CHAPTER - VI

ANALYSIS AND INTERPRETATION

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6.1 INTRODUCTION

In the Chapter IV, a full account of the research design was given. Both the process of data collection and the methods to be applied in analysing and interpreting the data yielded by the various tools were described. This Chapter will be devoted mainly to the interpretation of data and arriving at results. In this Chapter, results pertaining to comparison between experimental and control groups on development of conceptual structures are examined first.This will be followed by the presentation of results relating to comparison between experimental and control groups on meaningful assimilation of information and ideas.Then, the results pertaining to comparison between experimental and control groups on interest in inquiry will be discussed. The results relating to comparison between experimental and control groups on habits of precise thinking will also be discussed. This will be followed by the presentation of results with regard to comparison between experimental and control groups on retention of meaningful assimilation of information and ideas. Lastly, the results regarding students' reactions towards teaching thrbugh Advance Organizer Model will be discussed.

In the scheme of presentation, the objectives of the study and their corresponding hypotheses are presented first. These are followed by the results of analyses of data. The results of analyses will be presented in a tabular form. These will be followed by the conclusions whether the hypotheses are retained or not. Thereafter, the interpretation of the results will be presented.

6.2 COMPARISON BETWEEN EXPERIMENTAL AND CONTROL GROUPS ON THE DEVELOPMENT OF CONCEPTUAL STRUCTURES

The first objective of the study was to compare the effects of Advance Organiser Model and traditional method of teaching in terms of students' development of conceptual structures. In order to meet this objective, the following null hypothesis was formulated.

> " There will be no significant difference between the mean scores of the students taught through Advance Organizer Model and traditional method of teaching in development of conceptual structures".

To test the above hypothesis, four unit tests and one comprehensive test on conceptual structures were administered to students of both the groups. The conceptual structures or concept maps developed by the students were scored using the scoring key developed by Novak et al. (1981).

As it has been told in the scoring procedure used for the concept maps in the Chapter V that scoring of the concept maps had been done on the four elements of the concept maps, namely, relationship, hierarchy, branching, and general to specific, a student's concept map, therefore, received four different scores in these four elements. A student's total score on a concept map was obtained by adding the scores of all the four elements. Exactly the same way, the scores in each of the four elements and the total score for the experimental and control groups on a particular concept map were arrived at. In this way, the scores in each of the four elements and the total score for the experimental and control groups on all the four unit tests and the comprehensive test on conceptual structures were also arrived at.

While comparing the two groups on the development of conceptual structures, total scores on the unit tests and the comprehensive test were taken into account. Means and standard deviations were computed from the total scores obtained by the students of experimental and control groups on these tests. The t-test significance was applied to determine the statistical difference between the mean scores of experimental and control groups. The Table 6.1 presents means, standard deviations, and t-values for the unit tests and the comprehensive test on conceptual structures.

TABLE 6.1 : Means, Standard Deviations, and t-values for Unit Tests and Comprehensive Test on Conceptual Structures.

Tests	Groups	N	Means	S.Ds	t-values
Unit Test-1	Experimental	28	11.39	6.51	5.95 *
	Control	26	3.54	2.49	
Unit Test-II	Experimental	28	11.50	5.12	7.22 *
	Control	26	3.27	3.19	
Unit Test-III	Experimental	28	6.18	3.43	4.26 *
	Control	26	3.03	1.87	
Unit Test-IV	Experimental	28	8.96	5.78	5.26 *
	Control	26	2.49	3.00	
Comprehensive Test Passage-A	Experimental	28	12.68	7.06	6.13 *
	Control	26	3.73	3.18	
Comprehensive Test Passage-B	Experimental	28	9.78	6.47	5.93 *
	Control	26	2.19	1.91	

*Significant at .01 level

The Table 6.1 shows that t-values of 5.95, 7.22, 4.26, and 5.26 for the tests, I, II, III, and IV respectively are significant at .01 level. Similarly, t-values of 6.13 and 5.93 for the passages A and B respectively in the comprehensive

test are also significant at .01 level. This means that there is significant difference between the mean scores of experimental and control groups on the four unit tests and the comprehensive test. Hence, the null hypothesis formulated for the first objective is rejected. It is also clear from the Table 6.1 that the mean scores of 11.39, 11.50, 6.18, and 8.96 for the experimental group are higher than the mean scores of 3.54, 3.27 3.03, and 2.49 for the control group on unit tests I, II, III, and IV respectively. Similarly, the mean scores of 12.68 and 9.78 for the experimental group are higher than the mean scores of 3.73 and 2.19 for the control group on the passages A and B respectively of the comprehensive test.This indicates that the group taught through Advance Organizer Model achieved higher mean scores on all the unit tests and the comprehensive test. Therefore, it can be concluded that Advance Organizer Model facilitated development of conceptual structures among the students of experimental group.

The above result may be due to certain reasons. First, the teacher in the experimental group made use of concept mapping technique while teaching the students. He also trained the students to develop concept maps. Students also practised to develop concept maps on their own. Second, the concept mapping technique was a new learning experience for the students. Hence, they might have taken keen interest in developing concept maps. Third, while presenting the learning tasks through Advance Organizer Model, the superordinate concepts were presented

first followed by a gradual increase of subordinate concepts. The students might have found the concept mapping to be very useful to learn the learning tasks presented in this manner. Lastly, Ausubel (1963) believes that there is a parallel between the way subject matter is organised and the way people organize knowledge in their minds. When hierarchically organized schemes in the form of concept maps were presented to the students, they might have found it convenient to organize knowledge in their cognitive structure.

The finding obtained from the first objective supported the claim of Joyce and Weil (1980) that the Advance Organizer Model facilitates development of conceptual structures in the learners. According to them, when hierarchically organized concepts/propositions of a particular discipline are presented to the students, they become an information processing system for them. They form an intellectual or cognitive map which students use to analyse and solve problems within that particular discipline. Moreover, the ability to develop conceptual structures helped the students of experimental group to assimilate information and ideas in a meaningful manner. This is evident from the finding obtained from the second objective which will be discussed in the next section. Students of experimental group scored significantly higher than the students of control group on the comprehensive test on meaningful assimilation of information and ideas. This was due to the fact that their ability to develop well organized

hierarchies of concepts helped them to retain the learning of concepts, which was not found in the case of students of control group. This finding is in accord with the findings of previous studies (Novak, Gowin and Johansen, 1983; Ault, 1985; Lehman, Carter, and Kahle, 1985 and Okebukola, 1990). From the basis of Ausubelian psychology and based on the results of the present study as well as other studies, it can be concluded that a key factor for potential success in meaningful learning is the framework of relevant concepts or conceptual structures the individual possesses.

Although the difference between the mean scores of experimental and control groups on the four unit tests and the comprehensive test was taken into account to test the first hypothesis of the study, it was felt necessary to examine the difference between the mean scores of experimental and control groups in each of the four elements of concept maps on the unit tests and the comprehensive test. This decision was taken due to two reasons. First, the scoring key has been developed by Novak et al. (1981) in American setting. Hence, the examination of the workability of the scoring key in terms of the elements of a concept map, particularly in the context of the setting in which the present research was conducted, was required. Second, these four elements of the concept map are scored in four different ways which implies that these are independent of each other. With these two precise reasons,

examination of the difference between the mean scores of experimental and control groups in each of the four elements on all the unit tests and the comprehensive test was carried out. Means and standard deviations were computed from the scores obtained by the students of both the groups in each of the four elements on the unit tests and the comprehensive test. The t-test of significance was applied to find out the significant difference between the mean scores of both the groups on the unit tests and the comprehensive test. Means, standard deviations and t-values for the four elements of the concept maps on the unit tests and the comprehensive test are presented in Tables 6.2 to 6.7. The presentation of the Tables and their interpretations are done one by one.

TABLE 6.2: Means, Standard Deviations, and t-values for the Four Elements of the Concept Map on the Unit Test-I.

Sl. No.	Elements	Groups	N	Means	S.Ds	t-values
1.	Relationships	Experimental	28	3.76	3.88	4.92*
		Control	26	.12	.42	
2.	Hierarchy	Experimental	28	1.51	.52	1.79***
		Control	26	1.26	.51	
3.	Branching	Experimental	28	2.97	1.37	2.57**
		Control	26	2.02	1.45	
4.	General to specific	Experimental	28	3.15	1.33	10.38*
		Control	26	.14	.77	

* Significant at .01 level
** Significant at .05 level
*** Not Significant

From the Table 6.2, it is seen that t-values of 4.92 and 10.38 for the elements 1 and 4 are significant at .01 level, whereas the t-value of 2.57 for the element-3 is significant at .05 level. But, the t-value of 1.79 for the element-2 is not significant at either levels of significance. This implies that there is a significant difference between the mean scores of experimental and control groups in the elements 1, 3 and 4, whereas there is no significant difference between the mean scores in the element-2. Moreover, the mean scores of 3.76, 2.97 and 3.15 for the experimental group are higher than the mean scores of .12, 2.02 and .14 for the control group in the elements 1, 3 and 4. It can be said that students of AOM group obtained higher mean scores in comparison to students of control group. Hence, they are better in the three elements, namely, relationships, branching and general to specific. But, the no significant difference between the two groups in the element-2 shows that both the AOM and traditional method groups are equally competent in the element of hierarchy. This result is attributed to the fact that students of control group might have found the learning task involving making hierarchy simple, whereas they might have found the learning tasks involving relationships, branching and general to specific difficult.

TABLE 6.3: Means, Standard Deviations, and t-values for the Four Elements of the Concept Map on Unit Test-II.

Sl. No.	Elements	Groups	N	Means	S.Ds	t-values
1.	Relationships	Experimental	28	2.71	2.98	3.27*
		Control	26	.65	1.51	
2.	Hierarchy	Experimental	28	1.65	.36	7.53*
		Control	26	.92	.38	
3.	Branching	Experimental	28	3.21	.93	8.91*
		Control	26	1.16	.81	
4.	General to Specific	Experimental	28	3.93	1.10	12.55*
		Control	26	.54	.91	

* Significant at .01 level

The Table 6.3 points out that t-values of 3.27, 7.53, 8.91, and 12.55 for the elements 1,2,3,and 4 respectively are significant at .01 level. This implies that there is significant difference between the mean scores of experimental and control groups in the four elements. Moreover, it is also seen that the mean scores of 2.71, 1.65, 3.21, and 3.93 for the experimental group are higher than the mean scores of .65, .92, 1.16,and .54 for the control group in the elements 1,2,3,and 4 respectively. This means that students of Advance Organizer Model group obtained higher mean scores in all the elements. Therefore, it can be said that they are better in all the elements in comparison to students of control group.

TABLE 6.4: Means, Standard Deviations and t-values for the Four Elements of the Concept Map on Unit Test-III.

Sl. No.	Elements	Groups	N	Means	S.Ds	t-values
1	Relationships	Experimental	28	2.82	1.67	5.67*
		Control	26	.61	1.23	
2	Hierarchy	Experimental	28	1.04	.41	1.63***
		Control	26	.91	.09	
3	Branching	Experimental	28	1.39	1.17	2.18**
		Control	26	.91	.09	
4	General to Specific	Experimental	28	.93	1.09	1.23***
		Control	26	.61	.84	

* Significant at .01 level
** Significant at .05 level
*** Not Significant

In the Table 6.4, it is observed that the t-value of 5.67 for the element-1 is significant at .01 level, whereas the t-value of 2.18 for the element-3 is significant at .05 level. But, the t-values of 1.63 and 1.23 for the elements 2 and 4 respectively are not significant. This shows that there is a significant difference between the mean scores of experimental and control groups in the elements 1 and 3, whereas there is no significant difference between the mean scores of experimental and control groups in the elements 2 and 4. It is also clear that the mean scores of 2.82 and 1.39 for the experimental group are higher

than the mean scores of .61 and .91 for the control group in the elements 1 and 3. This indicates that students of AOM group have obtained higher mean; and therefore are superior to the control group with regard to elements 1 and 3. But in the case of the elements 2 and 4, no significant difference between the two groups points out that both experimental and control groups have performed equally well in these elements. This may be due to the reason that the learning tasks involving hierarchy and general to specific in the test might have been found simple by the students of the control group. On the contrary, they might have found the learning tasks involving relationships and branching difficult.

TABLE 6.5: Means, Standard Deviations, and t-values for the Four Elements in the Concept Map on the Unit Test - IV

Sl. No.	Elements	Groups	N	Means	S.Ds	t-values
1	Relationships	Experimental	28	2.60	3.12	3.35*
		Control	26	.42	1.39	
2	Hierarchy	Experimental	28	1.24	.55	4.21*
		Control	26	.65	.52	
3	Branching	Experimental	28	2.17	1.44	3.79*
		Control	26	.88	1.08	
4	General to Specific	Experimental	28	2.95	1.54	6.51*
		Control	26	.54	1.24	

* Significant at .01 level

The Table 6.5 points out that the t-values of 3.35, 4.21, 3.79 and 6.51 for the elements 1, 2, 3 and 4 respectively are significant at .01 level. This means that there is significant difference between the mean scores of experimental and control groups in all the four elements. Moreover, it is seen that the mean scores of 2.60, 1.24, 2.17, and 2.95 for the experimental group are higher than the mean scores of .42, 0.65, .88, and .54 for the control group in the elements 1,2,3 and 4 respectively. This means that the Advance Organizer Model group has secured higher mean scores in these elements in comparison to traditional method group. Therefore, it can be said that the AOM group is better in elements of relationships, hierarchy, branching and general to specific in comparison to tradition method group.

TABLE 6.6 : Means, Standard Deviations, and t-values for the Four Elements of the Concept Map on the Comprehensive Test Passage-A

Sl No.	Elements	Groups	N	Means	S.Ds	t-values
1	Relationships	Experimental	28	3.37	3.90	3.73*
		Control	26	.50	1.22	
2	Hierarchy	Experimental	28	1.96	.76	2.84*
		Control	26	1.42	.70	
3	Branching	Experimental	28	4.10	2.36	5.09*
		Control	26	1.35	1.65	
4	General to Specific	Experimental	28	3.25	1.21	9.62*
		Control	26	.46	.94	

* Significant at .01 level

From the Table 6.6, it is depicted that the t-values of 3.73, 2.84, 5.09 and 9.62 for the elements 1, 2, 3, and 4 respectively are significant at .01 level. This means that there is significant difference between the mean scores of experimental and control groups in the elements 1, 2, 3, and 4. The mean scores of 3.37, 1.96, 4.10, and 3.25 for the experimental group are higher than the mean scores of .50, 1.42, 1.35 and .46 for the control group in the elements 1,2, 3 and 4 respectively. Therefore, the AOM group obtained higher mean scores in all the four elements. It can be concluded that students of AOM group are superior to students of traditional method group in the elements of relationships,hierarchy, branching and general to specific.

TABLE 6.7: Means, Standard Deviations and t-values for the Four elements of the Concept Map on the Comprehensive Test: Passage -B.

Sl.No.	Elements	Groups	N	Mean	S.Ds	t-values
1	Relationships	Experimental	28	3.21	3.34	4.78*
		Control	26	.15	.44	
2	Hierarchy	Experimental	28	1.32	.63	2.39**
		Control	26	.89	.71	
3	Branching	Experimental	28	2.04	1.86	3.38*
		Control	26	.69	.95	
4	General to Specific	Experimental	28	3.29	1.05	11.00*
		Control	26	.46	.81	

* Significant at .01 level

** Significant at .05 level

The Table 6.7 shows that the t-values of 4.78, 3.38 and 11.00 for the elements 1, 3, and 4 are significant at .01 level, whereas that t-value of 2.39 for the element-2 is significant at .05 level. This implies that there is significant difference between the mean scores of experimental and control groups in all the four elements. The mean scores of 3.21, 1.32, 2.04, and 3.29 for the experimental group are higher than the mean scores of .15, .89, .69 and .46 for the control group in the elements 1, 2, 3 and 4 respectively. This means that the AOM group had obtained higher mean scores in all the elements. Thus, it can be said that students of AOM group are superior to the students of traditional method group in the elements of relationships, hierarchy, branching, and general to specific on the comprehensive test passage-B.

From the foregoing discussions on the four major elements of a concept map, it is evident that the students of Advance Organizer Model group are superior to the students of traditional method group in all the four elements in unit tests

II and IV and the two passages of the comprehensive test. Moreover, they are better than those of the control group in three elements except the element of hierarchy in the unit test - I and in the two elements, namely, relationship and branching in the unit test -III. Both the groups are equally competent in hierarchy and general to specific in the unit test-III. It is, therefore, observed that AOM group has maintained its superiority all through except at three occasions - twice with hierarchy and once with general to specific. This result may be attributed to the factor that students might have found the learning tasks involving these elements simple.

6.3 COMPARISON BETWEEN EXPERIMENTAL AND CONTROL GROUPS ON MEANINGFUL ASSIMILATION OF INFORMATION AND IDEAS.

The second objective of the study was to compare the effects of Advance Organizer Model of teaching and traditional method of teaching in terms of meaningful assimilation of information and ideas. To achieve this objective, the following null thypothesis was formulated:

"There will be no significant difference between the mean scores of students taught through Advance Organizer Model and traditional method of teaching in meaningful assimilation of information and ideas".

To test this hypothesis, four unit tests and one comprehensive test on meaningful assimilation of information and ideas developed by the researcher were administered to

students of both the groups. Means and standard deviations were computed from the scores secured by the students of experimental and control groups on these tests. The t-test of significance was applied to determine the statistical difference between the mean scores of experimental and control groups. The Table 6.8 presents means, standard deviations and t-values for the unit tests and the comprehensive test on meaningful assimilation of information and ideas.

TABLE 6.8 : Means, Standard Deviations, and t-values for the Unit Tests and the Comprehensive Test on Meaningful Assimilation of Information and Ideas.

Tests	Groups	N	Means	S.Ds	t-values
Unit Test-I	Experimental	28	15.54	3.60	.92*
	Control	26	14.69	3.34	
Unit Test-II	Experimental	28	19.57	3.02	1.66*
	Control	26	17.65	5.46	
Unit Test-III	Experimental	28	8.79	2.42	1.20*
	Control	26	9.50	2.04	
Unit Test-IV	Experimental	28	22.92	6.01	2.16**
	Control	26	19.92	4.33	
Comprehensive Test	Experimental	28	24.67	5.62	3.32***
	Control	26	19.69	5.73	

* Not Significant
** Significant at .05 level
*** Significant at .01 level

The Table 6.8 shows that the t-values of .92, 1.66, and 1.20 for the unit tests I, II, and III respectively are not significant at .01 and .05 levels. This indicates that there is no significant difference between the mean scores of experimental and control groups on the unit tests I, II, and III. This implies that both experimental and control groups have performed equally well on unit tests I, II, and III. But, the t-value of 2.16, in the Table 6.8, for the unit test IV is significant at .05 level. This means that there is significant difference between the mean scores of experimental and control groups on the unit test IV. Moreover, the mean of 22.92 for the experimental group on the unit test IV is higher than the mean score of 19.92 for the control group. Therefore, the performance of the experimental group is superior to that of the control group.

It is also evident from the Table 6.8 that the t-value of 3.32 for the comprehensive test is significant at .01 level. This means that there is significant difference between the mean scores of the experimental and the control groups on the comprehensive test. Therefore, the null hypothesis formulated for the second objective is rejected. The mean of 24.67 for the experimental group is higher than the mean score of 19.67 for the control group on the

comprehensive test.This implies that the experimental group had obtained higher mean score; and therefore, is better than the control group on the comprehensive test.

The results arrived at from the Table 6.8 provide very interesting pictures. Whereas both experimental and control groups have performed equally well on the unit tests I, II and III, the experimental group has done better than the control group on the unit test - IV and the comprehensive test. This result may be due to certain reasons. First, students of experimental group might have taken time to get themselves acquainted with the new kind of teaching i.e. Advance Organizer Model of teaching during the presentation of units I, II and III. Therefore, the impact of meaningful learning process might be less during the teaching of first three units. Second, since the unit tests were administered just after the teaching of a particular unit was over, the impact of recency of learning the subject matter and the rote memorization might have acted on the performance of the students of control group. But this trend did not continue with the unit test - IV and the comprehensive test. By the end of unit - IV, students of experimental group might have got themselves acquainted with the new kind of teaching and the meaningful learning process might have become more active.Therefore, the recency of learning and rote memorization occuring in the case of control group

might have failed to compete with the meaningful learning process occuring with the experimental group.

On the comprehensive test, students of experimental group exhibited significant performance in comparison to those of control group. This may be due to some reasons: (1) By the end of the experiment, meaningful learning process might have taken roots among the students of experimental group. Because of meaningful learning, students of experimental group might have retained information and ideas taught to them during the experimentation period. But students of control group with rote memorization failed to retain information and ideas taught to them during the experimentation period. (2) The ability of the students of experimental group to develop conceptual structures helped them, to a large extent, to learn the subject matter in a meaningful way and to retain them over a longer period. This is evident from the results obtained from the first objective. (3) The presentation of advance organizers ahead of the learning tasks and at a higher level of abstraction and inclusiveness than the learning tasks might have helped the students to establish the relationship between the past learning experiences and the new learning experiences. (4) Students of the experimental group might have found the presentation of the learning tasks more logical and psychological as they were based on the principles of

progressive differentiation and integrative reconciliation. (5) The Advance Organizer Model presentation of subject matter corresponds to structure of the subject of Civics wherein general concepts are presented first while the specific ones later. It is, therefore likely, that AOM might have helped the students in understanding the concepts in Civics.

Looking to the above reasons, it can be concluded that Advance Organizer Model of teaching facilitates meaningful assimilation of information and ideas. This finding validates the instructional effect of meaningful assimilation of information and ideas given by Joyce and Weil (1980). This finding is also in agreement with many studies showing the effectiveness of advance organizers on student learning in social studies at the high school level (Allen, 1969; Baker, 1974; Oppong, 1978; Panda, 1986; and Pandey, 1986). This finding is also in agreement with many studies reporting the effectiveness of advance organizers on student learning in mathematics and sciences at the high school level (Weisberg, 1970; Lantz, 1982; Gonzales, 1982; Chitriv, 1983; Avalos, 1986; Ghosh, 1986; Grewal and Kaur, 1987; Healy, 1989).

6.4 COMPARISON BETWEEN EXPERIMENTAL AND CONTROL GROUPS ON INTEREST IN INQUIRY

Thr third objective of the study was to compare the effects of Advance Organizer Model and the traditional method

of teaching in terms of students' interest in inquiry. In order to meet this objective the following null hypothesis was formulated.

"There will be no significant difference between the mean scores of students taught through Advance Organizer Model and traditional method of teaching in interest in inquiry".

To test the above hypothesis, the test on interest in inquiry was administered to the students of both experimental and control groups. Means, standard deviations were computed from the scores secured by the students of both the groups on the test. The t-test of significance was applied to determine the statistical difference between the mean scores of experimental and control groups on the test. The Table 6.9 provides means, standard deviations, and the t-value for the test on interest in inquiry.

TABLE 6.9: Means, Standard Deviations, and the t-value for the Test on Interest in Inquiry

Groups	N	Means	S.Ds	t-value
Experimental	28	26.11	5.96	5.09*
Control	26	19.04	4.39	

* Significant at .01 level

The Table 6.9 shows that the t-value of 5.09 for the test on interest in inquiry is significant at .01 level. This

means that there is significant difference between the mean scores of experimental and control groups on the test. Therefore, the null hypothesis formulated for the third objective is rejected. It is also seen in the Table 6.9 that the mean score of 26.11 for the experimental group is higher than the mean score of 19.04 for the control group. This indicates that the group taught through Advance Organizer Model achieved higher mean score than the group taught through traditional method. Therefore, experimental group is superior to the control group in terms of interest in inquiry.

The above result may be due to certain reasons. Interest of a person in the inquiry act depends on his/her liking to involve himself/herself in the act of inquiry or problem-solving. Advance Organizer Model of teaching might have provided students of experimental group through its third phase i.e. strengthening the cognitive structure, the scope to develop interest in the problem solving act. It is because, the experimental teacher, at this phase of the model, used to put a number of problem-oriented questions to the students. Students using their background experiences in the cognitive structures, might have taken interest to solve the problems. Ausubel et al.(1978) also believe that existing cognitive structure plays a key role in problem solving. According to them, the solution of any given problem involves a reorganization of the residue of past experiences so as to fit the particular requirements of the current problem situation.

The possession of relevant background knowledge (concepts, principles, transactional terms, and available functions) in cognitive structure, particularly if clear, stable, and discriminable facilitates problem solving (Novak, 1961; Ring & Novak, 1971; Saugstad, 1955; Saugstad & Raaheim, 1960). It can be said that Advance Organizer Model influences a person's interest in inquiry by helping him/her to make use of the existing experiences to solve new problems. Hence, the superiority of the Advance Organizer Model group in the test on interest in inquiry might be attributed to the nurturant effect of the AOM to develop interest in inquiry among the students. On the basis of the arguments provided, it can be concluded that the theoretical prediction of Joyce and Weil (1980) that Advance Organizer Model facilitates interest in inquiry among the learners is substantiated.

6.5 COMPARISON BETWEEN EXPERIMENTAL AND CONTROL GROUPS ON HABITS OF PRECISE THINKING

The fourth objective of the study was to compare the effects of Advance Organizer Model and traditional method of teaching in terms of students' habits of precise thinking To achieve this objective, the following null hypothesis was formulated.

"There will be no significant difference between the mean scores of the students taught through Advance Organizer Model of teaching and the traditional method of teaching in habits of precise thinking".

In order to examine the above hypothesis, the test on habits of precise thinking was administered to the students of both the groups. Means and standard deviations were computed from the scores obtained by the students of experimental and control groups on the test. The t-test of significance was applied to determine the statistical difference between mean scores of experimental and control groups. Means, standard deviations, and the t-value for the test on habits of precise thinking are presented in Table 6.10.

TABLE 6.10: Means, Standard Deviations, and the t-value for the Test on Habits of Precise Thinking

Groups	N	Means	S.Ds	t-value
Experimental	28	14.54	3.37	5.65*
Control	26	9.96	2.72	

* Significant at .01 level

It is evident from the Table 6.10 that the t-value of 5.65 for the test on habits of precise thinking is significant at .01 level. This means that there is significant difference between the mean scores of experimental and control groups on the test. Therefore, the null hypothesis formulated for the fourth objective is rejected. It is also seen from the Table 6.10 that the mean score of 14.54 for the experimental group is higher than the mean score of 9.96

for the control group. This implies that the group taught through Advance Organizer Model obtained higher mean score. Hence, it is superior to the group taught through traditional method group on habits of precise thinking.

The above result may be due to some reasons. One's habits of precise thinking depend on one's ability to acquire integrated and precise meanings. According to Ausubel (1985), a central task of pedagogy is to develop ways of facilitating an active variety of reception learning characterized by an independent and critical approach to the understanding of subject matter. This involves, in part, the encouragement of motivations and self-critical attitudes toward acquiring precise and integrated meanings, as well as the use of other techniques directed towards the same end. Moreover, he emphasizes that precise and integrated understanding can be developed if the teachers help the students to assimilate subject matter critically by encouraging them to recognize and challenge the assumptions underlying the new propositions, to distinguish between hypothesis and facts, to delineate differences and similarities between the related concepts, to identify the central idea of a theme, and to distinguish between warranted and unwarranted inferences.

The teacher in the Advance Organizer Model group used to utilize the above techniques both at the phase of the presentation of the learning task and the phase of strengthening of cognitive structures by putting different

questions. The frequent use of these techniques by the teacher over a period of time might have helped the students of experimental group to develop habits of acquiring integrated and precise meanings. Active meaningful learning depends on acquisition of integrated and precise meanings. Hence, the superiority of experimental group over the control group on meaningful assimilation of information and ideas which was evident from the result obtained from the second objective might be due to the students' habits of acquiring integrated and precise thinking. In other words, students of experimental group because of their habits of precise thinking might have done well in acquisition of meaningful learning. This nurturant effect of AOM might have helped the students to secure higher mean score on test on habits of precise thinking in comparison to control group. Therefore, the theoretical prediction of Joyce and Weil (1980) that AOM facilitates habits of precise thinking is supported.

6.6 COMPARISON BETWEEN EXPERIMENTAL AND CONTROL GROUPS ON RETENTION OF MEANINGFUL ASSIMILATION OF INFORMATION AND IDEAS

The fifth objective of the study was to compare the effects of Advance Organizer Model and the traditional method of teaching in terms of retention of meaningful assimilation of information and ideas. To attain this objective, the following null hypothesis was formulated.

"There will be no significant difference between the mean scores of students taught through Advance Organizer Model of teaching and the traditional method of teaching in retention of meaningful assimilation of information and ideas".

To test the above hypothesis, the test on meaningful assimilation of information and ideas, which was used as retention test, was administered to the students of both the groups after a gap of 40 days. Means and standard deviations were computed from the scores obtained by students of experimental and control groups on the test. The t-test of significance was applied to determine statistical difference between the mean scores of experimental and control groups. The Table 6.11 presents means, standard deviations, and the t-value for the retention test on meaningful assimilation of information and ideas.

TABLE 6.11 : Means, Standard Deviations, and the t-value for the Retention Test on Meaningful Assimilation of Information and Ideas

Groups	N	Means	S.Ds	t-value
Experimental	28	24.29	5.73	2.96*
Control	26	20.03	5.12	

* Significant at .01 level

The Table 6.11 shows that the t-value of 2.96 for the retention test on meaningful assimilation of information and ideas is significant at .01 level. This implies that there is significant difference between the mean scores of students of experimental and control groups on the test. Hence, the null hypothesis formulated for the fifth objective is rejected. It is also evident from the Table 6.11 that the mean score of 24.29 for the experimental group is higher than the mean score of 20.03 for the control group. This means that the group taught through Advance Organizer Model of teaching obtained higher mean score. Hence, it is better than the group taught through traditional method of teaching on the retention test. This result may be due to the following reasons:

According to Ausubel et al.(1978), there are two reasons, which probably account for the superiority of retention resulting from meaningful learning in contrast to retention after rote learning. First, since meaningful learning is more effective because of the advantages inherent in the substantive and nonarbitrary relatibility of new ideas to relevant established ideas in cognitive structure, a greater quantity of material is incorporated more easily and made more available immediately after learning. Second, since the same relationship between new and established ideas is maintained by assimilation during the retention interval and since the same variables

influence initial and later dissociability strength, this same relatibilityadvantage further enhances the efficiency of the process whereby acquired meanings are subsequently retained.

To put the second reason in another way, a new idea learned by assimilation to a well-established, relevant idea will tend to gain some of the inherant stability of the original idea and hence be retained for longer. Therefore, students in the experimental group might have been benefited by the advance organizers which helped them to assimilate the new ideas with the relevant, established ideas in the cognitive structure. In this process, the new ideas got some of the inherent stability of the original ideas and therefore could be retained for longer. In the absence of advance organizers, this was not possible with the students of control group. Hence, students of Advance Organizer Model group were able to retain meaningful assimilation of information and ideas even after 40 days of the experimentation.

The above result is in agreement with findings of some studies. The significance of advance organizer on the delayed post-test was found by Ausubel and Fitzgerald (1961) and Ausubel and Youssef (1963). Allen (1969) concluded that the advance organizer enhanced learning for average students as measured by the delayed post-test in social studies at the high school level. Ewing (1977) reported that an advance

organizer did significantly facilitate learning and retention for the combined knowledge, comprehension and application scores. Lantz (1982) concluded that advance organizers benefited students of all subsumer levels on cognitive learning of solar energy concepts in both immediate and delayed tests. The significant performance of advance organizer group on the retention test was also supported by Ghosh, 1986; Cliburn, 1985; and Ruangruchira, 1992.

6.7 STUDYING STUDENTS' REACTIONS TOWARDS ADVANCE ORGANIZER MODEL OF TEACHING

The sixth objective of the study was to examine the reactions of the students towards teaching through Advance Organizer Model. To meet this objective, the following hypothesis was formulated.

"Students taught through the Advance Organizer Model will express favourable reactions towards the model"

To examine the above broad hypothesis 'equal answer' hypothesis was formulated for each item to be tested. For this Chi-square was applied to see the significance of difference between the response categories, namely, Yes (agreed) and No (disagreed).

The frequency distributions and Chi-square values of reactions towards the model of teaching has been presented in Table 6.12.

TABLE 6.12 : Frequency Distributions and Chi-square values of Reactions towards Advance Organizer Model

Items	FREQUENCY Yes(agreed)	No (Disagreed)	x^2
1	25	03	15.75*
2	25	03	15.75*
3	05	23	10.32*
4	25	03	15.75*
5	07	21	6.04**
6	25	03	15.75*
7	05	23	10.32*
8	25	03	15.75*
9	27	01	22.32*
10	06	22	8.04*

df = 1

* Significant at .01 level

** Significant at .05 level

From the Table 6.12, it is evident that x^2 values of 15.75, 15.75, 15.75, 15.75, 15.75 and 22.32 for the positive items 1, 2, 4, 6, 8, and 9 are significant at .01 level. In these cases 'equal answer hypotheses' stand rejected. This means that there is significant difference among the students' responses failling under both the categories. On the basis of the majority of responses falling under Yes (agreed)category it may be concluded that students reacted favourably towards Advance Organizer Model.

The Chi-square values of 10.32, 10.32 and 8.04 for the negative items 3, 7 and 10 are significant at .01 level and the Chi-square value of 6.04 for the negative item 5 is significant at .05 level. This implies that there is significant difference among the students' responses falling under both the categories. On the basis of the majority of responses falling under No (disagreed) category it may be concluded that the students reacted favourably towards Advance Organizer Model. On the whole, looking to the majority of responses falling under agreed and disagreed categories, it may be concluded that the students have favourable reactions towards Advance Organizer Model of teaching.

The above result may be due to certain reasons. First, the students might have liked the new kind of teaching i.e. Advance Organizer Model of teaching. Second, the teaching through concept mapping technique might have been very interesting to the students of experimental group. Third, the presentation of the learning material from the very abstract ideas at the top to the specific ideas at the bottom might have been liked by the students. Fourth, the role of advance organizers in connecting the new learning tasks with the existing learning experiences might have been found interesting and meaningful to the students. Fifth, the interactive nature of teaching at the phase three of the model might have been liked by the students.

This finding of the study is supported by earlier researches. Pandey (1986) reported that students of class VIII expressed favourable reactions towards Advance Organizer Model of teaching as well as Inquiry Training Model of teaching. Similarly, Passi, Sansanwal, and Singh (1988), in the phase III of their study showed that students taught through Advance Organizer Model and Jurisprudential Inquiry Model of teaching expressed favourable reactions towards the models.

6.8 SUMMARY

This Chapter focussed on the analysis and interpretation of data obtained from the administration of different tools on both experimental and control groups during the experimentation. While analysing and interpreting data, objectives and hypotheses of the study were taken into consideration. Results of the analyses were presented in a tabular form. On the basis of the results, hypotheses were tested. The results of the analyses were also interpreted objectivewise. Data related to the first objective were analysed and it was found that students of experimental group were better in development of conceptual structures in comparison to control group. Data related to the second objective were analysed and it was seen that students of experimental group were better than students of control group in meaningful assimilation of information and ideas. Data related to interest in inquiry were analysed and it was concluded that students of experimental group were better in interest in inquiry in comparison to

students of control group. Data pertaining to the fourth objective were analysed and it was found that students of experimental group were superior to students of control group in habits of precise thinking. Analysis of data pertaining to fifth objective showed that students of experimental group were better in retention of meaningful learning in comparison to students of control group. Analysis of data related to the sixth objective revealed that students of experimental group had favourable reactions towards Advance Organizer Model. In the next Chapter, summary of results, major findings of the study, discussions and implications of the findings, and suggestions for further research will be presented.