCS. These are such as using Statements, Using Narrative of Inquiry, Arranging Laboratory Work, Designing Laboratory Programme, Using Invitation to Enquiry. Model of teaching includes some steps such as Syntax,Social System,Principles of Reaction,Support system,Application,Instructi onal and Nurturant Effect The application of the model are such as to deal with the high emotional areas,to make academic inquiry,to help all level of classes,to provide research techniques,to develop problem-solving skills,to enhance reasoning level,to increase critical thinking level,to develop understanding level,to apply inquiry into human behavior,to increase interaction level.*

Keywords : Biological,Model, Training, Study

Biological science is the study of life and a branch of the natural sciences which studies living organisms and how they interact with each other environment.

Biology is a natural science concerned with the study of life and living organisms, including their structure, function, growth, evolution, distribution, and taxonomy.[1] Biology has many subdisciplines unified by five so-called axioms of modern biology:[2]

1. Cells are the basic unit of life
2. Genes are the basic unit of heredity
3. New species and inherited traits are the product of evolution
4. An organism regulates its internal environment to maintain a stable and constant condition
5. Living organisms consume and transform energy

Subdisciplines of biology are defined by the scale at which organisms are studied and the methods used to study them: biochemistry examines the rudimentary chemistry of life; molecular biology studies the complex interactions among biological molecules; cellular biology examines the basic building block of all life, the cell; physiology examines the physical and chemical functions of tissues, organs, and organ systems of an organism; evolutionary biology examines the processes that produced the diversity of life; and ecology examines how organisms interact in their environment.[3]

he term biology is derived from the Greek word βίος, bios, "life" and the suffix -λογία, -logia, "study of."[4] The Latin form of the term first appeared in 1736 when Linnaeus (Carl von Linné) used biologi in his Bibliotheca botanica. It was used again in 1766 in a work entitled Philosophiae naturalis sive physicae: tomus III, continens geologian, biologian, phytologian generalis, by Michael Christoph Hanov, a disciple of Christian Wolff. The first German use, Biologie, was used in a 1771 translation of Linnaeus' work. In 1797, Theodor Georg Roose used the term in a book, Grundzüge der Lehre van der Lebenskraft, in the preface. Karl Friedrich Burdach used the term in 1800 in a more restricted sense of the study of human beings from a morphological, physiological and psychological perspective (Propädeutik zum Studien der gesammten Heilkunst). The term came into its modern usage with the six-volume treatise Biologie, oder Philosophie der lebenden Natur (1802–22) by Gottfried Reinhold Treviranus, who announced.

The Academic Reform Movement during the period of early 1950s to the late 1960s, made an innovative effort to make a well revision of the conventional curriculum areas of the school around conceptions of the major ideas and research methods of academic disciplines. Curriculum was constructed around the information processing systems of the academic disciplines. Biological Science Curriculum Study (BSCS) gave curricular and instructional patterns for use in high school biology. The social science curriculum taught the utilization of social psychology methods to study human relations.

The root of the BSCS approach is to make the teaching process for the students to process information with the help of various techniques as used by the biologist in their research work. In this area, the research biologists try to identify different problems and apply a specific methodology for solving the problems. BSCS makes emphasis on the content and process. Joseph J. Schwab said that "the problems created by growing human populations, by depletion of resources, by pollution, by regional developments and the like all require intelligent government or community action. These are, in part at least, biological, ecological problems and every citizen should have some awareness of their background". Further, he stated that "the essence then of a teaching of science as inquiry, would be to show some of the conclusions of science in the framework of the way they arise and are tested. This

would mean to tell the student about the ideas posed and the experiments performed to indicate the data. Thus found, and to follow the interpretation by which these data were converted into scientific knowledge".

There are several techniques which are applied in teaching of science as inquiry by BSCS. These are as under :

**First : using Statements**
This technique the teacher utilizes several statements which tell about the tentative nature of science as under :

i) We do not know
ii) I have not been able to find out how this happens
iii) The information about this is contradictory.

**Second : Using Narrative of Inquiry**
In this technique, the teacher presents the history of major ideas related to biology, explains them and the course of inquiry in this area is followed.

**Third : Arranging Laboratory Work**
The teacher makes the arrangement of laboratory work. The students are induced to find out various problems. Joseph J Schweb said that or they (Scientist) treat problems for which the text does not provide answers. They create situations in which the students can participate in the inquiry".

**Fourth : Designing Laboratory Programme**
In this technique the teacher designs laboratory programmes in several blocks. The students are involved in an investigation of a real problem related to biology.

At first students may be presented with materials already familiar to scientists and problems whose solutions are already disclosed, but as Schwab said that

"as the series of problems progresses they come nearer and nearer to the frontier of knowledge".

**Fifth : Using Invitation to Enquiry**
In this techniques, the teacher uses "invitation to inquiry". As the laboratory works, the students are encouraged to involved in "invitation to inquiry". Invitation to inquiry induces the students to take active parts in reasoning based activities of inquiry in laboratory or outside the laboratory as the case may be in the area of biology.

Rather than being a knowledge fountain, let students wrestle with problems or puzzles and helping students to derive hypotheses and make discoveries.

Reynaldo Martinez gives students materials and a manual and asks students to figure out equipment on their own, providing safety is preserved. Let students make mistakes and research for themselves among plentiful resources.

For instance, offer a range of options and ask students which is the best one and why. Students work out logistics and criteria for selection together or solo and get critique of preferred solution from the teacher.

Demo: 12 raw eggs with paper and tape. One person acts as recorder to write the open-ended problem-solving process:

1. Defining the problem with alternatives
2. Develop hypotheses
3. Define and clarify hypotheses
4. Explore assumptions, implications, logical validity
5. Gather facts about hypotheses
6. Generalize a solution

**Questions for Viewers**
1. What does the teacher do in the demo?
2. What do you wish the teacher had done or not done during the demo.

**Model of Teaching :**
As it is discussed that this model of teaching is based on 'Invitation to Inquiry' in the area of Biological Sciences. This model of teaching consists of several steps as under :
1. Syntax
2. Social System
3. Principles of Reaction
4. Support system
5. Application
6. Instructional and Nurturant Effect

**Syntax :**
The syntax of this model consists of four phases as under :
Phase I : Posing Investigation Area
Phase II : Structuring the problem
Phase III : Identifying problems in investigation
Phase IV : Speculating on ways for solving problems

**Phase I : Posing Investigation Area**
The teacher presents an area of investigation to his students. The teacher also explains about the methodology of research which is suitable for conducting investigation. There are several types of research methodology such as historical research, survey research, experimental research.

**Phase II : Structuring the problem**
The students are encouraged to make the structure of problem. The students try to find out the difficulties in the formation of the problem. The teacher tries to help the students and becomes supportive in this direction for the sake of constructing the problem in the right form. The teacher removes the difficulties faced by the students such as the difficulties of data interpretation data generation, the control of experiments, and making inferences etc.

**Phase III : Identifying Problems in Investigation**
The students are induced to speculate about the problem, so that they could be able to identify the difficulty involved in the inquiry.

**Phase IV : Speculating on ways for solving problem**
The student are further motivated and asked to speculate on ways of clearing up the difficult; either by redesigning the experiment, organizing data in different ways generating data, developing constructs and so on.

**Social System**
In this model of teaching, conducive cooperative and rigorous is expected. The students are induced to come into a community of investigators who apply the best techniques of science. The social climate consists of boldness as well as humility at a specific level. The students are expected to make hypotheses rigorously, take challenge of evidence make criticism of research design etc. As Joycee and Weil said that :

"In addition to the necessity for rigor, the students must also recognize the tentative and emergent nature of their own knowledge as well as that of the discipline and in doings so develop a certain humility with respect to their approach to the well developed scientific disciplines".

**Principles of Reaction :**
The most important work of teacher is to make the development of inquiry. The teacher gives due importance to the inquiry in area of biological sciences. The students are expected to make reactions on the activities of inquiry. As Joyce and Weil said that :

"The instructor's task is to turn the students toward the generation of hypotheses interpretation of data, and the development of constructs, which are seen as emergent ways of interpreting reality".

**Support System**
This model of teaching desires a flexible instructor. The instructor should well equipped with effective skills in the pro-

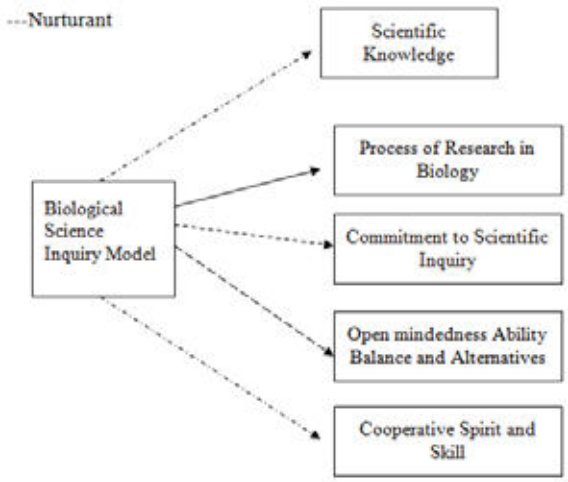
cess of inquiry. The teacher has to provide sufficient areas of investigation with their problems. The essential information sources must be provided for conducting inquiry which would be very helpful for the students.

**Application :**
The application of the model are :

1. To deal with the high emotional areas.
2. To make academic inquiry.
3. To help all level of classes.
4. To provide research techniques
5. To develop problem-solving skills
6. To enhance reasoning level
7. To increase critical thinking level
8. To develop understanding level
9. To apply inquiry into human behaviour.
10. To increase interaction level

**Instructional and Nurturant Effect :**
The following figure shows the instructional and nurturant effects as under :

- Instructional




## REFERENCES

1.Joyce, Bruce and Weil,Marsha (1985): Models of Teaching Printice Hall India Private Limited New Delhi | 2.http://wiki.answers.com/Q/What_is_biological_science | 3.https://en.wikipedia.org/wiki/Biology | 4.http://vccslitonline.cc.va.us/mrcte/inquiry_training.htm | 5.Joseph j schwab(1965):Biological Science Curriculum Study Biology Teachers' Handbook New York John Willy and Sons in Joyce, Bruce and Weil,Marsha (1985): Models of Teaching Printice Hall India Private Limited New Delhi | 6.Ronald Lippitt, Robert Fox and Lucille Schaible(1969): Social Science Laboratory Unit Chicago: Science Research Association in Joyce, Bruce and Weil,Marsha (1985): Models of Teaching Printice Hall India Private Limited New Delhi | 7.Siddiqui, Mujibul Hasan (1993) "Excellence of Teaching:A Model | Approach", Ashish Publishing House, New Delhi. ISBN NO 81-7024- 542-7 | 8.Siddiqui, Mujibul Hasan & Khan, Mohd.Sharif (1991): Models of teaching; Theory and Research, New Delhi, Ashish Publishing House. ISBN NO | 9.Siddiqui, MujibulHasan(2008) Models of Teaching Ashish Publishing House New Delhi ISBN NO 978-81-313-0382-5