Effect of Integrated Syntax of Advance Organizer Model and Inductive Thinking Model on Attitude towards Mathematics and Reaction towards Integration of Models

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Abstract: *Mathematics being application oriented subject expects students to apply their knowledge after thinking, reasoning, analyzing and generalizing principles. Traditional approach does not fulfil the condition to promote conceptual understanding of mathematics that create positive attitude towards the subject. There is need of such approaches which takes mathematics education from rote learning to procedural knowledge. The present study aims to investigate the effect of Integrated Syntax of Advance Organizer Model and Inductive Thinking Model on attitude towards mathematics and reaction towards Integration of Models. For this purpose a sample of 60 students is drawn from IX class students from Green Field Public School affiliated to CBSE of Kurukshetra (Haryana). Two groups of students each comprising 30 students were formed and were labelled as Experimental Group (A1), and Control Group (A2). Both the groups were equated on intelligence using Ravens Progressive Matrices Test. Lesson plans on Integrated Syntax (AOM and ITM) were prepared and implemented. After completion of the instructional treatment attitude scale and reaction scale were administered on students of Experimental group and Control group both. Two-Way ANOVA was used to arrive at the following conclusions: (i) Experimental Group was found to attain significantly higher attitude scores towards mathematics as compared to Control Group;(ii) Experimental Group students were found positive reaction towards integrated syntax of Advance Organizer Model and Inductive Thinking Model rather than Control Group. It can be concluded that Integrated Syntax (AOM and ITM) enhanced student's attitude towards mathematics. It should be used in classroom to teach mathematics.*

Keywords: *Integrated Syntax (AOM and ITM), Attitude, Reaction*

I. INTRODUCTION

Mathematics being application oriented subject expects students to apply their knowledge after thinking, reasoning, analyzing and generalizing principles. There is not much scope for rote learning and memorization in mathematics. It can be learnt properly by proper understanding as it is equipped with theories, rule axioms and postulates. Mathematics is fascinating because of its opportunities for creation and discovery as well as for its utility. It involves conversion of abstract concepts into concrete form. It bridges gaps between what exists in reality and its image in the mind of learner. It develops ability of induction, deduction and generalization. Achievement and retention are both important aspects of teaching mathematics and they are related to positive attitude towards the subject. Attitude is a variable which is directly correlated with achievement in mathematics. It is a very complex job to teach mathematics in classes. Considering the nature and characteristics of mathematics the researchers felt that there is a need to use such a teaching strategy which would generate understanding the fundamental of mathematics among students and not encourage rote learning. It would help the students to create positive attitude towards mathematics.

Integrated syntax of both these modes having such characteristics that can fulfil the objectives of mathematics teaching. Advance Organizer Model is designed to strengthen students thought process. Advance Organizer Model based on Ausubel's theory of meaningful verbal learning (1963). Ausubel's points out the presentation of an 'Advance Organizer, as an explicit cognitive structure of the new concepts to be attained. According to Ausubel, this enhances the meaningful learning of the concepts. This link between cognitive structure and the new concept is called the Advance organizer (Ao)-or' cognitive bridge (Novak 1977). In his view, the introduction of relevant subsumes, concepts (organizers) facilitates the learning and retention of new and meaningful material. His hypothesis based on the assumption that cognitive structure is hierarchically organized in which highly inclusive concept are at the top and less inclusive at the bottom (Ausubel, 1963); The advance organizers perform two different functions corresponding to two different aspects of the unfamiliarity of meaningful learning material. Firstly, they provide ideational encourage when the new material is almost completely unfamiliar, that is cognitive is totally based on related concepts. Secondly, the advance organizer Increases the discriminate ability of new concepts from analogous and conflicting concepts and ideas in the learner's cognitive structure.

The second model, developed from the work of Hilda Taba (1966) facilitates the learner for developing logical thinking and teacher has to develop thinking skills in students i.e. to teach the students how to think. Taba developed a series of teaching strategies that develop inductive mental processes, especially the ability to categorize and to use categories. The three teaching strategies involved are; first is concept formation, second in the interpretation of data and third is the application of principles.

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The first model teaches concepts deductively, whereas, the second model proceeds inductively. The Inductive Thinking Model also aims to develop the habit of inductive reasoning, and making generalizations, explanations and predictions. Advance Organizer Model and Inductive Thinking Model of teaching guide us how we design instruction to help students to achieve various objectives of teaching-learning of mathematics. Most of the researchers have studied the efficacy of Advance Organizer Model and Inductive Thinking Model separately with other teaching strategies in different subject areas like social science, sciences and languages on different variable. Runagruchira, 1992; Pandey & Purohit, 1993; Patel, 1994; Kaur, 2000; Singh, 2004; fount significant effect of models on different variables. Few researchers compared the effect of models on mathematics; Cook,1980; Yadav (1984) studied the effect of mastery learning on achievement and self concept in mathematics. Chitriv, 1983; investigated the effectiveness of Ausubel and Bruner model for acquisition of concepts of mathematics. He found that models were effective in terms of acquisition of concepts of mathematics.

Mondal (2013) compare the effect of AOM and ITM on cognitive achievement of the students on the criteria of immediate learning and retention. Results indicate that that both ITM and AOM are equally effective on the criteria of immediate learning but AOM group establishes superiority than the ITM group on retention. Billing (2013) studied the effect of Inductive Thinking Model on Achievement Motivation of Students in Relation to their Learning Approach. Batra (2013) studied the Effect of mathematical model on the mathematics achievement and reasoning ability of secondary school students. It was found that models of teaching are better than traditional teaching in mathematics.

Attitude towards the model examined by few researchers (Gupta ,1988; Kaushik, 1988; Gupta ,1991; Gupta, 1995; Sharma ;1996) studied the effect of Advance Organizer Model on Achievement in sciences in relation to reading ability, intelligence and scientific attitude of the learners. It was revealed that Advance Organizer was positively correlated with higher intelligence, reading comprehension and scientific attitude. Yadav, (1984) studied the effect of mastery learning on attitude towards mathematics and it was found positive attitude towards the mathematics through mastery learning. Behal, (1992) compared concept attainment model and computer model on achievement in mathematical concepts and attitude in relation to intelligence and cognitive style but investigator found no study which reveals the effect of teaching models or integrated syntax of teaching models on attitude toward mathematics.

Reaction of students towards the models was seen by few researchers. Passi, Singh & Sansanwal (1995) studied the effect of differential variation in components of models of teaching. The model included in the study was Concept Attainment Model, Inquiry Training Model, Advance Organizer Model and Jurisprudential Inquiry Model. Two models were studied at a time. The training strategy was found to be effective In terms of theoretical understanding and a favourable reaction towards models. The reaction scale used was more of an attitude scale. Buddhisagar and Sansanwal (1989) studied the effectiveness of Advance Organizer material in terms of students' achievement and their reaction. They came to the conclusion that Advance Organizer material was effective in terms of achievement of students on different criterion tests and reaction towards the instructional material. Investigator found only one study that reveals the reaction of the students towards the models. Due to lack of research studies related to attitude towards mathematics and reaction towards the integrated syntax of models, there is a need of scientific investigation. All of the above reason encouraged the investigators to go for the present study.

II. OBJECTIVES OF THE STUDY

Following were the objectives of the study.

1. To integrate the syntax of Advance Organizer Model and Inductive Thinking Model with respect to relevance of different steps In Mathematics teaching.
2. To find out the effect of Integrated Syntax (Advance Organizer Model and Inductive Thinking Model) in terms of students attitude towards Mathematics.
3. To find out the students reactions towards Integrated Syntax of Advance Organizer Model and Inductive Thinking Model.

III. RESEARCH METHODOLOGY

In order to find out the effect of the teaching approaches on the Students attitude towards Mathematics and reaction towards the integration of the models, experimental method was used. To achieve these objectives parallel group factorial design was followed. Test occasions varied in two ways - pre test and post test.

Variables under Study

1) **Independent Variable:** There were two independent variables, namely teaching approach (A) and levels of intelligence (B), however there were two levels of teaching approach i.e. Integrated Syntax of AOM and ITM (A1) and Conventional approach (A2).
2) **Dependent Variables:** Attitude towards mathematics and reaction towards the integration of models were dependent variables.
3) **Intervening Variables:** Variables like age, I.Q level and grade level, physical environment, Socio-Economic-Status and teachers were taken into consideration, however appropriate controls were employed to prevent the effect of said intervening variables on the dependent variable. To control age, I.Q. level and grade investigator opted sample from same grade i.e. ninth grade in which all students are of 14-15 years. Single school was selected to control physical environment and socio economic status. Investigator taught both the groups himself to control teacher's variation of teaching.

Sample

In order to study the investigator selected few topics of ninth class text book of mathematics. Sixty students of ninth grade studying in Greenfield Public School of Kurukshetra city affiliated to C.B.S.E. were opted purposively as sample of the

study. The sample was classified into two parallel groups of 30 students each. One group was designated as the control group and other designated as the experimental group randomly. The control group was taught by conventional and experimental group taught through Integrated Syntax of AOM and ITM.

Tools to be Used

Two types of tools were used in the present study.

1) **Instructional Tool**
2) **Measuring Tool**

Instructional Tool: Instructional material by using Integrated Syntax of AOM and ITM and conventional approach was prepared by the investigator. He selected ten units from ninth class text book of mathematics prescribed by N.C.E.R.T. Each lesson plan based on Integrated Syntax of AOM and ITM has been divided into two parts. The first part consisted of Instructional objectives in behavioural terms. In second part stretching exercise is given, identifying teacher's role and students' role.

Measuring Tool: Following tools were used to collect data related to attitude and reaction of students.

(1) Mathematics Attitude Scale:

It purports to measure student's attitude towards mathematics as a curricular area. Likert method and scale discrimination technique was considered to be more appropriate for use in the construction of Mathematics Attitude Scale. The split-half reliability of the scale was 0.89. Content validity was determined by experts. For scorning this scale an "SA" response is given a score of five "A" response is given a score of four, "U" response is given as case of three. "D" response is given a score of two and "SD" response is given a score of one for positive statement. The scoring was reversed in case of negative statement.

(2) Student's Reaction Scale:

The term student reaction in this study was concerned with the responses of students made in a reaction to the approaches of teaching in the classroom. In this study a student's reaction scale was developed. This scale consisted of twenty items. All the items in the scale reflected positive attitude of the learner. These items were scaled on a five-point scale with 'Strongly agree', 'Agree', Disagree' and 'Strongly disagree'. The test-retest reliability of the scale was 0.85. The validity of the scale was established against students' achievement scores came to 0.74.

IV. STATISTICAL TECHNIQUES

1) Two-way (2x3) Analysis of Variance was used.
2) Mean and S.D. were used to see the nature of the data,
3) t-test was used to see the significant differences in case of simple effects in the groups.

V. RESULT AND DISCUSSION

Results of the presents study are divided in two sections. Section A describes student's attitude toward mathematics and Section B describes student's reactions towards Integrated Syntax of Advance Organizer Model and Inductive Thinking Model. The results were interpreted in the following paragraphs.

Section A: Students Attitude towards Mathematics

The results of 2 x 3 ANOVA for the Students' attitude towards Mathematics were given in Table I

Table I
Two - Way (2X3) Analysis of Variance For Students Attitude

Sr.No.	Sources of Variation	Sum of Squares	df	Mean Squares	F-ratio
1.	Group (A)	4788.28	1	4788.28	485.84**
2.	Intelligence (B)	3753.30	2	1876.65	190.42**
3.	Group x Intelligence (A x B)	5.63	2	2.82	.29
4.	Within	532.2	54	9.86	

** Significance at .01 level

Table I indicates that F-ratios for simple effect were significant for different variable. In order to interpret these results, the F-ratios were supplemented by mean scores and t-ratios. These mean scores and t-ratios for simple effects have been entered in Table II and III.

Simple Effects

There were two independent variables, namely, approaches of teaching (A) and levels of intelligence (B), which were significant. The results for the same were interpreted in the following paragraphs.

Approaches of Teaching

Table I showed that the F-ratio, 485.84 was significant (df= 1/54) at 0.01 level of significance. In order to interpret the results, this F-ratio was supplemented by Mean scores and t-ratios as given in Table II.

Table II
Mean Scores And T-Ratio of The Students' Attitude for The Approaches of Teaching (A)

Sr.No.	Group (A)	Mean	Mean Difference	SED	t-ratio
1.	Experiment Group of (A_1)	79.03	17.86	2.22	8.05*
2.	Control Group (A_2)	61.17			

** Significance at .01 levels

Table II showed that t-ratio between the groups taught through Integrated Syntax of Advance Organizer and Inductive Thinking Model (A_1) and the group taught through Conventional Method (A_2) is 8.05 were significant at .01 level of significance. This further showed the group of

Students' taught through Integrated Syntax of Advance Organizer Model and Inductive Thinking Model approach (M=79.03) had higher positive attitude towards mathematics than the group taught through Conventional method (M=61.17). In other words from above result, it can be interpreted that Integrated Syntax approach was better than conventional approach with respect to attitude towards mathematics.

Levels of Intelligence

Table I indicated that the F-ratio for levels of intelligence was 190.42 which were significant at .01 level. It was supplemented by mean scores and t-ratios which were inscribed in Table III

Table III
Mean Scores and T-Ratio of Students' Attitude Towards Mathematics for Levels of Intelligence (B)

Groups	B_1	B_2	B_3
B_1		3.33**	6.49**
B_2			2.9**
B_3			
Mean Score	80.05	69.55	60.70

** Significant at .01 level

It was evident from table III that high intelligent Students (M = 80.05) which was taught through Integrated Syntax of Advance Organizer Model and Inductive Thinking Model had most positive attitude towards mathematics in comparison to middle intelligent (M = 69.55) and low intelligent (M = 60.70) students.

Double Interaction

Table I showed that the interaction between the approaches of teaching and levels of intelligence (A x B) was not significant (F=. 29)

It was evident from table III that high intelligence Students (M=80.05) had most positive attitude towards mathematics in comparison to middle intelligence (M 69.55) and low intelligent (M=60.70) Students.

Section B: Students Reactions towards Integrated Syntax of Advance Organizer Model and Inductive Thinking Model

The results of 2 x 3 ANOVA for Students' reactions had been given in Table IV

Table IV
Two-Way (2x3) Analysis of Variance Showing Students' Reaction

Sr. No.	Sources of Variance	Sum of Squares.	Df	Mean Squares	F-ratio
1.	Group (A)	9475.27	1	9475.27	1045.92**
2.	Intelligence (B)	3822.70	2	1911.35	210.98**
3.	Group X Intelligence (A x B)	8.23	2	4.12	.45
4.	Within	489.20	54	9.06	

** Significant at .01 level

Table IV indicated that the F-ratio for the approaches of teaching (A) and level of Intelligence (B) was significant. In order to interpret these results, the significant F-ratio had been supplemented by mean scores. The mean scores and t-test for simple effects had been entered in Tables V and VI.

Simple Effects

There were two independent variables, namely, approaches of teaching (A) and levels of intelligence (B), which were significant. The results for the same were interpreted in the following paragraphs.

Approaches of Teaching

Table V showed that the F-ratio 1045.92 was significant (df= 1/54) at .01 level of significance. In order to interpret the results this F-ratio was supplemented by Mean scores and t-ratios as given in Table V.

Table V
Mean Scores and T-ratio of The Students' Reaction for The Approaches of Teaching (A)

Sr.No.	Group (A)	Mean	Mean Difference	SED	t-ratio
1.	Experiment Group of (A_1)	80.67	25.13	2.23	11.28*
2.	Control Group (A_2)	55.53			

* Significant at .01 level

Table V showed that t-ratio between the group taught through Integrated Syntax of Advance Organizer and Inductive Thinking Model (A_1) and the group taught through Conventional Method (A_2) is 11. 28 were significant at .01 level of significance. Table V further showed that mean score of experiment (M=80.67) was higher than control group (M=55.53), this means Students reacted more positively towards Integrated Syntax of Advance Organizer Model and Inductive Thinking Model approach than conventional approach.

Level of Intelligence

Table IV indicated that F-ratio for level of intelligence was 210.98 which were significant at .01 level of significance. It was supplement by mean scores and t-ratios which were inscribed in Table VI.

Table VI
Mean Scores and T-ratios of Students Reactions Towards Integrated Syntax of AOM And ITM For Level of Intelligence (B)

Groups	B_1	B_2	B_3
B_1		2.38*	4.75**
B_2			2.35*
B_3			
Mean Scores	77.95	67.95	58.40

**, * Significant at .05 level

It was evident from Table VI that high intelligence Students (M=77. 95) had most positive reaction towards Integrated Syntax of Advance Organizer Model and Inductive Thinking Model In comparison to Middle Intelligent (M=67.95) and low intelligent (M = 58.40) Students.

Double Interaction

Table IV shows that the double interaction effect of the approaches of teaching and the levels of intelligence (AxB) is insignificant (F = .45). It connotes that high, middle and low intelligence Students when taught separately through Integrated Syntax of Advance Organizer Model and Inductive Thinking Model approach of teaching does not differ significantly in their reactions. It may further concluded from the above results the Students reactions towards Integrated Syntax of Advance Organizer Model and Inductive Thinking Model was more positive in comparison to Conventional Method.

VI. DISCUSSION

In the present study, integrated syntax of Ausubel's Advance Organizer Model and Taba's Inductive Thinking Model was used. Both these models facilitate learning of concept through different strategies. Ausubel's Advance Organizer Model makes the learning more effective and meaningful. Taba Inductive Thinking Model is designed to improve the Students' ability to handle information. The models help in developing the interest of the learners to understand the concepts very well and also to help the learner to discriminate the new concepts from previously learnt concepts. In this way, Ausubel's Model makes new learning easier by linking up the new information with the previously existing relevant material in the minds of the learners through "Advance Organizers", that is, through introductory notes. It is therefore, helpful to recall the learnt material quickly and correctly. On the other hand, Inductive Thinking model helps in developing thinking capacity, the strategy obviously require students to ingest and process large quantity of information. The study shows that integrated syntax of Advance Organizer Model and Inductive Thinking Model approach proved to be more effective with respect to different steps in Mathematics teaching. The result of the present study shows positive attitude of students taught through integrated syntax of AOM and ITM. Student's reactions were more positive towards integrated syntax of Advance Organizer Model and Inductive Thinking Model approach than conventional approach supported by Buddhisagar and Sansanwal (1989).

V.II CONCLUSION

1. The group of Students taught through Integrated Syntax of Advance Organizer Model and Inductive Thinking Model had higher positive attitude towards mathematics in comparison to conventional method.
2. Student's reactions were more positive towards integrated syntax of Advance Organizer Model and Inductive Thinking Model approach than conventional approach.

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