

EFFECT OF CONCEPT ATTAINMENT AND INQUIRY TRAINING MODEL IN TEACHING BIOLOGICAL SCIENCE AT SECONDARY LEVEL

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The purpose of the study was to find out the effect of Concept Attainment and Inquiry Training Model in teaching Biological Science at secondary level. Descriptive survey-experimental research design (quasi-experimental) was employed. For the realization of the objectives of the study, a random sample of 175 teachers teaching Biological Science was selected from 24 mandals of Srikakulam district for the purpose of a survey. A sample of 360 students was selected at random. 180 students each (90 each from class VIII and IX) from two schools were selected randomly for experimentation and as controlled group. The experimental group was given the Concept Attainment and Inquiry Training models of teaching. The control group was taught through the conventional method of teaching. The major data collecting tools were questionnaire and achievement test (experimental study). The collected data were analysed by using both descriptive and inferential statistics. In addition, qualitative analysis (by variation) was used. The main aim of this study is to bring out the relative effect of CAM, ITM and conventional method of teaching on the achievement of students for acquisition of Biology concepts in class VIII and IX. The study reveals that there is a significant difference not only between CAM and conventional method, but also between ITM and conventional method on the achievement of students in understanding of Biological Science concepts.

KEYWORDS: Effect, Concept Attainment Model, Inquiry Training Model

INTRODUCTION

One of the important activities of the educational process is teaching which includes training, instruction and development of cognitive process and

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abilities. The tremendous advances in science and technologies are impacting all human activities. So the teacher should adopt dynamic methods to create the needs and interest in the children. The teacher should create the needed environment for full development of the learner's potentials. One of the major aims of education is to make students successful social beings; therefore, efforts should be made to provide social practices along with formal education. Over the years, a large number of learning theories have been developed by educationists and psychologists. Such theories of learning alone do not suffice the purpose. Hence based on these theories, researchers have developed a number of teaching strategies to realize specific instructional goals. These teaching strategies show that there is no single best way to teach everything, but different strategies are required to realize different instructional goals. These perspective teaching strategies which help to realize specific goals are known as Models of Teaching.

In simple language a model of teaching may be defined as a blueprint designed in advance for providing necessary structure and direction to the teacher for realizing the stipulated objectives. The models can create environment and stimuli for the student to attain the concepts and develops inquiry skills. Several models of teaching have been developed out of which Bruce Joyce and Marsha Weil's (1980) have been known to be very effective. Development of models of teaching is the recent innovation in teaching. They described model of teaching as a plan or pattern that can be used to shape curricula (long-term courses of studies), to design instructional materials and to guide instruction in the classroom and other settings. An intelligent use of these approaches enables the teacher to adopt it to the learning needs of the students. The Concept Attainment Model (CAM) and Inquiry Training Model (ITM) are designed to teach concepts and to help students become more efficient at learning. The CAM developed by Bruner and ITM developed by Suchman succeeded in making the students learn the concepts. So a genuine interest was aroused in the investigators mind to probe the effect of CAM and ITM on secondary school students.

REVIEW OF RELATED LITERATURE

The review of research studies indicates that many research efforts have been made in India and abroad on models of teaching. Concept Attainment Model developed by Bruner and Suchmans' Inquiry Training Model was studied by many researchers in India, with reference to Science, Physics, Chemistry, Biological Science, Zoology and Environmental Sciences teaching. The research evidences under the review includes the studies of Pani (1985); Kumara(1985); Srivasthava and Sushama (1987); Aziz (1990); Anuradha and Anand(1993); Shylasree (1996); Ayishabi (1996); Bala (1997); Remadevi (1998); Sidhu and Singh (2005) Sanjiwani (2005); Bhalla. Sunila and Mohan (2007);

Pathak (2010); Singh (2011); Basapur (2012); Bala and Amita (2012); Bency and Nagarajan (2012); Kumar and Mathur (2013); Rajashree, Vaishnav and Chirayu (2013); Yabaji (2013).

Effects of models of teaching on achievement of learners cannot be ignored. It plays a vital role in the education of children. A quick glance on the studies cited above revealed that almost all the researchers reported the positive and significant effects of Concept Attainment Model and Inquiry Training Model on the academic achievement of students.

SIGNIFICANCE OF THE PROBLEM

Teaching through application of various models has been proven effective; yet in actual classroom situations they are seldom used (Buch, 1983, p20). Therefore, there is need to use them in everyday teaching. The teacher needs to be made aware on the usage of model of teaching because of its efficacy in normal classroom situations and are practical and usable. Hence, the researcher aims to develop the modules for giving orientation to Biological Science teachers. Biological Science teachers and students are curious by nature to explore and find out the insights in the nature. Thus using these models of teaching to train the teachers would help to make learning more effective. In view of this aspect, the researcher has chosen the area of research pertaining to the Concept Attainment Model and Inquiry Training Model for the teaching of Biological Science in Secondary schools in Srikakulam District.

OBJECTIVE OF THE STUDY

The objectives of the study are as follows:

1. To assess the perceptions of Biological Science Teachers towards using Models of Teaching.
2. To study the effect of Concept Attainment Model on academic achievement of VIII and IX class students in Biological Science.
3. To examine the effect of Inquiry Training Model on academic achievement of VIII and IX class students in Biological Science.
4. To know the perceptions of students and teachers about the usefulness of Biological Science teaching through CAM and ITM.
5. To make suggestions /recommendations about the study based on the findings.

HYPOTHESES

The various hypotheses framed for the study are :

H-1: For Standard VIII, there is no significant difference in the mean score of the post-test scores of the students from the experimental group and control group of standard VIII when taught using Concept Attainment Model and Traditional method respectively.

H-2: For Standard IX, there is no significant difference in the mean score of the post-test scores of the students from the experimental group and control group of standard IX when taught using Concept Attainment Model and Traditional method respectively.

H-3: For Standard VIII, there is no significant difference in the mean score of the post-test scores of the students from the experimental group and control group of standard VIII when taught using Inquiry Training Model and Traditional method respectively.

H-4: For Standard IX, there is no significant difference in the mean score of the post-test scores of the students from the experimental group and control group of standard IX when taught using Inquiry Training Model and Traditional method respectively.

RESEARCH DESIGN

After studying the review of literature and considering the objectives of the study the researcher found that Quasi Experimental Design is most suitable for the present study. The Experimental design found to be the most effective for this particular study was the pre-test, post-test Equivalent Group design. This design minimizes threats to the experimental validity. In this design, two Groups are randomly formed from the total available Group. One of the two Groups is treated as an Experimental Group and the remaining as a Control Group.

PROCEDURE

(A) For the Survey-Questionnaire: The researcher designed and developed a simple questionnaire to know the existing situation through the perceptions of teachers teaching Biological Science working in schools situated in the three revenue divisions of the Srikakulam district. Teachers teaching Biological Science in various schools of the selected mandals (Purposive Sample) were considered as the sampled respondents to know their perceptions. The researcher selected the teachers, who are handling the Biological Science subject at secondary level. Every school is having one

Biological Science Teacher, where as some schools where the strength is more two teachers for biological sciences were available. This data helped the researcher in planning for the conduct of the Experimental study.

B) For the Experiment:

Phase I: Product Oriented

Training Programme: Biological Science teachers were trained in the selected schools on the theoretical and practical knowledge on the Models of Teaching i.e. on CAM and ITM. A handbook for Biological Science teachers was prepared to help them to teach Biological Science subject in school using CAM and ITM.

Phase- II: - Implementation and Material Development

Implementation of the material viz. lesson notes, achievement tests etc. were given in this phase.

Phase- III: - Third Phase - Application Oriented

Training was provided in a simulated setting before going in actual classrooms for experimentation. The Biological Science teachers taught Biological science lessons in schools using Models of Teaching in experimental schools and Traditional Method in controlled schools. This procedure was followed to compare the student's achievement levels in the Biological Science subject when taught by the teachers using Models of Teaching and by Traditional method. The trained teachers conducted experiment in teaching the lessons using CAM and ITM for VIII and IX class students. To find out the effect of CAM and ITM Models, the researcher has developed Achievement tests for the classes VIII and IX students on selected topics for administration.

(C) Feedback After the Experimentation from the Sample Students:-

The feedback sheet was developed to know the usefulness of the Models of Teaching, i.e. the clarity on the lessons taught using Inquiry Training Model and Concept Attainment Model. This was developed in order to know the perceptions of the students of VIII and IX class on the effect of CAM and ITM at school level.

RESULTS AND DISCUSSION

The results of this investigation have been presented and discussed hypotheses wise as under:

H1: States that "For standard VIII there is no significant difference in the mean score of the post-test scores of the students from the experimental Group and Control Group when taught using Concept Attainment Model and Traditional method". The data related to this hypothesis was analysed with the

help t-test. The results are given below in Table1.

Table 1

The Comparison of Post-Test Mean Scores of Experimental and Control Groups (Class-VIII- CAM).

Post-Test	N	Average	SD	CR
Experimental	90	62.03	11.07	2.21*
Control	90	57.78	6.56	

**Significant at 0.05 level*

Table 1 reveals that the average value for class VIII of Experimental Group in the Post-Test in the usage of Concept Attainment Model was 62.03, whereas the average value for the Controlled Group was 57.78. The calculated CR value was 2.21. It is statistically significant. It shows that the Experimental group is superior in attaining the scores when using CAM than that of the controlled group. It shows that, the adoption of Concept Attainment Model in the teaching of Biological science concepts influenced the students in attaining the achievement level. It shows that CAM is very effective model for teaching.

H2: States that “For standard IX there is no significant difference in the mean score of the post-test scores of the students from the experimental Group and Control Group when taught using Concept Attainment Model and Traditional method.” The data related to this hypothesis was analysed with the help of t-Test. The results are given below in Table 2.

Table 2

The Comparison of Post-Test Mean Scores of Experimental and Control Groups (Class- IX- CAM).

Post-Test	N	Average	SD	CR
Experimental	90	60.33	10.38	4.45**
Control	90	51.56	8.22	

***Significant at 0.01 levels*

Table 2 reveals that the average value for class IX of Experimental Group in the Post-Test in the usage of Concept Attainment Model was 60.33, whereas the average value for the Controlled Group was 51.56. The calculated CR value was 4.45. It is statistically significant. It shows that the Experimental group attained the higher achievement scores in the teaching of Biological Science in using the CAM than that of the controlled group students of class IX. It shows that teaching through CAM may have its influence on the class IX students in attaining the achievement scores in Biological Science concepts. It shows that

CAM is an effective model for teaching Science concepts.

H3: States that, "For standard VIII there is no significant difference in the mean score of the post-test scores of the students from the experimental Group and Control Group when taught using Inquiry Training Model and Traditional method." The data related to this hypothesis was analysed with the help of t-Test. The results are given below in Table 3.

Table 3

The Comparison of Post-Test Mean Scores of Experimental and Control Groups (Class - VIII-ITM)

Post-Test	N	Average	SD	CR
Experimental	90	61.67	10.95	4.42**
Control	90	51.67	10.50	

***Significant at 0.01 level*

Table 3 reveals that the average value for class VIII of Experimental Group in the Post-Test in the usage of Inquiry Training Model was 61.67, whereas the average value for the Control Group was 51.67. The calculated CR value was 4.42. It is statistically significant. It shows that the Experimental Group students are superior in attaining the achievement scores in the teaching of Biological Science in using the Inquiry Training Model in Class VIII. It shows that, teaching Biological Science concepts through ITM influenced the students in attaining the scores than that of the traditional method.

H4: For standard IX there is no significant difference in the mean score of the post-test scores of the students from the experimental Group and Control Group when taught using Inquiry Training Model and Traditional method respectively. The data related to this hypothesis was analysed with the help of t-Test. The results are given below in Table 4.

Table 4

The Comparison of Post-Test Mean Scores of Experimental and Control Groups (Class-IX-ITM).

Post-Test	N	Average	S.D.	C.R.- Value
Experimental	90	62.67	11.00	4.65**
Control	90	53.78	6.6	

***Significant at 0.01 level*

Table 4 reveals that the average value for class IX of Experimental Group in the Post-Test in the usage of Inquiry Training Model was 62.67, whereas the

average value for the Control Group was 53.78. The calculated CR value was 4.65. It is statistically significant. It shows that the Experimental group students are superior in attaining the achievement scores in the teaching of Biological Science in using the Inquiry Training Model in Class IX than that of the controlled group students. It shows that the ITM is very effective in the teaching of Biological Science concepts.

Analysis of the Data Collected from the Teachers

The analysis and interpretation of the data on the perceptions of teachers towards teaching Biological Science at Secondary Level on the models of teaching are shown as below :

- Figure 1 shows the methods of teaching generally used by the teachers for teaching Biological science. Majority of the teachers (86.29%) revealed that, Lecture cum Demonstration method was adopted by teachers when teaching Biological Science in the schools.

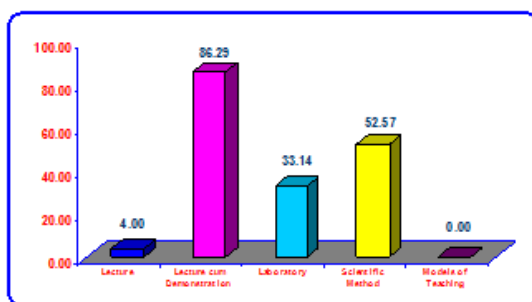


Figure 1. Methods of teaching used by the teachers to teach Biological Science.

It was noticed that, in the teaching of Biological Science at secondary level, the most commonly used methods were Discussion, Lecture and Lecture cum Demonstration methods, whereas, it clearly shows that, none of the models of teaching in the teaching of Biological Science were used by the teachers.

- 96.57% of the respondents revealed the fact that, teaching Biological Science through innovative models of teaching is more effective than the adoption of regular methods of teaching in making the students understand the concepts (Figure 2).

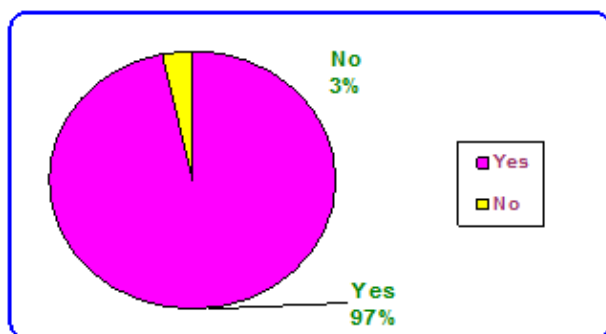


Figure 2. Perceptions of teachers on teaching through innovative models of teaching Biological Science subject.

- 66.86% of the teachers suggested that, Demonstration lessons by Experts using CAM and ITM are useful to teach Biological Science. The teachers revealed that, they encounter the problems when adopting Models of teaching i.e. Time management, coverage of syllabus, preparation of lesson plans etc. This shows that, the application of Models of teaching in the teaching of Biological Sciences is practically difficult for teachers (Figure 3).

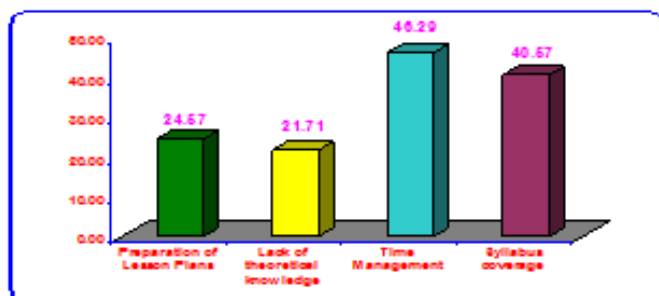


Figure 3. Perceptions of teachers on difficulties encountered while teaching Biological Science concepts using models of teaching.

- 66.86% of the teachers suggested that, Demonstration lessons by Experts using CAM & ITM are useful to teach Biological Science through models of teaching in secondary schools. 35.43% of the teachers suggested that, model teachings covering CAM & ITM are useful to teach Biological Science concepts in secondary schools. 14.86% of the teachers suggested that, hand books on CAM & ITM are useful to teach Biological Science concepts in secondary schools (Figure 4).

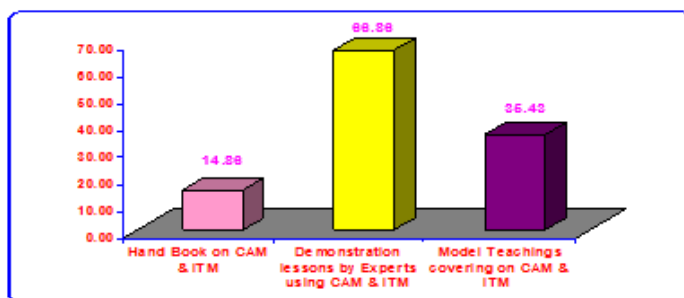


Figure 4. Suggestions of teachers on more practical and effective training programmes.

5. 26.86% of the teachers suggested that, Andhra University Education Department should train the teachers on Models of Teaching during the training programme. 26.86% of the teachers suggested that, CTE's which are having expertise should train the teachers on Models of Teaching. 29% of the teachers suggested that, IASE representatives should train the teachers on Models of teaching. 26.29% of the teachers suggested that, Dr. B.R. Ambedkar University Education department should train the teachers on Models of Teaching during the training programme (Figure 5).

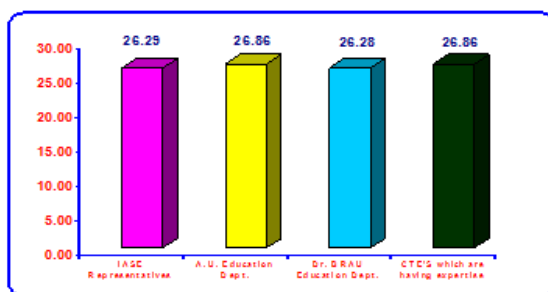


Figure 5. Suggestions of regarding training of teachers on the models of teaching.

6. 56.00% of the teachers expressed that the usage of Models of Teaching in the teaching of Biological Science in secondary schools is very useful. It helps in the development of scientific attitude among students. Some teachers revealed that usage of the Models of teaching is very useful for creating conducive atmosphere in the class room and also helps the students for the development of hypothetical thinking (Figure 6).

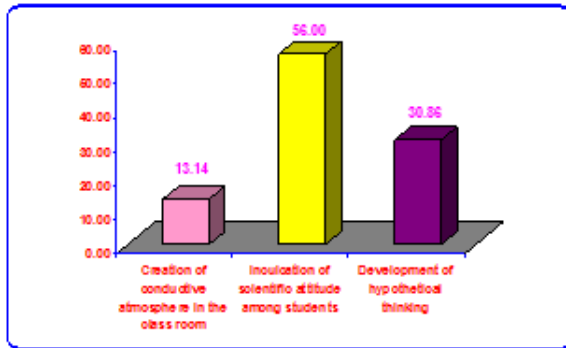


Figure 6. Perceptions of teachers on usefulness on the usage of Models of Teaching in the teaching of Biological Science.

7. 51.43% of the teachers expressed that, the different Models of Teaching enables the teacher to inculcate scientific thinking process and inspires the children to adopt scientific approach in learning the concepts of Biological science.
8. 79 % of the teachers expressed that, Models of Teaching enable the teachers to plan the activities for children in such a way that they can understand the concepts properly.

FEEDBACK OF STUDENTS

The student feedback is given as under:

1. 90.56% of students revealed that, application of Models of teaching by the teachers in the teaching of Biological Science concepts, helped them to understand the concepts easily.
2. 91.11% of the students revealed positively that the Learning abilities and also the level of interest was enhanced among the students, when teaching Biological Science concepts by applying CAM and ITM models.
3. 92.22% students agreed that learning Biological Science concepts are easier through the usage of Concept Attainment Model and Inquiry Training Model.
4. 90.56% of the students agreed that when adopting concept attainment and inquiry training models the teachers gave many projects as part of the practical activity to the students to perform on their own.

CONCLUSIONS

Following are the conclusions of the study:

1. The results of the study reveal that the teachers are using mainly traditional methods for teaching of Biological Science concepts and they expressed that innovative teaching techniques are to be adopted so that the students can understand the concepts easily.
2. The results of the study show that Models of Teaching have enabled the teacher to undertake continuous and comprehensive evaluation by observing and recording children's learning abilities during various activities conducted in the classroom.
3. The results of the study prove that both the models of teaching CAM and ITM are more effective than the Conventional method of teaching Biological Science concepts at the secondary level.
4. The results of the study show that, there is a statistically significant difference in the mean scores of the post-test between the experimental and control groups of Class VIII and Class IX when Biological Science was taught by using CAM and ITM.

EDUCATIONAL IMPLICATIONS

This study can be said to have implications for science education in particular and other disciplines in general, for teacher educators, teachers, research workers, curriculum developers and planners. These are:

- 1) The important purpose of discussing models of Teaching is to assist the teacher to have a wide range of approaches for creating a proper interactive environment.
- 2) Students also get more involved in higher order thinking skills when they see the teacher as the model.
- 3) Through these approaches the students get examples presented and also get to differentiate among the hierarchical order of information.
- 4) The child grows and his brain experiences intellectual development and he/she starts to construct mental structures through his /her interaction with the environment.
- 5) An intelligent use of these approaches enables the teacher to adapt him to the learning needs of the students.
- 6) The CAM and ITM are very much useful teaching models for enhancing the student's achievement. Hence, the teachers must use the teaching models

which are appropriate.

- 7) Models of Teaching are applicable to the Indian classrooms because of its instructional applicability, and suitability.
- 8) The programme outline may also be useful for planning the future training programmes in other models also.
- 9) The policy makers and administrators must plan and implement the models of teaching in school subjects for the enhancement of learning abilities.

SUGGESTIONS

Based on the observations made, the statistical analysis done and the conclusions drawn the investigator is of the perception, that the following suggestions will go a long way for the effective implementation of the Models of teaching both CAM and ITM.

1. As many of the teachers are not aware of the Models of Teaching, the Government should conduct workshops on Models of Teaching to ensure its effective implementation.
2. Many of the teachers have suggested that, demonstration lessons by experts using CAM and ITM are useful to teach Biological Science in Secondary schools. It indicates that, demonstration lessons are to be organized by the experts using CAM and ITM at school complex levels.
3. It is suggested that, teachers need more number of in-service programmes covering the innovative practices and also on the application of various Models of Teaching for practice at their school level.
4. As many of the researchers saw the benefits of using CAM and inquiry-based teaching the investigator has pointed out that the teachers should first look at the organization of the classroom and make sure that the seating arrangement is going to help children transition easily from one activity to the other.
5. In order to facilitate concept attainment and inquiry-based learning, the teachers should make simple changes and organize the classroom in a way so that they could manage transition and gain attention as the children use hands- on- investigative activities, use of science journals, and use of group- based activities to guide students and to reflect on their learning process.
6. It is suggested that, the teachers should get support from school

administration in creating the learning environment suitable for implementing the innovative teaching techniques.

7. It is suggested that, both the in-service and pre-service teachers should be exposed to Models of Teaching so that they can develop hands-on activities for their science classroom.

The study has indicated that the use of Models of Teaching such as CAM and ITM are found better for improving the inquiry skills and concept attainment levels of the students at secondary level than that of the traditional methods of teaching. This study revealed that the achievement levels of class VIII and IX students can be accelerated through the CAM and ITM models than traditional methods. The application of models of teaching increases the student's scientific attitude, concept formation and also enhances the inquiry skill. The teachers are very much interested in the implementation of these models in the classroom teaching. It is imperative on the part of the administrators, policy makers to review the teaching practices in schools and see that these models can be applied when teaching school subjects.

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