RES MILITARIS
REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

Effect of Integrating Inductive Method of Teaching with Advanced Organizer Model in the Achievement of Conceptual Understanding in Mathematics of Class-Viii Students

By

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Abstract

Mathematics education is a domain of professional work that makes fundamental use of highly specialized kinds of mathematical knowledge or as a kind of applied Mathematics. The present study has aimed to compare Conceptual Understanding in Mathematics of class-VIII students who were taught Mathematics through Integrating Inductive Method with Advanced Organizer Model and those taught through Conventional Method. The study has also aimed to find the difference in the concept achievements between the two groups. For the present study, all the Class-VIII students of two CBSE schools in Dibrugarh Town, Assam were selected using purposive sampling technique and only those students who attended all the classes and appeared in both pre-test and post-test were considered. To eliminate the initial variability of the students, intelligence of the students were measured through Standard Progressive Matrices prepared and standardized by Raven, J.C. (1950), where students were paired on the basis of their scores and on the basis of the ordered pair of students, one student from each pair had been put in Experimental group and the other student was put in the Control group. Lottery method had been used while selecting a student for either Experimental Group or Control Group from every pair of students. A Concept Achievement Test in Mathematics was constructed and standardized by the researcher to measure achievement of Conceptual Understanding in Mathematics of Class-VIII students. The researcher had chosen the Geometry part of Class-VIII Mathematics Textbook for Concept Achievement Test. The test was a Two-Tier Multiple Choice Test. The first tier of each multiple choice item was a content question having three choices, where only one choice was correct among the three choices. The second tier of each item included a set of four reasons for the answers given in the first tier. Out of these four reasons, one was correct and the other three were the students' misconceptions regarding the concept. Students' answers to each item was considered correct only when they provided correct choice as well as the correct reason for each item. Split-half technique and Test-retest method were used to estimate the reliability of the Concept Achievement Test. The coefficient of reliability of the test using split-half technique and test-retest method were found as 0.86 and 0.76 respectively. Again, content validity was used to estimate the validity of the Conceptual Achievement Test. The study revealed a significant difference in the scores of Achievement of Conceptual Understanding in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model and Conventional Method. The scores of Concept Achievement in Mathematics of students who were taught by Integrating Inductive Method of Teaching with Advanced Organizer Model were higher than the scores of Concept Achievement in Mathematics of students who were taught by Conventional Method.

Keywords: Inductive Method of Teaching, Advanced Organizer Model, Conceptual Understanding, Achievement

Introduction

Mathematics is the science of structure, order, and relation that has evolved from elemental practices of counting, measuring, and describing the shapes of objects. It deals with logical reasoning and quantitative calculation, and its development has involved an increasing degree of idealization and abstraction of its subject matter (Mesquita, Restivo and D'Ambrosio, 2011). The invention of printing in the 15th century led the creation of schools to educate the masses and made immense landscape of social, economic, and political events that accompanied the evolution of Mathematics teaching. As a result, Mathematics which was an arcane subject 600 years ago has become a subject studied by virtually all students in the world (Furinghetti, Matos and Menghini, 2013). Mathematics education, on the other hand, is not Mathematics. It is a domain of professional work that makes fundamental use of highly specialized kinds of mathematical knowledge or as a kind of applied Mathematics. And the first task of the mathematician who wishes to contribute in this area is to understand sensitively the domain of application, the nature of its mathematical problems, and the forms of mathematical knowledge that are useful and usable in this domain (Bass, 2005). However, from a more practical perspective, a Mathematics teacher is faced with the need to orchestrate a good number of meanings derived from multiple sources that students develop mathematical knowledge (Kilpatrick, Hoyles, Skovsmose and Valero, 2005).

Among the different branches of school Mathematics, Geometry is one of the most important branches and has a very significant place in education. The study of Geometry helps to develop critical thinking and problem solving skills of students (Pesen, 2006). Therefore, Geometry instruction should develop logical thinking abilities of students and spatial intuitions about the real world. The instruction should also impart the knowledge needed to study more Mathematics and teach students the reading and interpretation of mathematical arguments (Suydam, 1985). In India, Mathematics has occupied a prominent place ever since the Vedic Period and it was taught and learned since then. It is considered as a highly revered subject in Indian culture and viewed as a measure of one's intellectual ability. A great impact of new technological revolution is seen on Indian society and as a result, much of the curriculum development in Mathematics has been taken place during the past forty years. In the post independence period, much emphasis and effort has been given on Mathematics teaching and learning and it is made as a compulsory subject in the school as per recommendation of the Secondary Education Commission appointed in 1952. The Education Commission, 1964-66 also emphasized the need for Mathematics as a compulsory subject for students at school level. The National Policy on Education (1986) has suggested that Mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject it should be treated as concomitant to any subject involving analysis and reasoning. In the recent past, there has been a tremendous development in theories of learning and the science of teaching and it is becoming very important for the students to understand the basic principles of Mathematics very clearly. The commission also points out the teaching of Mathematics and suggests that teachers should give more emphasis on the understanding of basic principles of Mathematics rather than providing mechanical teaching of mathematical computations only. The National Curriculum Framework (NCF), 2005 also has given due emphasis on Mathematics and set the 'mathematization' of a child's thinking as the main goal of Mathematics education. It should be the right to very child to get success in Mathematics. One of the fundamental principles of National Education Policy (NEP), 2020 is to give emphasis on conceptual understanding rather than rote learning and learning-for-exams. Conceptual understanding in Mathematics is the comprehension of mathematical concepts, operations, and relations that provide a frame for thinking and allowing learners for in-depth understanding of relations of the constituents of the concept which will enable them to connect it with new knowledge. Conceptual Mathematics knowledge emphasizes students' ability to interconnect Mathematics across disciplines, critically think about the content, and communicate key components of Mathematics (Zeeuw, Craig and You, 2013). Conceptual understanding in Mathematics can explore the nature of Mathematics, understanding, and pedagogical methodologies. The student having conceptual understanding in Mathematics will be able to understand the mathematical ideas and to achieve the ability to transfer his/her knowledge into new situations and also be able to apply it to new contexts. Conceptual understanding enables students to solve mathematical problems in various forms and novel settings. Students with high levels of conceptual knowledge are capable of solving problems that they have never come across before (Ghazali and Zakaria, 2011). When a student understands the meaning and underlying principles of mathematical concepts, he or she has conceptual knowledge in Mathematics (Frederick & Kirsch, 2011). Conceptual knowledge requires the learner to be active in thinking about relationships and making connections, along with making adjustments to accommodate the new learning with previous mental structures (Reys, Suydam, & Lindquist, 1995). The National Council for Teachers of Mathematics (2000), in their work: Principles and Standards for School Mathematics, argued that in the twenty-first century, students need to have conceptual understanding in Mathematics in order to flourish and solve problems as adults in the present changing environment. Also, conceptual understanding in Mathematics encourages students to be more independent and confident which evidences itself in students not shrinking back from challenging problems and openness in solving problems differently (NCTM, 2000). Teachers are constantly gathering innovative ways to teach essential information so that students can explore and investigate Mathematics. Teachers, therefore, need to investigate their own practice in professional collaborative settings (Ponte, 2008). Thus, various educational approaches must be considered when teaching understanding, specifically conceptual understanding in Mathematics, so that students may be best served and may learn in the most holistic way possible.

Among various teaching methods, inductive method is one of the scientific methods in teaching different subjects. Winch (1913) found that the inductively taught group was the more competent when tested on the power of application to new material. Students taught by inductive method show better achievement than that of the Deductive method in teaching geometry at secondary level (Acharya, 2016). Students taught by inductive method of teaching show better performance in electrochemistry than the students taught by traditional method (Taha, 2014). Again an advanced organizer can be considered a very useful tool as it helps students in the classroom to understand, retain and remember new learning material. Teachers use this tool to introduce the lesson and illustrate the relationship between what the students are about to learn and the previous knowledge, i.e. the information they have already learned. As compared to conventional methods, Advanced Organizer Model is better in teaching of concepts of science (Kapri, 2017). Advanced Organizer Model is also effective for the achievement of primary school students in social science (Mohanty, 2016). Regarding the achievement of students in Biology, Advanced Organizer Model is more effective than Conventional Method of teaching (Kowshik, 2015). In the achievement of students in Mathematics, Advanced Organizer Model is found more effective than Conventional Method of teaching (Babu and Reddy, 2013). Jadhav (2011) conducted an investigation to examine the effectiveness of AOM over customary method in the teaching of Physics to grade IX students and found that AOM strategy was more effective than conventional strategy of teaching physics. On the similar lines, Pachpande (2012) conducted a study to check the affect of AOM on the performance of students in school level Mathematics. Study concluded that AOM was more effective than regular ways of teaching Mathematics to school students. Thus, from the different studies done by different researchers cited above, it is becoming very much clear that Inductive Method of Teaching and Advanced Organizer Model can be considered as very effective means for teaching different subjects and is better than conventional methods of teaching. The Inductive Method and the syntax of Advanced Organizer Model have the characteristics that can fulfill the objectives of teaching Mathematics, where Inductive Method develops the habit of inductive reasoning, and making generalizations, explanations and predictions in the students and the syntax of the Advanced Organizer is used as introductory material presented ahead of the learning task to the students to promote integrating reconciliation and active reception learning with clarity. The phase-II of the syntax of Advanced Organizer Model is the stage of execution where materials to be learnt is actually presented before the students. In this phase an important task is to maintain students' attention by communicating well what is presented before them and by taking proper cognition of their existing cognitive structure as well as already provided intellectual information through Advanced Organizer. Thus, keeping in view the effectiveness of Inductive Method and Advanced Organizer Model in teaching students, the researcher wants to study the effect of integrating Inductive Method of Teaching with Advanced Organizer Model over Conventional Method in teaching Mathematics. The researcher introduced the Inductive Method of Teaching in the phase-II of the syntax of the model by presenting students many examples so that the students were able to identify some common rules or formulae with proper understanding.

Method

In the present study, the pretest-posttest equivalent-groups design has been considered. This study has aimed to compare Conceptual Understanding in Mathematics of class-VIII students who were taught Mathematics through Integrating Inductive Methodwith Advanced Organizer Model and those taught through Conventional Method. The study has also aimed to find the difference in the concept achievements between the two groups. For the present study, all the Class-VIII students of two CBSE schools in Dibrugarh Town, Assam were selected using purposive sampling technique and only those students who attended all the classes and appeared in both pre-test and post-test were considered.

Moreover, Kandeel (2016) found that there was a significant impact of intelligence on students' academic achievements in Mathematics. Ozdemir, Guneysu and Tekkaya (2006) revealed that logical-mathematical intelligence was the most dominant factor in enhancing learning of fourth grade students. Babu and Reddy (2013) found that there was a significant impact of intelligence on students' academic achievements in Mathematics. Thus, in view of the different studies done by different researchers, in the present study, the researcher considered intelligence of the students as the most important intervening variable which might influence the dependent variable. To eliminate the initial variability of the students, intelligence of the students were measured through Standard Progressive Matrices prepared and standardized by Raven, J.C. (1950), where students were paired on the basis of their scores and on the basis of the ordered pair of students, one student from each pair had been put in Experimental group and the other student was put in the Control group. Lottery method had been used while electing a student for either Experimental Group or Control Group from every pair of students.

In the present study, the students of **School-1** were divided into three groups of 40 students each as High Group, Average Group and Low Group on the basis of their obtained scores in the intelligence test viz., Standard Progressive Matrices prepared and standardized by Raven, J.C. (1950). The High Group was again subdivided into two equivalent groups of 20 students each as Experimental Group and Control Group. Likewise the Average Group and Low Group also were subdivided into two equivalent groups of 20 students each as Experimental Groups and Control Groups. In the **School-2**, the students were divided into two groups of 24 students each as High Group and Low Group on the basis of their obtained scores in the intelligence test viz., Standard Progressive Matrices prepared and standardized by Raven, J.C. (1950). The High Group was again subdivided into two equivalent groups of 12 students each as Experimental Group and Control Group. Likewise the Low Group also was subdivided into two equivalent groups of 12 students each as Experimental Group and Control Group. The Experimental groups were taught through Integrating Inductive Method of Teaching with Advanced Organizer Model (AOM) and the Control groups were taught through Conventional Method. During the course of study, Achievement of Conceptual Understanding in Mathematics was measured two times: before the experimental treatment (Pretest Stage) and after providing the experimental treatment (Posttest Stage). Again, co-variance technique was used to minimize the effect of other intervening variables on the dependent variable on the achievement of Conceptual Understanding of students.

A Concept Achievement Test in Mathematics was constructed and standardized by the researcher to measure achievement of Conceptual Understanding in Mathematics of Class-VIII students. Geometry is quite difficult to learn and comprehend for students as compared to other branches of school Mathematics and it becomes a nightmare for most of the students (Akin & Cancan, 2007). Geometrical thinking skills of the students are lower than expected is one of the reasons of this failure due to which Geometry needs a strong pedagogical approach along with deep knowledge providing an enjoyable and intellectual atmosphere for students. Thus, Mathematics teachers must apply different teaching methods to improve students' geometrical thinking skills and to make teaching more efficient (Serin, 2018). Moreover, Concept Achievement is more prevalent in the nature of content in the Geometry part as compared to other branches of Mathematics and there is more scope in testing the reasoning ability of the students through teaching Geometry. Therefore, the researcher had chosen the Geometry part of Class-VIII Mathematics Textbook for Concept Achievement Test. The test was a Two-Tier Multiple Choice Test. The first tier of each multiple choice item was a content question having three choices, where only one choice was correct among the three choices. The second tier of each item included a set of four reasons for the answers given in the first tier. Out of these four reasons, one was correct and the other three were the students' misconceptions regarding the concept. Students' answers to each item was considered correct only when they provided correct choice as well as the correct reason for each item.

The responses made by the students to each item were scored in the following ways:

i) Zero for incorrect answer followed by incorrect reason.
ii) One for correct answer followed by incorrect reason.
iii) Two for incorrect answer followed by correct reason and
iv) Three for correct answer followed by correct reason.

Split-half technique and Test-retest method were used to estimate the reliability of the test for the achievement of Conceptual Understanding. The coefficient of reliability of the test using split-half technique and test-retest method were found as 0.86 and 0.76 respectively.

Again, content validity was used to estimate the validity of the test for the achievement of Conceptual Understanding.

For the purpose of the present study, the researcher had selected the pretest-posttest equivalent-groups design, which was equated in all relevant aspects as shown in the following table-1:

Tabel-1: *The pretest-posttest equivalent-groups design:*

Experiment I	Experiment II	Experiment III	Experiment IV	Experiment V
R O_1 X O_2	R O_3 X O_4	R O_5 X O_6	R O_7 X O_8	R O_9 X O_{10}
X gain=O_2–O_1	X gain=O_4–O_3	X gain=O_6–O_5	X gain=O_8–O_7	X gain=O_{10}–O_9
R O_{11} C O_{12}	R O_{13} C O_{14}	R O_{15} C O_{16}	R O_{17} C O_{18}	R O_{19} C O_{20}
X gain=O_{12}–O_{11}	X gain=O_{14}–O_{13}	X gain=O_{16}–O_{15}	X gain=O_{18}–O_{17}	X gain=O_{20}–O_{19}

O_1 O_3 O_5 O_7 O_9 O_{11} O_{13} O_{15} O_{17} O_{19} = pretests
O_2 O_4 O6 O_8 O_{10} O_{12} O_{14} O_{16} O_{18} O_{20} = posttests
Where,
R – Random assignment of subjects to groups or treatments
X – Exposure of a group to an experimental (treatment) variable
C – Exposure of a group to the control condition
O –Test administered

Comparison of Achievement of Conceptual Understanding in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model (Experimental Group) and Conventional Method (Control Group)

The directional hypothesis formulated for testing the significant difference in the Achievement of Conceptual Understanding in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model (Experimental Group) and Conventional Method (Control Group) was, "Achievement of Conceptual Understanding in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model is higher than the students taught by Conventional Method**.**" The comparison of Achievement of Conceptual Understanding in Mathematics of Class-VIII students between Experimental Group and Control Group of School-1 has been shown in the following Table-2:

Table-2: *Comparison of Achievement of Conceptual Understanding in Mathematics of Class-VIII students between Experimental Group and Control Group of School-1*

Group	Concept Achievement	N	Mean	SD	r	SE_D	t	Inference
High Group	Experimental Group	20	101.10	2.05	0.38	2.80	4.52	Significant at 0.05 level
	Control Group	20	94.45	2.84				
Average Group	Experimental Group	20	100.25	1.53	0.40	2.20	4.46	Significant at 0.05 level
	Control Group	20	90.45	2.31				
Low Group	Experimental Group	20	91.45	2.48	0.47	3.34	5.55	Significant at 0.05 level
	Control Group	20	72.90	3.69				

From Table-2, the calculated t-values of High Group, Average Group and Low Group of School-1 were found to be 4.52, 4.46 and 5.55 respectively, which were greater than the tabulated value of t (=1.73) w.r.t. 19 d.f. at 0.05 level of significance.

Again, comparison of Achievement of Conceptual Understanding in Mathematics of Class-VIII students between Experimental Group and Control Group of School-2 has been shown in the following Table-3:

Table-3: *Comparison of Achievement of Conceptual Understanding in Mathematics of Class-VIII students between Experimental Group and Control Group of School-2*

Group	Concept Achievement	N	Mean	SD	r	SE_D	t	Inference
High Group	Experimental Group	12	109.08	2.50	0.21	3.60	5.60	Significant at 0.05 level
	Control Group	12	88.92	3.17				
Low Group	Experimental Group	12	101.67	2.51	0.29	4.53	4.27	Significant at 0.05 level
	Control Group	12	82.33	4.57				

From Table-3, the calculated t-values of High Group and Low Group of School-2 were found to be 5.60 and 4.27 respectively, which were greater than the tabulated value of t (=1.80) w.r.t. 11 d.f

The calculated t-values of all the groups in both School-1 and School-2 were greater than the tabulated t-values, therefore, we reject the null hypothesis and accept the directional hypothesis. So, we can conclude that Achievement of Conceptual Understanding in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model is higher than the students taught by Conventional Method**.**

The comparison of scores of Concept Achievement in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model and Conventional Method (High Group, Average Group and Low Group) of School-1 using Analysis of Co-variance technique has been shown in the following Tables (From Table-4 to Table-12):

School-1: High Group

Table-4: *Analysis of Variance of X (pre-test) and Y (post-test) scores, taken separately*

Sources of Variation	d.f.	SSx	SSy	MSx(Vx)	Msy(Vy)	Fx	Fy
Among Means	1	106	1600	106	1600	1.32	13.08
Within Groups	38	3056	4649	80.42	122.34		
Total	39	3162	6249				

From Table-4, the calculated F-value of High Group of School-1 was found to be 13.08, which is greater than the tabulated value of F (=4.12) w.r.t. 1 and 38 d.f. at 0.05 level of significance.

Table-5: *Analysis of Co-variance*

Sources of Variation	d.f.	SSx	SSy	Sxy	SSy.x	MSy.x(Vy.x)	SDy.x	Fy.x
Among Means	1	106	1600	411	1274	1274	10.72	11.08
Within Groups	37	3056	4649	1099	4254	115		
Total	38	3162	6249	1510	5528			

From Table-5, the calculated F-value of High Group of School-1 was found to be 11.08, which is greater than the tabulated value of F (=4.12) w.r.t. 1 and 37 d.f. at 0.05 level of significance.

Table-6: *Calculation of Adjusted Y- Means and Comparison of Concept Achievement of Experimental Group and Control Group*

Group	N	Mx	My	My.x (Adjusted)	SDy.x	SE_D	t	Inference
Experimental Group	20	49.9	107.10	106.52	10.72	3.43	5.80	Significant at 0.05 level
Control Group	20	46.65	94.45	95.04				
General Means		48.28	100.78					

From Table-6, the calculated t-value of High Group of School-1 was found to be 5.80, which is greater than the tabulated value of t (=1.69) w.r.t. 37 d.f. at 0.05 level of significance.

School-1: Average Group

Table-7: *Analysis of Variance of X (pre-test) and Y (post-test) scores, taken separately*

Sources of Variation	d.f.	SSx	SSy	MSx(Vx)	Msy(Vy)	Fx	Fy
Among Means	1	93	960	93	960	2.71	12.52
Within Groups	38	1305	2915	34.34	76.71		
Total	39	1398	3875				

From Table-7, the calculated F-value of Average Group of School-1 was found to be 12.52, which is greater than the tabulated value of F (=4.12) w.r.t. 1 and 38 d.f. at 0.05 level of significance.

Table-8: *Analysis of Co-variance*

Sources of Variation	d.f.	SSx	SSy	Sxy	SSy.x	MSy.x(Vy.x)	SDy.x	Fy.x
Among Means	1	93	960	299	781	781	8.78	10.14
Within Groups	37	1305	2915	278	2856	77		
Total	38	1398	3875	577	3637			

From Table-8, the calculated F-value of Average Group of School-1 was found to be 10.14, which is greater than the tabulated value of F (=4.12) w.r.t. 1 and 37 d.f. at 0.05 level of significance.

Table-9: *Calculation of Adjusted Y- Means and Comparison of Concept Achievement of Experimental Group and Control Group*

Group	N	Mx	My	My.x (Adjusted)	SDy.x	SE_D	t	Inference
Experimental Group	20	45.65	100.25	99.93	8.78	2.81	4.75	Significant at 0.05 level
Control Group	20	42.60	90.45	90.77				
General Means		44.13	95.35					

From Table-9, the calculated t-value of Average Group of School-1 was found to be 4.75, which is greater than the tabulated value of t (=1.69) w.r.t. 37 d.f. at 0.05 level of significance.

School-1: Low Group

Table-10: *Analysis of Variance of X (pre-test) and Y (post-test) scores, taken separately*

Sources of Variation	d.f.	SSx	SSy	MSx(Vx)	Msy(Vy)	Fx	Fy
Among Means	1	144	3441	144	3441	1.20	17.44
Within Groups	38	4556	7497	119.90	197.29		
Total	39	4700	10938				

From Table-10, the calculated F-value of Low Group of School-1 was found to be 17.44, which is greater than the tabulated value of F (=4.12) w.r.t. 1 and 38 d.f. at 0.05 level of significance.

Table-11: *Analysis of Co-variance*

Sources of Variation	d.f.	SSx	SSy	Sxy	SSy.x	MSy.x(Vy.x)	SDy.x	Fy.x
Among Means	1	144	3441	705	2782	2782	13.45	15.37
Within Groups	37	4556	7497	1927	6682	181		
Total	38	4700	10938	2632	9464			

From Table-11, the calculated F-value of Low Group of School-1 was found to be 15.37, which is greater than the tabulated value of F (=4.12) w.r.t. 1 and 37 d.f. at 0.05 level of significance.

Table-12: *Calculation of Adjusted Y- Means and Comparison of Concept Achievement of Experimental Group and Control Group*

Group	N	Mx	My	My.x (Adjusted)	SDy.x	SE_D	t	Inference
Experimental Group	20	42.55	91.45	90.65	13.45	4.30	7.27	Significant at 0.05 level
Control Group	20	38.75	72.90	73.70				
General Means		40.65	82.18					

From Table-12, the calculated t-value of Low Group of School-1 was found to be 7.27, which is greater than the tabulated value of t (=1.69) w.r.t. 37 d.f. at 0.05 level of significance.

In **School-1**, the calculated t-values of High Group, Average Group and Low Group were found to be 5.80, 4.75 and 7.27 respectively, which are greater than the tabulated value of t (=1.69) w.r.t. 37 d.f. at 0.05 level of significance.

Again, the comparison of scores of Concept Achievement in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model and Conventional Method (High Group and Low Group) of School-2 using Analysis of Co-variance technique has been shown in the following Tables (From Table-13 to Table-18):

School-2: High Group

Table-13: *Analysis of Variance of X (pre-test) and Y (post-test) scores, taken separately*

Sources of Variation	d.f.	SSx	SSy	MSx(Vx)	Msy(Vy)	Fx	Fy
Among Means	1	100	2400	100	2440	0.01	24.95
Within Groups	22	1649	2152	74.96	97.80		
Total	23	1749	4592				

From Table-13, the calculated F-value of High Group of School-2 was found to be 24.95, which is greater than the tabulated value of F (=4.30) w.r.t. 1 and 22 d.f. at 0.05 level of significance.

Table-14: *Analysis of Co-variance*

Sources of Variation	d.f.	SSx	SSy	Sxy	SSy.x	MSy.x(Vy.x)	SDy.x	Fy.x
Among Means	1	100	2440	494	2064	2064	9.38	21.28
Within Groups	21	1649	2152	431	2039	97		
Total	22	1749	4592	925	4103			

From Table-14, the calculated F-value of High Group of School-2 was found to be 21.28, which is greater than the tabulated value of F (=4.32) w.r.t. 1 and 21 d.f. at 0.05 level of significance.

Table-15: *Calculation of Adjusted Y- Means and Comparison of Concept Achievement of Experimental Group and Control Group*

Group	N	Mx	My	My.x (Adjusted)	SDy.x	SE$_D$	t	Inference
Experimental Group	12	49.75	109.08	104.47	9.85	4.04	6.95	Significant at 0.05 level
Control Group	12	45.67	88.92	93.55				
General Means		47.71	99					

From Table-15, the calculated t-value of High Group of School-2 was found to be 6.95, which is greater than the tabulated value of t (=1.72) w.r.t. 21 d.f. at 0.05 level of significance.

School-2: Low Group

Table-16: *Analysis of Variance of X (pre-test) and Y (post-test) scores, taken separately*

Sources of Variation	d.f.	SSx	SSy	MSx(Vx)	Msy(Vy)	Fx	Fy
Among Means	1	150	2243	150	2243	1.59	13.80
Within Groups	22	2076	3575	94.40	162.50		
Total	23	2226	5818				

From Table-16, the calculated F-value of Low Group of School-2 was found to be 13.80, which is greater than the tabulated value of F (=4.30) w.r.t. 1 and 22 d.f. at 0.05 level of significance.

Table-17: *Analysis of Co-variance*

Sources of Variation	d.f.	SSx	SSy	Sxy	SSy.x	MSy.x(Vy.x)	SDy.x	Fy.x
Among Means	1	150	2243	580	1271	1271	9.95	12.84
Within Groups	21	2076	3575	1769	2068	99		
Total	22	2226	5818	2349	3339			

From Table-17, the calculated F-value of Low Group of School-2 was found to be 12.84, which is greater than the tabulated value of F (=4.32) w.r.t. 1 and 21 d.f. at 0.05 level of significance.

Table-18: *Calculation of Adjusted Y- Means and Comparison of Concept Achievement of Experimental Group And Control Group*

Group	N	Mx	My	My.x (Adjusted)	SDy.x	SE_D	t	Inference
Experimental Group	12	50.42	101.67	99.55	9.95	4.08	7.02	Significant at 0.05 level
Control Group	12	45.42	82.33	84.46				
General Means		47.92	92					

From Table-18, the calculated t-value of Low Group of School-2 was found to be 7.02, which is greater than the tabulated value of t (=1.72) w.r.t. 21 d.f. at 0.05 level of significance.

In **School-2**, the calculated t-values of High Group and Low Group were found to be 6.95 and 7.02 respectively, which are greater than the tabulated value of t (=1.72) w.r.t. 21 d.f. at 0.05 level of significance.

The calculated t-values of all the groups in both School-1 and School-2 were greater than the tabulated t-values, therefore, we reject the null hypothesis and accept the directional hypothesis and can conclude that we can conclude that Achievement of Conceptual

Understanding in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model is greater than the students taught by Conventional Method**.**

The study revealed a significant difference in the scores of Achievement of Conceptual Understanding in Mathematics of Class-VIII students taught by Integrating Inductive Method of Teaching with Advanced Organizer Model and Conventional Method. The scores of Concept Achievement in Mathematics of students who were taught by Integrating Inductive Method of Teaching with Advanced Organizer Model were higher than the scores of Concept Achievement in Mathematics of students who were taught by Conventional Method.

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