ISSN 2455-8729 **Chetana**
(International Educational Journal)

Effect of Models of Teaching on Achievement in Biology in Relation to Styles of Learning and Thinking and Intelligence

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Abstract

In this study researcher investigated the effect of advance organiser model and concept attainment model on achievement in Biology in relation to Styles of Learning and Intelligence. The sample was taken from 11th grade students from four different schools of Abohar, affiliated to PSEB. Instructional material based on both models was prepared and implemented. Style of Learning and Thinking (SOLAT) by Venkataraman (1994) was administered to identify the hemispheric preference and Standard Progressive Matrices (SPM) by Raven, Raven & Court (2000) was administered to measure the intelligence levels of the student. Pre-test, post- test were conducted for all the students to know their achievement. A 2×2×2 analysis of variance was used and it was concluded that; (i) The achievement of the group through advance organiser model was found to be significantly higher than that of the group taught through concept attainment model of teaching. (ii) The achievement of right hemisphere group was significantly higher than that of left hemisphere groups. (iii) The achievement of high intelligence groups was significantly higher than that of the low intelligence. (iv) The interaction effect of models of teaching and styles of learning and thinking in respect of achievement scores was not significant. (v) The interaction effect of the models of teaching and intelligence levels on achievement scores was significant. (vi) The groups with different styles of learning and thinking did not interact significantly with levels of intelligence. (vii) The interaction effect among the models of teaching, styles of learning and thinking and levels of intelligence was not significant on achievement scores.

Key Words: Achievement, Right Hemisphere, Left Hemisphere, Styles of learning and Thinking, Intelligence.

Introduction

Models of Teaching have an important place in teaching. Joyce and Weil (1972) developed more than 20 models for achieving specific instructional goals and classified them into 4 families. Ausubel formulated Advance Organiser Model to provide students with a cognitive structure for comprehending material presented through lectures, readings and other media. Concept

Attainment Model was developed by Jerome Bruner that uses a structured inquiry process. Students compare and contrast examples that contain the attributes of the concept with examples that do not contain those attributes.

Review of Literature

Several studies have been conducted to evaluate the effect of models and styles on achievement. Rani (2003) found model based teaching superior than traditional strategies of teaching; Kohli (2005), Wanjari (2005), Singh (2005) and Kalani (2009) found concept attainment model more effective than other strategies of teaching. Pachpande (2012) found that advanced organizer model is more effective than traditional method on achievement of students in mathematics teaching. Willems, Peelen & Hagoort (2010) found that left-hemisphere dominance is a core example of the functional specialization of the cerebral hemispheres; Shi (2012) Found that implications are presented that learning styles may be useful to teachers for making learners more independent and more effective in language learning and Cheng & Guan (2013) revealed that students tended to be more holistic in cognitive style and holistic style significantly predicted learning behavior.

Some studies are available emphasising models approach to teaching is not effective than other teaching strategies. Mehar (1997) found no significant difference between advance organiser model and conventional method of teaching on learning; Driver (2001) found no significant difference in the direct instruction and the concept attainment group; Kalia (2005) found that inquiry training model of teaching does not have as much significant impact on achievement as mastery learning model. North, Ahern & Fee (2007) revealed that the selection of teaching methodology is largely affected by specific learning style group; Vengopal & Mridula (2007) found a significant difference among right hemisphere and left hemisphere dominant students in concept learning and Jindal (2008) found that cognitive styles were significantly effective in acquisition of Biological concepts.

Need and Significance of the Study

There are many researches proving that application of models has been proven very much effective for good achievement. However, there are also some studies which deny the effect of models in some subjects. Researcher having experience in teaching of biology found that there are many variables which affect the achievement of students. The investigators' experience and awareness regarding the methodology of teaching convinced her that there is a felt need to

change the method instruction in respect of styles of learning and thinking and other variables to produce the desirable results.

1. To study the achievement of students having different styles of learning and thinking.
2. To study the achievement of students having different levels of intelligence.
3. To examine the interaction effect between models' approach of teaching and styles of learning.
4. To examine the interaction effect between models' approach of teaching and intelligence.
5. To examine the interaction effect between styles of learning and intelligence.
6. To examine the interaction effect between models' approach of teaching, styles of learning and intelligence.

Hypotheses

H_1 There exists no significant difference in means of achievement in Biology between groups taught through advance organiser model and concept attainment model.

H_2 There exists no significant difference in means of achievement in Biology between the groups having different styles of learning and thinking.

H_3 The achievement of groups having different intelligence levels will be significantly different from one another in Biology.

H_4 There exists no significant interaction effect of models of teaching and styles of learning and thinking.

H_5 There exists no significant interaction effect of models of teaching and intelligence.

H_6 There exists no significant interaction effect of styles of learning and thinking and intelligence.

H_7 There exists no significant interaction effect among models' approach of teaching, styles of learning and thinking and intelligence.

Methodology of the Study

Various steps of research followed in the present study are as follows:

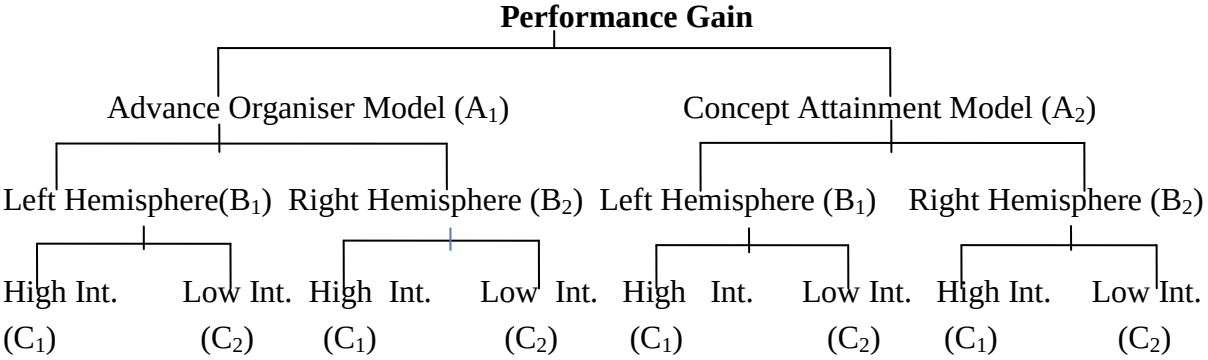
Sample

The study was conducted on a randomly selected sample of 120 students of 11th class, taken from purposefully selected four Government Schools of Abohar town of Punjab. To equalize the groups some subjects were left and finally study was conducted on 80 students.

Design

A pre- test and post-test factorial design was employed. To analyse the data a 2×2×2 analysis of variance was used for the three independent variables viz. instructional treatment, styles of learning and thinking and intelligence levels. The variable of teaching model was studied at two levels, namely advance organiser model and concept attainment model. The variable of styles of learning and thinking was studied at two levels, viz. left hemispheric preference and right hemispheric preference and the variable of intelligence was also studied at two levels, viz. high and low intelligence. The main dependent variable was achievement gain which was calculated as the difference in post- test and pre-test scores for the subject. The schematic layout of factorial design is given in Figure 1.

Figure 1: Schematic layout 2×2×2 factorial design



Tools Used

The following tools were used for data collection:

- Style of Learning and Thinking (SOLAT) by Venkataraman (1994).
- Standard Progressive Matrices (SPM) 1988 by Ravens, to measure the intelligence of the students.
- Self-constructed achievement test on the segment of Biology was developed by the investigator herself.

Procedure

After the selection of the sample and allocation of students for the two instructional strategies, the experiment was conducted in four phases:

Firstly, the SOLAT was administered in each school on the whole sample to categorize the students at two levels i.e. left and right hemispheric preference.

Secondly, SPM was administered on the subjects to measure their intelligence for grouping at three levels i.e. high, average and low.

Thirdly, Achievement Test on the segment of Biology was administered as pre-test to evaluate the previous knowledge of the students.

Fourthly, control group was taught with advance organizer model and experimental group was taught with concept attainment model. Five topics were taught to both groups in five periods each
of 45 minutes duration.

Fifthly, after the completion of the course, a post- test was administered to the students and collected data was scored with the help of scoring key for statistical treatment.

Analysis and Interpretation of the Results

The data was analysed with ANOVA. The means and standard deviations of different sub groups have been presented in Table 1.

Table 1: Means and SDs of achievement scores for the different sub groups

Variable		Advance Organiser Model N	M	SD	Concept Attainment Model N	M	SD
Right Hemisphere	High Intelligence	10	17.02	1.03	10	13.80	2.30
	Low Intelligence	10	13.60	1.96	10	11.50	2.27
Left Hemisphere	High Intelligence	10	15.09	2.02	10	12.70	1.83
	Low Intelligence	10	11.60	1.51	10	11.30	2.16
Total		40	14.58	2.71	40	12.33	2.30

It may be observed from the Table 1 that the mean scores of various groups differ. But the significance of variation was to be tested statistically. To probe deeper analysis of variance was employed and calculations have been presented in Table 2.

Table 2: Summary of analysis of variance of 2×2×2 factorial design

Source of variance	df	Sum of squares	Mean square variance	F-ratio
Models (A)	1	101.25	101.25	27.24**
Styles of Learning and Thinking (B)	1	26.45	26.45	7.12**
Intelligence (C)	2	168.20	168.20	45.26**
A×B	1	5.00	5.00	1.35
A×C	2	22.05	22.05	5.93**
B×C	2	0.05	0.05	0.01
A×B×C	2	3.20	3.20	0.86
SS within conditions	72	267.60	3.72	

**** Significant at the .01 level**

(Critical value 3.88 at 0.05 and 6.75 at 0.01 level, df 1/228)

(Critical value 3.04 at 0.05 and 4.70 at 0.01 level, df 2/228)

Model's Approach of Teaching (A)

It may be observed from the Table 2 that the F-ratio for difference in mean scores of Advance Organiser Model Group and Concept Attainment Model Group group is 27.24, which in comparison to the table value is found to be significant at the 0.01 level of significance. Hence, the null hypothesis H_1 i.e. There exists no significant difference in means of achievement in Biology between groups taught through advance organizer model and concept attainment model, is rejected.

Styles of Learning and Thinking (B)

It may be seen from the Table 2 that the F-ratio for difference of mean of the two groups on Styles of Learning and Thinking types is 7.12, which in comparison to the table value is found to be significant at the 0.01 level of significance. Hence, the null hypothesis $H_{2:}$ i.e. there exists no significant difference in means of achievement in Biology between the groups having different styles of learning and thinking, is rejected.

Intelligence (C)

It may be observed from the Table 2 that the F-ratio for difference in mean gain scores of intelligence levels is 45.26, which is found to be significant at 0.01 level of significance. It shows that the groups were different beyond doubt of operating chance factor. Hence, the hypothesis

H_3: i.e. The achievement of groups having different intelligence levels will be significantly different from one another in Biology, is accepted.

Interaction between Model of Teaching and Styles of Learning and Thinking (A×B)

It may be seen from the Table 2 that the F-ratio for interaction between model of teaching and styles of learning and thinking is 1.35, which is found to be not significant even at 0.05 level of significance. Hence, the null hypothesis H_4: i.e. There exists no significant interaction effect of models of teaching and styles of learning and thinking is accepted.

Interaction between Model of Teaching and Intelligence (A×C)

It may be observed from the Table 2 that the F-ratio for interaction between model of teaching and cognitive style is 5.93, which is found to be significant at 0.01 level of significance. Hence, the null hypothesis H_5: i.e. There exists no significant interaction effect of models of teaching and intelligence, is rejected.

Interaction between Styles of Learning and Thinking and Intelligence Levels (B×C)

It may be seen from the Table 2 that the F-ratio for interaction between styles of learning and thinking and intelligence is 0.01, which is found to be not significant even at 0.05 level of significance. Hence, the null hypothesis H_6: i.e. There exists no significant interaction effect of styles of learning and thinking and intelligence, is accepted.

Interaction among Models of Teaching, Styles of Learning and Thinking and Intelligence Levels (A×B×C)

It may be observed from the Table 2 that the F-ratio for interaction among model of teaching, cognitive style and intelligence is 0.86, which is found to be not significant even at 0.05 level of significance. Hence, the null hypothesis H_7: i.e. There exists no significant interaction effect among models' approach of teaching, styles of learning and thinking and intelligence, is accepted.

Findings of the Study

(i) The achievement of the group through advance organizer model was found to be significantly higher than that of the group taught through concept attainment model of teaching.

(ii) The achievement of right hemisphere group was significantly higher than that of left hemisphere groups.

(iii) The achievement of high intelligence groups was significantly higher than that of the low intelligence.

(iv) The interaction effect of models of teaching and styles of learning and thinking in respect of achievement scores was not significant.

(v) The interaction effect of the models of teaching and intelligence levels on achievement scores was significant.

(vi) The groups with different styles of learning and thinking did not interact significantly with levels of intelligence.

(vii) The interaction effect among the models of teaching, styles of learning and thinking and levels of intelligence was not significant on achievement scores.

Educational Implications of the Study

From above findings it is suggested that for better achievement in teaching of Biology for class 11^{th} advance organiser model can be more useful than concept attainment model. Students with right hemispheric preference learn more in both models and high intelligence also played its positive role in achievement. So in future Biology teachers are advised to follow the findings of the study.

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