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Effectiveness of Biological-Science Inquiry Model of Teaching in Enhancing Scientific Creativity among Pre-University Students.

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Introduction: (sensing the problem)

Science education occupies a very eminent place in curriculum both at school and university stages of education in India. Continuous advances in scientific and technological research has led to the growth and greater application of science in contemporary society. Accordingly science becomes a priority area in education, both at the compulsory education level as well as the level of specialization. Science education is supposed to perform a two-fold task. Jawaharlal Nehru, the first prime minister of India strongly advocated the sciences education. In any science education program life science has its own important place and it has a direct bearing on the welfare of the society.

Today, educators and researchers understand that most people learn best through personal experience and by connecting new information to what they already believe or know (National Research Council [NRC], 1996; American Association for the Advancement of Science [AAAS], 1993). Excellent teaching and quality textbooks aren't enough. Students need to personally construct their own knowledge by posing questions, planning investigations, conducting their own experiments, and analyzing and communicating their findings. Also, students need to have opportunities to progress from concrete to abstract ideas, rethink their hypotheses, and retry experiments and problems (NRC,1996; AAAS, 1990, 1993; National Council of Teachers of Mathematics [NCTM], 1991;Rosenshine, 1995; Flick, 1995). In short,

students construct their own knowledge by actively taking charge of their learning one of the primary tenets of inquiry.

Joseph Schwab (1966) believed that students should view science as a series of conceptual structures that should be continually revised when new information or evidence is discovered. Earlier, Schwab (1960) had described two types of inquiry: stable (growing body of knowledge) and fluid (invention of new conceptual structures that revolutionize science). Schwab considered that science should be taught in a way that was to be consistent with the way modern science operates. He also encouraged science teachers to use the laboratory to assist students in their study of science concepts. He recommended that science be taught in an inquiry format. Besides using laboratory investigation to study science concepts, students could use and read reports or books about research and have discussions about problems, data, the role of technology, the interpretation of data, and any conclusions reached by scientists. Schwab called this "enquiry into enquiry" (Duschl & Hamilton, 1998).

From a science perspective, inquiry oriented instruction engages students in the investigative nature of science, There is evidence that inquiry based instruction enhances student performance and attitudes about science David Haury (1993). Students who participate in inquiry-based programs develop better laboratory and graphing skills, and learn to interpret data more effectively in a creative way. The purpose of this research was to examine pre-university students' understanding of teaching biology in an inquiry-based learning environment. The research also aimed to determine the influence of inquiry-based biology teaching courses on participants scientific creativity. In this context, it can be accepted that the creativity is an important aspect of scientific skill. The problem solving, creating hypotheses, designing experiments, and technical innovation require a special type of scientific creativity. The human being is creative in a special field. For instance, while an individual is creative in chemistry, he or she may not be creative in painting (Liang, 2002). Therefore, it is generally necessary to separate the scientific creativity from creativity (Lin et al., 2003).

Methodology :

The present study of effectiveness of Biological science inquiry model in Enhancing Scientific Creativity for Pre-University students will be carried out by using experimental method.

For the present study parallel group design will be carried out by **experimental group** and **control group**.

Experimental design:

The pre-test post-test experimental model with control group was used in the research. When random assignments cannot be made, true experimental research cannot be done. In its place, quasi-experimental research is used, which embodies the characteristics of experimental research, except for random selection and assignment of participants (Charles, 1998:308). Therefore, the semi-experimental model was used since the students' score averages were used in

creating the control and experimental groups. While teaching the concepts to the students at the experimental group science course, the training was performed using supportive activities which made them use scientific process skills and to develop their scientific creativities (by means of open-ended experiments based on problem solving in addition to general experiments).

Objectives Of The Study:

The purpose of this research was

1. To develop a Biological science inquiry model to teach biology for Pre-University students.
2. To examine the effectiveness of Biological science inquiry model of teaching on the scientific creativity of Pre-University students.
3. To compare the influence of Biological science inquiry model of teaching on scientific creativity among the boys and girls Pre University students.

Hypotheses:

Based on the above objectives the following hypothesis have been formulated

1. There is no significant difference between the mean scores of scientific creativity among the experimental group and control group.

2. There is no significant difference between the mean scores of scientific creativity among the boys and girls Pre university students of experimental group.

Data Analysis:

The analysis of data, the answers given to the scales by the students were evaluated by means of the statistical techniques such as mean, Standard deviation, Independent Samples t-test, and Paired sample t-test by SPSS 11.0 statistical program.

Interpretation of data and drawing inferences

The averages of pre-test and post-test scientific creativity scores of the groups were compared by using t-test analysis. The results of pre-test SC scores obtained from the control and experimental group before the application are given in table 1.

	Number (N)	Mean	Standard Deviation	t	Significance Level
Pre-test (experimental)	60	18.30	5.99	1.00	$p > 0.05$ Not significant
Pre-test (control)	60	17.65	5.58		

Table 1. Scientific Creativity Pre-Tests of Experimental and Control Groups

According to the results given in Table 1, there is no significant difference between the SC levels of the experimental and control groups before the application. This result shows that the SC levels of both groups were close to each other before the application of the model of teaching. The results of SC scale scores obtained after applying the scale again after the application are given in table 2.

Table 2. Scientific Creativity Scale Post-Tests of Experimental and Control Groups

	Number (N)	Mean	Standard Deviation	t	Significance Level
Post-test (experimental)	20	21.85	4.88	5.11	$p < 0.05$ Significant
Post-test (control)	20	14.30	4.45		

As seen in Table 2, there is a significant difference between total SC scores of the experimental and control groups after the application according to the significance level of at 0.05 level. Looking at the averages to determine what the difference is, it is seen that there was a significant difference in favour of experimental group.

Conclusion

After the study was completed, the effects of the Biological science inquiry model of teaching on the students' scientific creativity, was investigated. The results obtained for each sub-problem are as follows:

1. The students who had Biological science inquiry model of teaching succeeded more than the students had traditional training. This result shows that giving Biological science inquiry model of teaching increased the academic achievements of the students. Similar results show that there was an increase on the achievement levels of the students at the end of the Biological science inquiry model of teaching done in science courses.
2. When SC scores were compared for both groups, the increase on the scientific creativity of the students given Biological Science Inquiry model of teaching constituted a significant difference compared to the students in the traditional group.

It can be said that Biological Science Inquiry model of teaching improves scientific creativity and academic achievement. Scientific creativity is an educable or a learned skill in some activities rather than an innate or an extraordinary understanding skill. In addition, Biological Science Inquiry model of teaching can be used for improving students' scientific creativity.

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Online Resources

http://www.gene.com/ae/21st/

http://www.ceismc.gatech.edu/BusyT/TOC.html

http://www.enc.org/