

A Comparison of the Efficacy of Concept Formation Teaching Methods and Traditional Teaching Methods in Science Subject at Secondary Level

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Abstract

The purpose of this research was to find out the existing level of learning for the class X students in Chemistry to find out the effectiveness of concept formation and traditional methods of teaching at secondary level. The nature of the study was experimental in which concept formation method of teaching was compared with traditional method of teaching. A sample of 180 students (90 boys and 90 girls) were selected from four public high schools of boys and girls of district Charsadda (Pakistan). An achievement test was arranged. Pre- test and post- test were used for the collection of data. Each of the experimental and controlled group was taught with concept formation and traditional method of teaching for two months. Pre-test was arranged in the beginning of the experiments. After two months post-test is taken to know the effectiveness of concept formation and traditional methods. To determine the effects of concept formation method of teaching on achievement of Class X students in the subject of Chemistry, the significance of difference between the mean achievement scores of experimental and controlled groups was tested at .05 levels by applying *t* Test. For the analysis of the data it was clear that the current position of learning of the class X students in Chemistry was not up to 50 percent. The experimental group shows better or good result than the controlled group in post-test because of concept formation method of teaching. Hence the ultimate results of the study indicated that concept formation method of teaching was more effective as compared to traditional method. Furthermore, concept formation method of teaching appeared to be more favorable for both boys and girls for the understanding of Chemistry concepts.

Keywords: Pakistan, secondary school level, concept formation, traditional method, and science subject.

Introduction

Teaching is an important technique used by the teacher to transfer information and guideline to the students. It must be a dynamic and planned rather than a static one. Effective teaching is an important guideline to promote the understanding of the students. Several teaching methods have been used time and again to make the teaching process more effective. Like the third world countries Pakistan is also a developing country and the development of our country is based on the quality and quantity of education. To improve the quality of education the instruction inside the classroom must be improved. Teacher is the key factor in this direction. It is believed that skill, knowledge, and teaching methodology which can be used by the teacher can affect the teaching process and improved the learning ability of the students. This is possible only when a suitable method is used by the Teacher. According to Gerges (2000) Concept formation is one of the modern and successful method used for the clarification and understanding of the students' concept. It is an inductive teaching method which helps to form a clear understanding idea and concept through studying a small set of examples of the concept.

Hollyman (2010) Teaching at secondary level is mostly criticized. It is believed that the method of teaching used for the science subject especially for Chemistry is obsolete and cannot clear the concept of the students inside the classroom. Usually the learning process of the students is based on memorization. The teacher is unable to encourage his students to take part in the activities of the classroom. This type of teaching methodology has only one aim as to prepare students just for examination and better grade. The present classroom teaching is based on strict discipline, memorization, fixed and ridged curriculum. The classroom is full of fear, tension, formalities and strict control. The most important of educational system is to find out some new teaching methodologies to facilitate the learning process. It is the responsibility of the class teacher to use an effective teaching method based on thinking and interest rather than memorization and compulsion.

Chand (1999) concluded that the present classroom teaching is based on repetition, compulsion, ridged controlled, tension, fear. It is the general observation that the aim of education is to prepare adult for truth and precision and mental discipline. *Joshi* in (2005) suggested that the teacher creating situation in the classroom in to use the abilities of the students to gets the vital and effective goals of education. Khan (2011) concluded that Concept clarification is based on appropriate teaching method. A method is not merely advice adopt for communicating certain items of information to students. It links the teacher and his pupil into an organic relationship with the constant mutual interaction. The quality of students' life may rise by applying good methods and bad methods may debase it. Good methods play a great role in the development of concepts. Concept formation method is a proper teaching method, used by the teacher to transfer information to the students. It allows simplification and the expansion of knowledge from known objects to

unknown. Examples are provided from the events, things, and process to make a link between the teacher and the students. Thus, concept must be formed at the initial stage to find out the solution of the problem. Thus, it is the need of the situations to find out new method or techniques in addition of the traditional teaching method for the clarification of students' concept.

Research Objectives

1. To know the level of understanding and concept formation of students in Chemistry at secondary level.
2. To know the effect of concept formation method of teaching in Chemistry at secondary level.
3. To find out the difference of the academic achievements of the students when taught by concept formation and traditional teaching method.

Hypotheses

1. The existing level of understanding of concept in Chemistry at secondary level students is not satisfactory.
2. The position of understanding of the controlled group students in Chemistry at secondary level is not satisfactory.
3. The achievement scores in pre-test of developmental and controlled group is different.
4. The achievement score in post-test of controlled group are different through traditional teaching method.
5. The achievement scores in post-test of the experimental group are different through concept formation method of teaching.

Literature Review

Caey in (2001) write an article on conceptual change in science education. The article was based on the learning of science and math in which strategies were described to show the effects of conceptual changes necessary for the learning of the students. From the study it is conclude that conceptual change shows successful results for the average students.

Mikkila (2002) conducted study on the topic of photosynthesis for the 5th class students. The students were motivated through conceptual changes statistically show better result than the traditional group schoolboys.

Johnson and Alibali in (2002) find out a relationship in conceptual development and mathematical procedure skill. The result finds out show that conceptual change is important in the procedural skill for mathematics.

Howson and Howson (2004) through an article show` the effect of teaching by using student's earlier knowledge and the strategies for the conceptual change in the learning of science. The study was basically conducted for the effect of alternate conceptual change toward scientific concept. The students show a significant improvement in the achievement of scientific concept with the help of teaching strategies and the use of related learning materials. Johnson and Cook (2003) find out through a research the development of perversion path of concept. They concluded that teacher first develop the concept of the students before teaching of any subject.

The research of the Azizoglu (2005) in the field of Chemistry related to the topic of equilibrium for the misconception of the students learning power. She fined that learning power of the students is increased if suitable questions are asked from the students related to the topic. She concluded that if the existing concept of the students in promoted to a new concept the learning power can be increase in a satisfactory manner.

Narsessian in (2005) find out with the help of a paper the conceptual development in science education. Through evidence it was find out the traditional method of teaching is not satisfactory for the conceptual development. In this paper stressed were given on the formation of fresh concept for the achievement of knowledge.

Geban (2005) conducted a research on acid-base in the subject of Chemistry. The research was conducted for the class 10th students to promote the conceptual development and the textbook oriented teaching accompanied with resemblance. They find out through research work that conceptual changes are a process of the replacement of the old concept followed by the addition of new materials in learning process of the students. The conceptual changes materials should be arranged in such a way to motivate the students for better understanding. From the research it was concluded that results of the experimental group were through conceptual changes than the results of the controlled group through traditional teaching methodologies.

The working group of Institute of Max Plank and Haifa (2007) in Berlin find out through a research that how the understanding of the students can be revised, shifted and gained with the help of concept formation teaching methodology. According to these researchers there is a link in the gain, shift and the revision of knowledge.

Onder (2005) concluded through a research through conceptual development for the class 10th students on the topic of the equilibrium in the solubility in the subject of Chemistry. From the study it was clear that results of the experimental group students were better through conceptual changes then the results of the traditional group students.

Howson (2007) put forward his research proposal for the conceptual change in the subject of Physics. From the result obtained it was concluded that transfer of knowledge through conceptual development is an effective mean in teaching learning process.

Bisbey (2007) concluded that concept development is an important cognitive agent where transfer of knowledge related to the example of objects and events in the daily life.

Baser (2007) arrange a research for the understanding heat and temperature for the grade 2 primary school students. Two groups of the students such as experimental and controlled group were selected. From the results obtained it was clear that score obtained were considerably higher than the score of the controlled group students.

Revenscoft (2008) through an article showed the promotion of conceptual changes and thinking power of the students in digital discussion game. The review of this paper was a dialogue based research in the past 10 year's conclusions of conceptual changes and dialogue in the digital game.

The paper of Atilla (2008) base on the effective teaching of science and presented six principles for the teaching of science effectively like encouraging the students, dealing with students, promoting the concept, how to apply the new concept and skill, feedback from the teacher, cooperative learning.

Vosniadon (2008) presented a paper on the conceptual changes in education. He concluded that for effective learning and conceptual changes students are not relied only memorization process. Students must learn how to construct a new concept base on the daily life examples and experience. Conceptual changes are only possible when the teacher used a systematic method of teaching. Teacher first creates an effective social environment of the classroom which helps and motivates the students for the learning process.

Pecina (2009) concluded through a research the indication and assessment of fundamental teaching procedures needed for the encouragement of conceptual changes of the students. They find out significant learning of Physics, it is needed that the teacher find out alternate concept which help the students to overcome the difficulties that arise in the formation of an effective concept.

Boumova Viera (2009) conducted a research study on traditional vs. modern teaching methods' advantages and disadvantages. From the study it was concluded that how to modify the concepts of the students in learning of language through traditional and modern methodology.

Pinarba (2010) perform research for the promoting of conceptual development on the topic of chemical equilibrium. He found that when conceptual development student shows significant results than the students of the traditional teaching method. The result of the students having better conceptual changes have better results in the learning of chemical equilibrium.

Ozmen (2010) concluded through an article the importance of conceptual development in computer animation for class 11th students. Student having better conceptual development shows significantly higher results in the computer animation.

Muhammad and Pardhan conducted research and published a paper in (2006) on conceptual understanding of the students in science and mathematics. With the help of this paper they find out that for the teaching of science and mathematics the skill of the teacher and their novel teaching are very important. The teacher first developed a conceptual understanding of the students through question answer technique and thinking ability to answer the questions.

Rahman and Zaidi (2008) conducted a paper on the study of chemical education in Pakistan. They highlight the curriculum of Chemistry of class XI and X and the contents included the curriculum. Four periods are allowed within a week with time duration of 40 minutes. Eight months average working session within one year which is about 128 periods for the teaching is available. Stressed were given on the problem solving method of teaching and the used concept formation skill methodology in the teaching learning of Chemistry.

Awan (2010) find out through a research the misconception of the students and Meta cognitive effect upon the student's achievement. From the results obtained it was clear that students having refined conceptual changes shows better results about atom, molecules, and matter.

Ammna (2011) Conduct a research upon concept formation and its importance over the traditional teaching method in Chemistry for class X students at secondary level. From the results it was clear that student of the experimental group when taught through concept formation method of teaching show significantly better results than students of the controlled group through traditional method of teaching.

Besides these research works, more struggle is needed in the form of research to find out more effective methods and the importance of concept formation and traditional method of teaching to motivate students for better understanding and achievement at secondary level.

Procedure of the Study

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The researcher selected two group of class X randomly from the selected public high schools for boys and girls of district Charsadda. One group named as experimental group select for the concept formation method of teaching. Second group named as controlled group select for traditional method of teaching. The teacher select for the teaching of both groups were the same qualification and experience such as Postgraduate degree in Chemistry, M.Ed., and 4 to 5 years of teaching experience. The teachers of both experimental and controlled group students taught the same topic in the same time-period duration of 40 minutes. The researcher taught the Chemistry itself to the experimental group through concept formation teaching method. The teaching material used from the chapter 10 to 12 of the Chemistry textbook for class X of Khyber Pukhtoonkhwa Textbook Board.

Before starting experimental teaching, a pre-test was arranged for both experimental and controlled group students to find out the position of learning of the students' concept in the learning of Chemistry. The research study was continued for about two months. Each Monday was selected for the test in the lesson studied earlier. Every fourth Monday was selected for monthly test in which all the learned course lessons during one month were included. The weekly and monthly test were components of direct teaching method. All the remaining five days per week, the students were busy in teaching-learning process of concept formation method of teaching.

At the end of the experimental research the pre-test was again arranged as post-test, both for the experimental and controlled group students to know the results of concept formation and traditional method of teaching.

One section of the class X was selected randomly by the researcher as experimental group for the teaching group of Chemistry with the help of Concept formation method of teaching. Another group was named as controlled group which was taught by their schoolteacher. Qualification and experience of both the experimental and controlled group teachers were the same such as Postgraduate degree holders of Chemistry and M.Ed. with 6 to 7 years of teaching experience. The teacher of the experimental and controlled group students taught the same topic with same period of duration of 40 minutes according to the school timetable. The experimental process was observed and proceed for two months.

Research Tools

The following two research tools were used by the researcher for the collection of data:

1. An achievement test used by the researcher to know the current position of understanding of the Class X students in Chemistry. The conducted test was consisted of 40 multiple choices questions (MCQs). The (MCQs) were selected from the General Science Book of class VI, VII and VIII and Chemistry Book for class X of KPK

Textbook Board. The Achievement test was arranged for 120 students of four public High Schools for Boys and Girls in district Charsadda.

2. A pre-test was set in Chemistry to know the level of knowledge of the class X students. The test was consisting of 40 Multiple Choice Questions (MCQs) from Chapter 9, 10 and 11 in the Chemistry of class X of KPK Textbook Board Peshawar. The pre-test was arranged for about 100 students of Controlled groups and 100 students of experimental group students of Class X of four selected Public High Schools for Boys and Girls in district Charsadda.

Variables of the Study

The following are the variables for the research study these are

1. Independent variables: concept formation and traditional method of teaching are the independent variables.
2. Dependent Variables: the test score achievement of the students in their pre-test and post-test are the dependent variables.
3. Controlled Variables: the class duration and timetable of the class are the controlled variables.
4. Uncontrolled Variables: the preceding knowledge of the students I.Q level of the students, the earlier achievement of the students, family background, educational background, attitude, interest and nervousness are the uncontrolled variables.

Data Analysis

The following statistical processes were used for the calculation of data obtained through test instruments,

1. Standard deviation and mean were the statistical terms used for the calculation of the test score of understanding level for the class X students in Chemistry (formulas for means, variance, standard deviation and t-test see paper any)
2. Similarly, standard deviation and mean were also used for the calculation of test score of the experimental and controlled group students in their pre-test and post-test in Chemistry for boys and girls of class X.
3. The t-test was used for the calculation to find out the difference of the mean test achievements score in pre-test and post-test of the experimental and controlled group students of class X.

STATEMENT		N	\bar{X}	SD
1	Standard deviation and mean achievement score for male in Chemistry	60	15.33	9.47

2	Standard deviation and mean achievement score for female in Chemistry	60	14.66	9.53
3	Test achievement score of the controlled group in their pre-test for school I.	22	15.5	9.77
4	Test achievement score of the controlled group in their pre-test for school II.	23	17.67	11.01
5	Test achievement score of the controlled group in their pre-test for school III	22	15.5	9.77
6	Test achievement score of the controlled group in their pre-test for school IV.	24	17.67	11.01
7	Difference in the standard deviation and mean score of the experimental controlled group students in their pre-test for school I	22	16.40	10.87
		23	17.54	11.83
8	Difference in the standard deviation and mean score for the experimental and controlled group students in pre-test of school II.	22	16.79	10.74
		23	16.80	10.75
9	Difference in the standard deviation and mean score for the experimental and controlled group students in pre-test of school III	23	15.95	10.69
		22	15.54	9.77
10	Difference in the standard deviation and mean score for the experimental and controlled group students in pre-test of school IV	22	17.67	10.20
		24	17.54	11.01
11	Test achievement score of the controlled group in their post- test for School I	23	18.10	11.51
12	Test achievement score of the controlled group in their post-test for school II	22	18.02	11.56
13	Test achievement score of the controlled group in their post-test for School III	22	15.95	10.64
14	Test achievement score of the controlled group in their post-test school IV	23	18.10	11.12
15	Test achievement score of the experimental group in their post-test for school I	22	25.5	10.87

16	Test achievement score of the experimental group in their post-test for school II.	22	23.68	11.14
17	Test achievement score of the experimental group in their post-test for school III	23	23.32	11.00
18	Test achievement score of the experimental group in their post-test for school IV	24	23.83	9.48
19	A comparison of the experimental and controlled group in the attainment of their post-test and pre-test score for school I	22	25.5	10.87
		23	17.54	11.01
20	A comparison of the experimental and controlled group in the achievement of their post-test and pre-test score for school III	22	23.68	11.13
		23	16.80	11.01
21	A comparison of the experimental and controlled group in the achievement of their post-test and pre-test score for school III	24	23.32	11.00
		22	15.5	9.77
22	A comparison of the experimental and controlled group in the achievement if their post-test and pre- test score for school IV	23	23.83	9.48
		23	17.67	11.01
23	A comparison of the experimental and controlled group in the achievement of their post-test score for school I	22	25.5	10.87
		23	18.10	11.51
24	A comparison of the experimental and controlled group in the achievement of their post-test score for school II	22	23.68	11.13
		23	18.02	11.56
25	A comparison of the experimental and controlled group in the achievement of their post test scores for school III	22	23.32	11.00
		23	15.95	10.64
26	A comparison of the experimental and controlled group in the achievement of their post-test for school IV	24	23.83	9.48
		23	18.02	11.12

The mean score for boys is 9.47 and 15.33 and for girls are 9.53 and 14.66 which shows that the learning of chemistry level is less than 50% for both boys and girls students which is not satisfactory. Result of item 3 shows that the mean score of the controlled group is 9.77 and 15.5 respectively which is not encouraging and below satisfactory level while the other school result

mean values are 11.01 and 17.67 which is nearly the same unsatisfactory as that of the previous group. Test achievement for controlled group in pre-test for school iii was 9.77 and 15.5 respectively which indicate that the performance of the learners was not satisfactory. School vi data revealed the mean score 11.01 and 11.67 which was the same below standard score. Item 8 result indicated that the SD of the experimental group was 10.74 and 10.75, respectively. Mean was 16.79 and 10.75 respectively and the differences of the mean were less than 0.05 level which is non-significant. Item 9 result shows that SD for the experimental and controlled groups were 10.69 and 9.77 and mean values are 15.95 and 15.54 respectively for the experimental and controlled groups. Hence the difference of the two means was less than 0.05, non-significant. The standard deviation score for the experimental and controlled groups for item 10 were 10.20 and 10.01 respectively. While mean of the experimental group is 17.67 and controlled group is 17.54. The difference is less than 0.05 which is non-significant. The item 11 shows that standard deviation and mean achievement score for the controlled group in their posttest through traditional teaching method were 11.51 and 18.10 respectively. The item 12 indicates that S.D and mean value for the controlled group in their post-test through traditional teaching method were 11.56 and 18.02 respectively. Item 13 shows that S.D and mean value score for the controlled group in their post-test through traditional teaching method were 10.64 and 15.95. Item 14 show that standard deviation and mean value for the controlled group in their post-test through traditional teaching method were 11.12 and 18.10. Item 15 shows that standard deviation and mean value for the experimental group in their post-test through concept formation teaching concept formation teaching method were 10.87 and 25.5. Item 16 results that S.D and mean value for the same group is 11.14 and 23.68. Item 17 results that S.D and mean achievement score were 11.00 and 23.32. Item 18 results that S.D and mean value for the experimental group in their post-test through concept formation teaching method were 9.48 and 23.83. Item 19 results that the mean test score of the experimental group in their post-test is 25.5 and controlled group in their pre-test is 17.54. Item 20 show that the mean value of the experimental group in their post rest is 23.68 and controlled group in their pre -test is 16.80. Item 21 shows that the mean value for the experimental group is 23.32 and controlled group 15.5. Item 22 show that the mean value of the experimental group in their post- test is 23.83 and controlled group in their pre- test is 17.67. Item 23 show that the mean value of the experimental group in their post- test is 25.5 and controlled group in their pre- test is 18.10. Item 24 indicate that the mean value of the experimental group in their post- test is 23.68 and controlled group in their pre-test is 18.02. Item 25 indicate that the mean test value of the experimental group in their post -test is 23.83 and controlled group in their pre- test is 15.95. Item 26 that the mean value of the experimental group in their post- test is 23.83 and controlled group in their pre- test is 18. 02.

Discussion

The aim of this research study was to find out the position of understanding of the class 10th students in Chemistry with the help of concept formation and traditional teaching method. This research work supports the research study of the *Goodhew, Hayes, Gillan* in 2003, the study of *Atilla* 2007, *Awan* 2010 and *Ammna* 2012. From their statistical calculation, they found that the present position of understanding of the class X students in Chemistry is not satisfactory. Most of the students find Chemistry as a difficult subject as compared to other science subject. They do not know about the concept of basic definition in Chemistry. Concept bearing teaching is the main factor for the successful understanding in Chemistry which requires experiences and more effort in part of the teacher to teach Chemistry to the students at secondary level. It is the responsibility of a teacher to utilize the preceding knowledge of the students to clarification of the concepts. This research study also supports the research work of the *Picina* and *Susac* in 2008. They found that teacher should stress on the conceptual changes in Science subjects and especially in Chemistry. The finding of the research of the *Azizoglu* in 2005 indicates that teacher student's interaction through questions inside in the classroom play a pivotal role in the process of learning. The current study of this research is related with the finding that suitable method which clarifies the students' concept make the learning process mere easy. In concept formation teaching method opportunities are provides to the students through question asking and discussion to clarify their concept. This method cause difference in the test score of the controlled and experimental group students. Differences existed in the concepts of the controlled group students and experimental group students. The students of the controlled group students face some difficulties in the explanation of the concept. The experimental group student uses their previous knowledge for the clarification of the concepts.

The present research study is also similar with the finding of the research study of the *Cimer, Jakson* and *Porter* 2004. According to their studies if the early mistakes of the students are not controlled in the initial stages than the students are habitual of these mistakes. Teacher through proper evaluation and monitoring can rooted out the mistakes to increase the understanding of the students. The finding of the *Ammna Saleem Khan* in 2011 proved with the help of research, the effectiveness of concept formation method of teaching and its importance over the traditional method of teaching in Chemistry at secondary level. According to *Ammna Saleem* when the teacher teach to the experimental group with the help of concept formation method of teaching the concept of the students is clear and their achievement in the post test is increased as compared to the controlled group students as taught by their school teacher through traditional teaching method. The research study also supports the finding of the *Salami* and *Baser* in 2006. According to *these* research studies there is no significant difference in the attainment of the male and female students in Chemistry subject. The study supports the work of the *Hewson* and *Nersessian* in 2006. The results of their studies show that with the help of concept formation methodology of teaching the old ideas of the students can be molded in to new and improves ideas. From the results of the pre-

test and post-test they proved that concept formation method is helpful to modify the concept of the students.

The current research study indicates that the present position of understanding in Chemistry of the class X students is not satisfactory which is clear from the data of the controlled group. Concept formation teaching method improved the performance of the students as the data obtained from the experimental Group in their post-test.

Summary

The main purpose of this research study was to find a solution to the criticism against the method of teaching and position of understanding of the students in Chemistry at secondary level. Concept formation and traditional method of teaching was used to teach Chemistry to the class X students of the secondary level. Weaknesses of the students were found through proper evaluation of the students with the effectiveness of concept formation and traditional method of teaching.

Two tests were developed for the collection of data to prove the hypothesis. These tests were:

1. For the measurement of understanding of the students in Chemistry the test was developed known as achievement test. The test consists of 40 multiple choice questions (MCQs) which were selected from the General Science book of class VI, VII, VIII and chapter 10 from the Chemistry book of KPK Textbook Board. The achievement test was developed for the purpose to know the knowledge, understanding and application level of students in the class X in Chemistry at secondary level. The achievement test given to about 120 students.

2. Pre-test was arranged in Chemistry of class X for the Measurement of understanding and knowledge of the class X students at secondary level. The pre-test was consisting of 40 multiple choice questions MCQs selected from chapter 10, 11 and 12 of the Chemistry books by KPK Textbook Board.

3. Pretest was then given to the experimental Group as post-test to know the effect of concept formation and traditional teaching method of the class X students at secondary level.

Lesson plans for the concept formation teaching method was developed in chapter 10 and 12 of the Chemistry Book of KPK Textbook Board. The format of the lesson plans was derived from the instruction of Mc Vittie (2002). The expert in Chemistry and education checked and then approved the lesson Plans. The teacher of the traditional group also developed the lesson plans in the same chapter as for the concept formation method through the format of *Herbartain* steps.

After collecting of data with the help of achievement tests, statistical methods like standard deviation and t-test were for the analysis of tests data.

4. The position of the mean of the experimental group in their post-test through concept formation method of teaching for school I school III and school IV. From the values it is clear that all means of the four public high schools for male and female was greater than 50 percent and position of learning of the experimental group through concept formation method of teaching is better than the performance of the controlled group and satisfactory. So HO5 accepted.

5. A comparison of the pre-test score of the controlled group and post test score of the experimental group with the help of t-test, the values obtained for school I school II school IV. These values are greater than the table t-values at 0.05 in significance. From the result it is clear that attainment score of the experimental and controlled groups in their pre-test and post was different and performance of the experimental group is better than controlled group.

6. A comparison of the post test score of the experimental and controlled group with the help of t-test, the values obtained for school I School II school I and School VI. These values are greater than the table t value at 0.05 and significance. From the results it is clear that attainment score of the experimental group is better than the controlled group.

Conclusions

Based on the findings of the research study the conclusions were made are as follows:

1. From the results it became clear that the existing level of understanding of the students in Chemistry was not satisfactory and weak. Most of the students have not a successful position in Chemistry and ratio of failure is greater. On the other hand, the results of the concept formation method of teaching is very successful and the teacher developed clear understanding of the students.
2. The current position of learning of both male and female are less than 50 percent, which is not satisfactory.
3. The attainment test score of the controlled and experimental groups of four selected public high schools for male and female is different in their pre-test.
4. The performance of the experimental groups of four selected public high schools for male and female were better in their post-test.

5. The performance of the experimental groups of four selected public high schools for male and female were better in their post- test than their pre-test.
6. The performance of the controlled groups of schools I and II for females were better in their post-test than their pre-test.
7. Better academic attainments of the experimental group of class X in Chemistry for male and female students were related to concept formation method of teaching.
8. The attainments test score of the score of the female students of the controlled and experimental groups of four selected public high schools were better than male students.
9. The performance of the male and female students of the experimental group was the same in their post-test.
10. The effects of the concept formation method of teaching were satisfactory for the entire experimental group.
11. Test score of the experimental groups for male and female students considerably superior to the controlled group students of four selected public high schools.

Recommendations

1. Concept formation is more successful than traditional method of teaching for the clarification of the student's concept in Chemistry. Teacher used the concept formation to increase the academic attainment of the learners. It enhances the learning ability of the students by adding new knowledge into a fresh concept.
2. Concept formation method of teaching is helpful to change the old and traditional setting inside in the classroom where the students used their own knowledge to resolve their own problems.
3. Concept formation method of teaching is helpful to change the concept of the students, these changes reinforce the concept. Conceptual modification helpful in the formation of composite concept.
4. Teacher used important techniques during the demonstration of lecture. Interesting materials must be included to preserve the interest of the students and increased the learning process.
5. The old and obsolete methods for assigning of homework must be avoided. Comprehensive and concept formed method must be used for the process of evaluation of the students.

6. The results of this research study are a guideline for the policy maker to provide training to teacher based on concept formation method of teaching.
7. The research study recommended concept formation method for Chemistry and other science subjects at secondary and higher levels.

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