Original Article

Effect of Concept Attainment Model on Achievement in Mathematical Concepts of VIII Class Students.

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Abstract

Mathematics is an intellectual subject which helps to develop intellectual powers of the individual. But majority of the students consider it a dreary and dry subject that is due to the lack of clear understanding of the mathematical concepts. Many methods are used by Mathematics teachers to give clear understanding to the students about Mathematical concepts. Concept attainment model is one of them. The present study is an attempt to study the effect of the Concept Attainment Model (CAM) on the achievement of Class VIII students. Experimental Method was used for the purpose. A purposive sample of 80 students was selected from a nearby Senior Secondary School in Abohar. From this sample two groups of 40 students each were formed randomly. One was named as experimental group and other named as controlled group. The experimental group was taught using concept attainment model and control group with traditional method. After that a self-constructed and standardized achievement test was used to assess the achievement of both groups. Mean, Standard deviation and t-test were used for data analysis. A significant difference was found between the mean mathematical concept achievement scores of Class VIII students taught through the traditional method and those taught through the Concept Attainment Model. Also significant difference was found between the mean mathematical concept achievement scores of Class VIII students taught through the traditional method and those taught through the Concept Attainment Model across gender and locality.

KeyWords: Concept, Concept attainment Model, Achievement, Mathematics.

Introduction

Mathematics is taught in schools as compulsory subject. The main aim of teaching Mathematics is not the knowledge but to develop powers of logical reasoning, critical thinking, concentration, attention, observation, imagination, decision making and problem solving. Middle school stage is a stage where shifting starts from concrete concepts to abstract concepts. Therefore, if we want that student understand Mathematics clearly at the latter stages, concept understanding is very necessary at middle stage. Lack of understanding of concept of Mathematics may develop disinterest and fear towards the subject. Use of faulty and routine methods also make the students to develop negative attitude towards Mathematics.To create interest and positive attitude towards the subject Mathematics, teachers are encouraged to use variety of methods which includes students in the teaching and learning process. Concept Attainment Model is one of them. It is a model given by Jerome S.Bruner. This Model is used to give clear understanding of concepts to students. Positive and negative examples related to the concept are presented before the students. They are to analyzed patterns and identify the essential elements of the concepts and then define the concept. Through the process of this method students observe, reflect, reason and become active in the class. Learning of Mathematics highly depends upon concept understanding, so Concept Attainment Model becomes highly suitable for Mathematics. In this model students actively find out the elements of the concept and then define the concepts by themselves.

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How to cite this article:

This procedure gives the clear and long lasting understanding of concepts to the students, thus making the students confident in doing Mathematics. It reduces the anxiety and fear among the students about Mathematics. Class VIII is a stage where shifting starts from concrete concepts to abstract concepts in Mathematics. As students go higher the nature of concepts become more abstract. Therefore concept clarification is must at this stage. So strategies like Concept Attainment Model may be very helpful for improvement and creating interest in Mathematics.

Review of Related Studies

Acharya and Punjabi (2018) revealed that a systematic and organized procedure is adopted in the Concept Attainment Model that helps the student to develop a critical thinking among them. It develops the power to recognize, observe, interpret and compare the elements present in the situation and find the relationship between the elements and understanding the concepts. Praveen (2018) revealed that Concept Attainment Model was more effective than the traditional method for teaching Social Science. Also same results were found for boys and girls showing equally beneficial and effective for both genders.Patel and Trivedi (2020) reviewed a number of studied that were conducted to study the impact of Concept Attainment Model on the achievement of students at different levels for different subjects. They reported that all studies found that achievement of students taught through Concept Attainment Model was significantly higher than those taught through traditional method. Reviewing the results of all studies it was concluded that concept attainment model is an effective instructional strategy for making the concept clarification and understanding among students across different subjects.Herma (2021) found that in the teaching of Mathematics the Concept Attainment Model was more effective than the traditional method. Findings also highlighted no significant difference in the performance of students having high level of achievement whether taught through Concept Attainment Model or by traditional Method.Honmane, Olaifa and Emmanuel (2024) indicated a marked improvement in student performance, demonstrating that the Concept Attainment Model is an effective instructional approach for strengthening mathematical understanding.

Objectives of the Study

1. To design lesson plans using concept attainment model for teaching mathematical concepts to the 8th class students.
2. To construct and standardized achievement test for testing achievement of 8th class students in mathematical concepts.
3. To compare the achievement of 8th classstudents in mathematical concepts with respect to the traditional method of teaching and concept attainment model.
4. To compare the achievement of 8th class students in mathematical concepts with respect to the traditional method of teaching and concept attainment model across gender (boy/girl) and locale (Urban/Rural).

Hypotheses of the Study

1. There exists no significant difference between means of mathematical concept achievement scores of 8th class students when taught by the traditional method and concept attainment model.
2. There exists no significant difference between means of mathematical concept achievement scores of 8th class boys when taught by the traditional method and concept attainment model.
3. There exists no significant difference between means of mathematical concept achievement scores of 8th class girls when taught by the traditional method and concept attainment model.
4. There exists no significant difference between means of mathematical concept achievement scores of 8th class urban students when taught by the traditional method and concept attainment model.
5. There exists no significant difference between means of mathematical concept achievement scores of 8^{th}class rural students when taught by the traditional method and concept attainment model.

Significance of the Study

Mathematics is used in all spheres of our life. Without Mathematics it will not be possible to perform any activity. Mathematics is being taught as compulsory subject at secondary school level. It has been observed that Mathematics is considered as dreary and dry subject and because of poor concepts or lack of understanding of concepts in Mathematics, performance of students in Mathematics is very poor. Present study is an attempt to help the students to understand the importance of concept understanding in Mathematics. It will help the teachers to arouse and maintain the interest of the students in Mathematics. Present study studied the effectiveness of concept attainment model on achievement in Mathematical concepts of 8th class students. The study will help the teachers to understand the importance of Concept attainment model and they will feel necessity to apply the model in the teaching of Mathematics. It will also help the curricular planners to make necessary changes in the Mathematics text book. It will also help the other stakeholders to make improvements in teaching strategies.

Design of the Study

Experimental method of research was used to study the effectiveness of concept attainment model. Method of teaching was the independent variable and achievement in mathematical concepts was the dependent variable. Post-test only design was used. 10 lesson plans on 10 different mathematical concepts were prepared on the basis of traditional

method and concept attainment model each. Experimental group was taught by concept attainment model and control group was taught through traditional method. Post test (achievement test) was administered on both groups after the treatment. t-test was used to test the significance of the difference between means of mathematical concept achievement scores of different groups based on demographical variables- gender (boy/girl) and locale(urban/rural).

Sample

A purposive sample of 80 students of Class VIII was selected from a nearby Senior Secondary School in Abohar, keeping in view the relevant demographic variables. Using the randomization technique, two equivalent groups of 40 students each were formed. These groups were then randomly assigned as the experimental group and the control group.

Tools

Personal Data Sheet: A personal data sheet regarding the information about the name, gender, and locale of the subject was prepared.

Lesson Plans: Ten lesson plans on ten different mathematical concepts of Class VIII were developed by the researchers. The same concepts were taught to the experimental group using the Concept Attainment Model and to the control group using the traditional method of teaching.

Achievement Test: A self-constructed and standardized achievement test in Mathematics for Class VIII was used to measure the achievement scores of students belonging to both the control and experimental groups.

Statistical Techniques

The following statistical techniques were applied for data analysis:

Descriptive Statistics: Descriptive measures such as mean and standard deviation were computed for different groups.

Tests of Normality and Significance: To test the normality of the data Kolmogorov–Smirnov (K–S) test was used. The t-test was used to examine the significance of the difference between the mean scores of the various groups

Delimitations of the Study

1. Only 8th class students from nearby school in Abohar were taken for the study.
2. Only 10 lessons based on concept attainment model were taught to the experimental group.
3. Only self constructed and standardized achievement test in mathematical concepts was used to assess the achievement in mathematical concepts of the 8th class students.
4. Study was confined to the dependent variable achievement in mathematical concepts and independent variable methods of teaching and demographical variables gender (boy/girl) and locale (urban/rural) of students.

Analysis and Interpretation of Data

Testing Of Hypotheses

Hypothesis-1

"There exists no significant difference between means of mathematical concept achievement scores of 8th class students when taught by the traditional method and concept attainment model."

Table-1
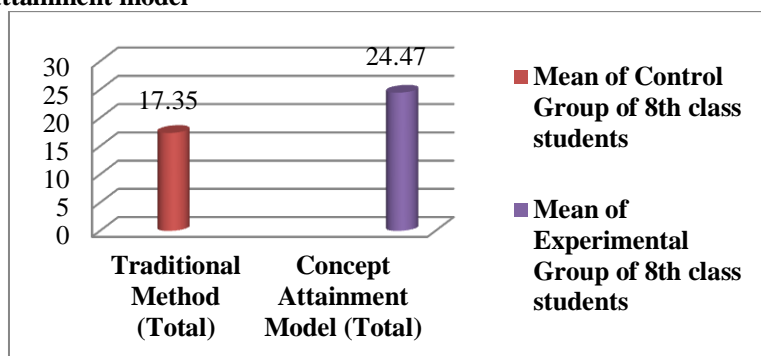**Comparison of Mathematical Concept Achievement Scores of 8th Class Students**

Sr. No.	Group	M	SD	N	SE_D	t-ratio
1	Tradition Method (Total)	17.35	2.02	40		
2	Concept Attainment Model (Total)	24.47	2.95	40	0.56	12.71**

Significant at .01 level of Significance

Table-1 reveals that the t-ratio of the means of mathematical concept achievement scores of 8th class students, when taught using the traditional method and the Concept Attainment Model is, t = 12.71. This value is significantly greater than the critical values (t = 1.96 at 0.05 level and t = 2.58 at 0.01 level). Therefore, it is statistically significant at the 0.01 level of significance. This indicates that the observed difference in the achievement scores is not due to chance.

Thus, the Null Hypothesis -1 is rejected. There exists a significant difference between the mean scores of 8th class students taught through the traditional method and those taught through the Concept Attainment Model. Therefore, It can be concluded that the Concept Attainment Model is significantly more effective in improving the achievement in mathematical concepts among 8th class students.

Figure-1 Means of mathematical concept achievement scores of 8th class students when taught by the traditional method and concept attainment model

Hypothesis-2

"There exists no significant difference between means of mathematical concept achievement scores of 8th class boys when taught by the traditional method and concept attainment model."

Table 2
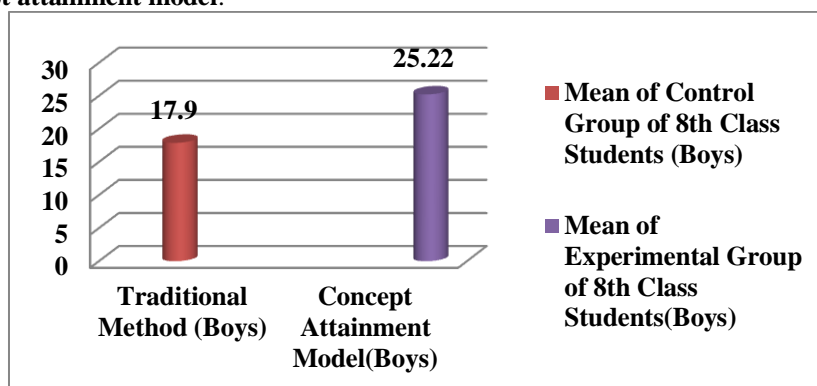**Comparison of Mathematical Concept Achievement Scores of 8th Class Boys**

Sr. No	Group	M	$\Sigma(X-M)^2$	N	df	t-ratio
1	Traditional Method (Boys)	17.90	123.81	21	42	10.51**
2	Concept Attainment Model (Boys)	25.22	99.91	23		

Significant at 0.01 level

Table -2 reveals that the t-ratio of the means of mathematical concept achievement scores of 8th class boys, when taught using the traditional method and the Concept Attainment Model is, t = 10.51**.** This value is significantly greater than the critical table values (t = 2.02 at 0.05 level and t = 2.70 at 0.01 level, with df = 42)**.** Since the computed t-value exceeds the table values, it is statistically significant at the 0.01 level of significance**.** This indicates that the observed difference in achievement is not due to chance**.**

Thus, the Null Hypothesis -2 is rejected**.** There exists a significant difference between the mean scores of 8th class boys taught through the traditional method and those taught through the Concept Attainment Model. Therefore, it can be concluded that the Concept Attainment Model is significantly more effective in improving the achievement in mathematical concepts among 8th class boys.

Figure -2 Means of Mathematical concept achievement scores of 8th class boys when taught by the traditional method and concept attainment model.

Hypothesis-3

"There exists no significant difference between means of mathematical concept achievement scores of 8th class girls when taught by the traditional method and concept attainment model."

Table - 3
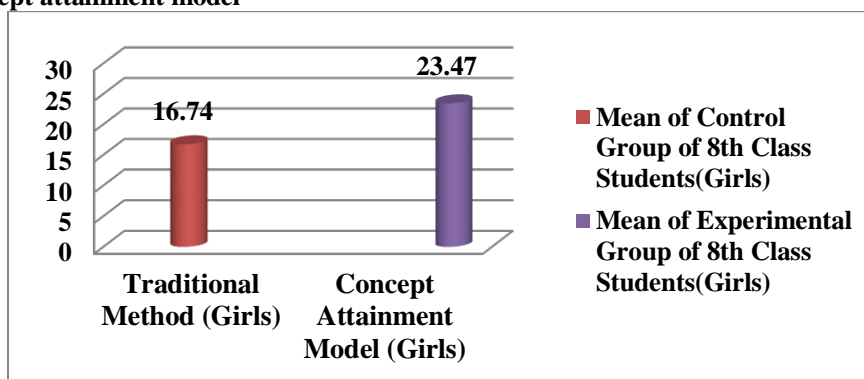**Comparison of Mathematical Concept Achievement Scores of 8th Class Girls**

Sr. No	Group	M	$\Sigma(X-M)^2$	N	df	t-ratio
1	Traditional Method (Girls)	16.74	127.68	19	34	6.33**
2	Concept Attainment Model (Girls)	23.47	218.23	17		

Significant at 0.01 level

Table-3 reveals that the t-ratio of the means of mathematical concept achievement scores of 8th class girls, when taught using the traditional method and the Concept Attainment Model is, t = 6.33. This value is significantly greater than the critical table values (t = 2.03 at 0.05 level and t = 2.72 at 0.01 level, with df = 34). Since the computed t-value exceeds the table values, it is statistically significant at the 0.01 level of significance. This indicates that the observed difference in achievement is not due to chance.

Thus, the Null Hypothesis -3 is rejected. There exists a significant difference between the mean scores of 8th class girls taught through the traditional method and those taught through the Concept Attainment Model. Therefore, it can be concluded that the Concept Attainment Model is significantly more effective in improving the achievement in mathematical concepts among 8th class girls.

Figure -3 Means of Mathematical concept achievement scores of 8th class girls when taught by the traditional method and concept attainment model

Hypothesis-4

"There exists no significant difference between means of mathematical concept achievement scores of 8th class urban students when taught by the traditional method and concept attainment model."

Table - 4
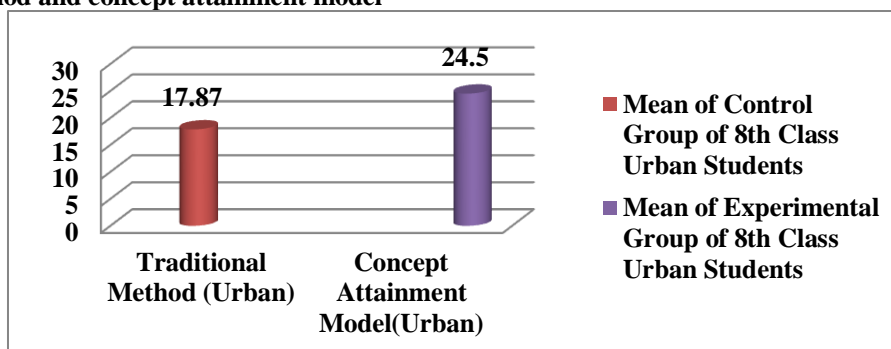**Comparison of Mathematical Concept Achievement Scores of 8th Class Urban Students**

Sr. No	Group	M	$\Sigma(X - M)^2$	N	df	t-ratio
1	Traditional Method (Urban)	17.87	180.62	24	44	7.56**
2	Concept Attainment Model (Urban)	24.5	207.5	22		

Significant at 0.01 level

Table - 4 reveals that the t-ratio of the means of mathematical concept achievement scores of 8th class urban students, when taught using the traditional method and the Concept Attainment Model, is t = 7.56.This value is significantly greater than the critical values from the t-distribution table (t = 2.02 at the 0.05 level and t = 2.69 at the 0.01 level, with df = 44). Since the computed t-value exceeds both critical values, it is statistically significant at the 0.01 level of significance. This indicates that the observed difference in achievement is not due to chance.

Therefore, Null Hypothesis - 4 is rejected. A significant difference exists between the mean scores of 8th class urban students taught through the traditional method and those taught through the Concept Attainment Model. It can thus be concluded that the Concept Attainment Model is significantly more effective in enhancing achievement in mathematical concepts among 8th class urban students.

Figure - 4 Means of Mathematical concept achievement scores of 8th class urban students when taught by the traditional method and concept attainment model

Hypothesis-5

"There exists no significant difference between means of mathematical concept achievement scores of 8th class rural students when taught by the traditional method and concept attainment model."

Table - 5
Comparison of Mathematical Concept Achievement Scores of 8th Class Rural Students

Sr. No	Group	M	$\Sigma(X - M)^2$	N	df	t-ratio
1	Traditional Method (Rural)	16.56	67.9376	16	32	8.99**
2	Concept Attainment Model (Rural)	24.44	140.4448	18		

Table -5 reveals that the t-ratio of the means of mathematical concept achievement scores of 8th class rural students, when taught using the traditional method and the Concept Attainment Model, is t = 8.99. This value is significantly greater than the critical values from the t-distribution table (t = 2.04 at the 0.05 level and t = 2.74 at the 0.01 level, with df = 32). Since the computed t-value exceeds both critical values, it is statistically significant at the 0.01 level of significance. This indicates that the observed difference in achievement is not due to chance.

Therefore, Null Hypothesis-5 is rejected. A significant difference exists between the mean scores of 8th class rural students taught through the traditional method and those taught through the Concept Attainment Model. It can thus be concluded that the Concept Attainment Model is significantly more effective in enhancing achievement in mathematical concepts among 8th class rural students.

Figure - 5 Means of Mathematical concept achievement scores of 8th class rural students when taught by the traditional method and concept attainment model.
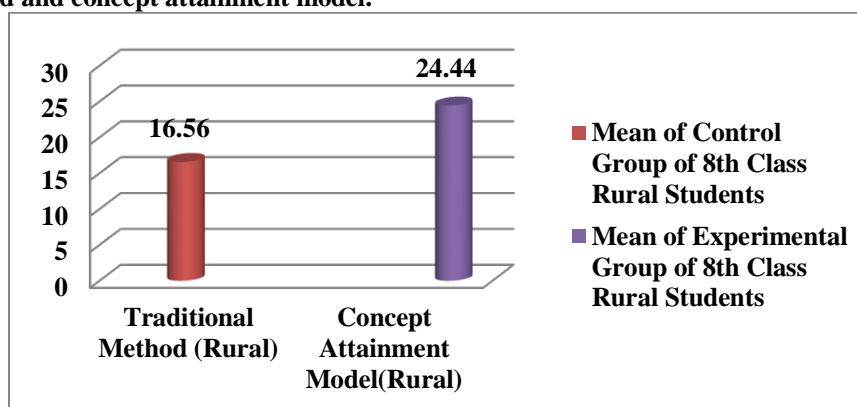
Findings of the Study

1. A significant difference was found between the mean mathematical concept achievement scores of Class VIII students taught through the traditional method and those taught through the Concept Attainment Model.
2. A significant difference was observed between the mean achievement scores of Class VIII boys taught through the traditional method and those taught through the Concept Attainment Model.
3. A significant difference was found between the mean achievement scores of Class VIII girls taught through the traditional method and those taught through the Concept Attainment Model.
4. A significant difference was observed in the mean achievement scores of urban students of Class VIII when taught by the traditional method and the Concept Attainment Model.
5. A significant difference was found in the mean achievement scores of rural students of Class VIII when taught by the traditional method and the Concept Attainment Model.

Educational Implications

Results of the study suggest the following educational implications:

1. Use of CAM in Mathematics Teaching: Results of the study showed significant difference in the achievement of students taught through concept attainment model and traditional method. Mean score of students taught through concept attainment model was higher. It suggests that CAM should be used in the teaching of Mathematics.

2. Training of Teachers in Modern Pedagogies: Results of the study suggests implication of CAM in the teaching of Mathematics. To use CAM properly training should be provided to the teachers. Therefore training workshops should be organised to provide practice session to use CAM.

3. Suitability for Diverse Learners: Results of study showed significant difference between the mean mathematical concept achievement scores of Class VIII students taught through the traditional method and those taught through the Concept Attainment Model for boys, girls, urban and rural. It shows that CAM can be used for in different learning situations and for diverse learners-Boys/Girls, students with diverse background-Rural/Urban.

4. Curriculum and Policy Recommendations: Mathematics curriculum should include methodology based on CAM at different levels of Education.

5. Textbook and Instructional Material Development: Textbook of Mathematics should be written on CAM lines. It should include positive and negative examples for different concepts. Teaching aids should also be developed to give clear understanding about different concepts using CAM.

6. Use for Students of Different Ability Levels: CAM can be used for all type of students by improved positive and negative examples related to the concept. Difficult concept can be taught in a very effective way using enrichment activities.

7. Improvement in Engagement and Motivation: The syntax of CAM ensures the active participation of the students that will enhance the interest and positive attitude towards Mathematics among the student of Mathematics.

Suggestions for Further Studies

1. The effect of Concept Attainment Model on Achievement in Mathematical Concepts of primary school students may be studied
2. The effect of Concept Attainment Model on Achievement in other subjects like Science, language and environmental studies of primary and secondary school students may be studied.
3. The effectiveness of the Concept Attainment Model (CAM) with other instructional strategies- blended learning, Inquiry based learning, project –based learning may be compared.
4. The effect of CAM on diverse students like gifted, backward, slow learners may be studied

Conclusion

It is evident from the results of the study that Concept attainment is more effective than the traditional method in the achievement of class VIII students of Mathematics. Concept attainment model is also proved to be effective for boys, girls, urban and rural students. The syntax of the model helps the student to develop inductive reasoning, to understand concept clearly and to become more active in the class. Therefore concept attainment model should be made an integral part of Mathematical curriculum to improve the teaching and learning of Mathematics.

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