CHAPTER 6

CONCLUSIONS AND SUGGESTIONS
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This chapter is meant for presenting the conclusions and suggestions derived from the study. The chapter concludes with the recommendations based on the findings of the study and suggestions for further research. The details are given under appropriate heads:

6 CONCLUSIONS AND SUGGESTIONS

The conclusions that have emerged from the present study are summarized under appropriate heads:

6.1 ERROR ANALYSIS

6.1.1 ERROR SCORES OF STUDENTS (TOTAL LEARNING POINTS)

Analysis of Error Scores of students (based on total learning points) revealed that students committed errors in all the learning points selected for Diagnostic test. Majority of students committed errors in identifying the change in atomic size along a period and minimum number of students committed errors in recalling the Molecular formula of water.
6.1.2 ERROR ANALYSIS (TOPIC-WISE)

Analysis of average error scores of students (based on selected topics) revealed that students committed errors in all learning points included under the following topics: Periodic Table, Atomic Structure, Oxidation and Reduction, Chemical bonding, Acids and bases Language of Chemistry and Physical and Chemical Changes. Maximum number of students committed errors in learning points selected from Periodic Table and Minimum number of students committed errors on Physical and chemical changes.

6.1.2.1 ERROR ANALYSIS (LEARNING POINT-WISE)

(1) Periodic Table

Analysis of error scores of students (based on learning points) on the Topic Periodic Table revealed that students committed errors in all the learning points included under the topic Periodic Table (in identifying the atomic size along a period, size of an atom and its ion, recalling the concept of Transition Elements, identifying the change in atomic size down the Group, Identifying the change in Electronegativity down the Group, recalling the concept of Period, identifying the relation between Group number
and number of valence electrons, citing the noble metals, recalling the concept of Group, identifying the most reactive nonmetal, recalling the Modern periodic Law, identifying the position of Hydrogen in the Periodic Table, Electropositive nature of metals and recalling the most electronegative element). Maximum number of students committed errors in identifying the change in atomic number along a period and minimum number of students committed errors in recalling the most electro negative element.

(2) Atomic Structure

Analysis of error scores of students (based on learning points) on the Topic Atomic Structure revealed that students committed errors in all the learning points included under the topic Atomic Structure (recalling the formula for finding out the number of electrons in any orbit, the atomicity of Hydrogen, concept of mass number, elements, isotopes, atomic number, nucleons and citing allotropic forms of Carbon). Maximum number of students committed errors in recalling the formula for finding out the number of electrons in any orbit and minimum number of students committed errors in citing allotropic forms of Carbon.
(3) Oxidation and Reduction

Analysis of error scores of students (based on learning points) on the Topic Oxidation and Reduction revealed that students committed errors in all the learning points included under the topic Oxidation and Reduction (identifying the relation between oxidation number and oxidising agent, recalling the oxidation state of Oxygen, concept of oxidation, identifying the relation between valency and oxidation state and determining the oxidation state of an element in a compound). Maximum number of students committed errors in identifying the relation between oxidation number and oxidising agent and minimum number of students committed errors in determining the oxidation state of an element in a compound.

(4) Chemical Bonding

Analysis of error scores of students (based on learning points) on the Topic Chemical Bonding revealed that students committed errors in all the learning points included under the topic Chemical Bonding (identifying the formation of anion, chemical bond positive ion(cation), Nitrogen molecule, ionic compounds and polar compounds). Maximum number of students committed
errors in identifying the formation of anion and minimum number of students committed errors in the formation of polar compounds.

(5) Acids and Bases

Analysis of error scores of students (based on learning points) on the Topic Acids and Bases revealed that students committed errors in all the learning points included under the topic Acids and Bases (identifying the gas liberated when metals are treated with acids, basicity of acids, concept of alkalies, relation between basicity and number of replaceable Hydrogen atoms, comparing oxy and non-oxy acids and number of replaceable Hydrogen atoms).

Maximum number of students committed errors in identifying the gas liberated when metals are treated with acids and minimum number of students committed errors in identifying the number of replaceable Hydrogen atoms.

(6) Language of Chemistry

Analysis of error scores of students (based on learning points) on the Topic Language of Chemistry revealed that students committed errors in all the learning points included under the topic Language of Chemistry (identifying relation between valency and valence electrons, Law of conservation of mass, valency of halogens, molecular formula of Sulphurhexa fluoride, valency of
Sodium and chemical formula of water). Maximum number of students committed errors in identifying the relation between valency and valence electrons and minimum number of students committed errors in recalling the chemical formula of water.

(7) Physical and Chemical Changes

Analysis of error scores of students (based on learning points) on the Topic Physical and Chemical Changes revealed that students committed errors in all the learning points included under the topic Physical and Chemical Changes (recalling the concepts of compound, alloy, chemical change physical change and reactants). Maximum number of students committed errors in recalling the concepts of compound and minimum number of students committed errors in recalling the concept of reactants.

6.2 COMPARISON OF IMMEDIATE POST-TEST ACHIEVEMENT SCORES OF REMEDIAL TEACHING GROUP, SELF LEARNING GROUP AND LECTURE METHOD GROUP (TOTAL SAMPLE)

Comparison of overall mean scores (based on the total sample) of the Treatment Groups (Remedial Teaching Group-RT, Self Learning Group-SL and Lecture Method Group-LM) on Immediate Post-test
Achievement in Chemistry revealed that Remedial Teaching Group is significantly superior to Self Learning Group and Lecture Method Group in terms of Immediate Post-test Achievement. Difference in achievement can be attributed to the influence of Remedial Teaching (using Remedial Teaching Materials prepared by the investigator).

Comparison of the overall mean scores (based on the Total sample) of the Treatment Groups (Self Learning Group-SL and Lecture Method Group-LM) on Immediate Post-test Achievement in Chemistry revealed that Lecture Method Group is significantly superior to Self Learning Group in terms of Immediate post-test Achievement.

6.3 COMPARISON OF DELAYED MEMORY ACHIEVEMENT SCORES OF REMEDIAL TEACHING GROUP, SELF LEARNING GROUP AND LECTURE METHOD GROUP (TOTAL SAMPLE)

Comparison of overall mean scores (based on the total sample) of the Treatment Groups (Remedial Teaching Group-RT, Self Learning Group-SL and Lecture Method Group-LM) on Delayed Memory Achievement scores in Chemistry revealed that Remedial Teaching Group is significantly superior to Self Learning
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Group and Lecture Method Group in terms of Delayed memory Achievement. Difference in achievement can be attributed to the influence of Remedial Teaching (using Remedial Teaching Materials prepared by the investigator).

Comparison of the overall mean scores (based on the Total sample) of the Treatment Groups (Self Learning Group-SL and Lecture Method Group-LM) on Delayed Memory Achievement in Chemistry revealed that Self Learning Group (SL) is significantly superior to Lecture Method Group (LM) in terms of Delayed Memory Achievement. Difference in achievement can be attributed to the influence of Remedial Teaching (using Remedial Teaching Materials prepared by the investigator).

6.4 COMPARISON OF EXTENT OF FORGETTING SCORES OF REMEDIAL TEACHING GROUP, SELF LEARNING GROUP AND LECTURE METHOD GROUP (TOTAL SAMPLE)

Comparison of overall mean scores (based on the total sample) of the Treatment Groups (Remedial Teaching Group-RT, Self Learning Group-SL and Lecture Method Group-LM) on Extent of Forgetting scores revealed that Remedial Teaching Group is significantly superior to Self Learning Group and Lecture Method Group in terms of Retention Power. Difference in
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achievement can be attributed to the influence of Remedial Teaching (using Remedial Teaching Materials prepared by the investigator)

Comparison of the overall mean scores (based on the Total sample) of the Treatment Groups (Self Learning Group-SL and Lecture Method Group-LM) on Extent of Forgetting Scores revealed that Self Learning Group (SL) is significantly superior to Lecture Method Group(LM) in terms of Retention Power. This can be attributed to the influence of Remedial Teaching by the teacher using Remedial Teaching Materials (prepared by the investigator)

6.5 COMPARISON OF THE IMMEDIATE POST-TEST ACHIEVEMENT SCORES OF REMEDIAL TEACHING GROUP (SUB SAMPLES)

Comparison or the mean scores of the sub samples of Remedial Teaching Group (Immediate Post-test Achievement Scores in Chemistry) revealed that there is no significant difference between the Boys and Girls, students belonging to Urban and Rural areas, Government and Private school students, students belonging to High and Low Educational status and English and Malayalam Medium students with regard to
Immediate Post-test Achievement, when the Groups were exposed to Remedial Teaching using Remedial Teaching Materials.

6.6 COMPARISON OF DELAYED MEMORY ACHIEVEMENT SCORES OF REMEDIAL TEACHING GROUP (SUB SAMPLES)

Comparison of the mean scores of the sub samples of Remedial Teaching Group (Delayed Memory Achievement Scores in Chemistry) revealed that there is no significant difference between the Boys and Girls, students belonging to Urban and Rural areas, Government and Private school students, students belonging to High and Low Educational status and English and Malayalam Medium students with regard to Delayed Memory Achievement, when the Groups were exposed to Remedial Teaching using Remedial Teaching Materials.

6.7 AVAILABILITY OF RESOURCES FOR REMEDIAL TEACHING IN CHEMISTRY

Ratings of the Experts and Secondary School Chemistry Teachers regarding the Availability of the Remedial Teaching Materials for teaching Chemistry on the Topics Periodic Table, Atomic Structure and Oxidation and Reduction (prepared by the investigator) revealed that majority of Experts and Teachers
reported that resources are not available for Remedial Teaching in Chemistry. The above mentioned findings highlight the need for providing suitable resources for teaching Chemistry. There is no significant difference between the responses of Experts and Teachers regarding the Availability of Resources.

6.8 SUITABILITY OF THE REMEDIAL TEACHING MATERIALS

Ratings of the Experts and Secondary School Chemistry Teachers regarding the Suitability of the Remedial Teaching Materials in Chemistry (Periodic Table, Atomic Structure and Oxidation and Reduction) revealed that majority of Experts and Teachers reported that Remedial Teaching Materials (prepared by the investigator) are suitable to a great extent for teaching the above mentioned topics. There is no significant difference between the responses of Experts and Teachers regarding the Suitability of Resources.

6.8 PRACTICABILITY OF THE REMEDIAL TEACHING MATERIALS

Ratings of the Experts and Secondary School Chemistry Teachers regarding the Practicability of the Remedial Teaching Materials in Chemistry (Periodic Table, Atomic Structure and
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Oxidation and Reduction) revealed that majority of Experts and Teachers reported that Remedial Teaching Materials (prepared by the investigator) are practicable to a great extent for teaching the above mentioned topics. There is no significant difference between the responses of Experts and Teachers regarding the Practicability of Resources.

6.9 NECESSITY OF THE REMEDIAL TEACHING IN CHEMISTRY FOR EDUCATIONALLY BACKWARD STUDENTS AT SECONDARY SCHOOL LEVEL

Analysis of responses of Experts and Secondary School Chemistry Teachers regarding the Necessity of Remedial Teaching Materials revealed that cent percent of Experts and Teachers recorded that Remedial Teaching Materials is Necessary to a great extent for the Topics (Periodic Table, Atomic Structure and Oxidation and Reduction). There is no significant difference between the responses of Experts and Teachers regarding the Necessity of Remedial teaching in Chemistry for Educationally Backward Students on above mentioned topics.
6.10 THE NEED FOR SPECIAL TRAINING TO TEACHERS FOR THE EFFECTIVE USE OF DIAGNOSTIC TEST AND REMEDIAL TEACHING

Analysis of responses of Experts and Secondary School Chemistry Teachers regarding the Need for special training to teachers using Remedial Teaching Materials revealed that cent percent of Experts and Teachers recorded that special training is necessary for Secondary School Chemistry Teachers for Remedial Teaching in Chemistry (Periodic Table, Atomic Structure and Oxidation and Reduction). There is no significant difference between the responses of Experts and Teachers regarding the Need for special training to Teachers for Remedial teaching.

6.11 EXTENT OF PRACTICE: DIAGNOSTIC TESTING AND REMEDIAL TEACHING IN CHEMISTRY

Analysis of ratings of Secondary School Chemistry Teachers regarding the Extent of use of Diagnostic test revealed that only minority of teachers are using Diagnostic test in Chemistry at the Secondary School level.

Analysis of ratings of Secondary School Chemistry Teachers regarding the Extent of practice of Remedial Teaching revealed that only minority of teachers are practising Remedial Teaching in Chemistry at the Secondary School level.
6.12 THE PRACTICAL DIFFICULTIES LIKELY TO BE ENCOUNTERD WHILE USING DIAGNOSTIC TEST IN CHEMISTRY AT SECONDARY SCHOOL LEVEL

Analysis regarding the practical difficulties encountered by teachers while using Diagnostic test for Educationally Backward students in Chemistry recorded by teachers revealed that Rigid time-table and lack of time are the difficulties recorded by a great majority of teachers. Other practical difficulties recorded are: non-co-operation from the part of authorities and colleagues, lack of library facilities, knowledge regarding the diagnostic testing, overcrowded class room, laboratory facilities and lack of practice.

6.13 THE PRACTICAL DIFFICULTIES LIKELY TO BE ENCOUNTERD WHILE PRACTISING REMEDIAL TEACHING IN CHEMISTRY AT SECONDARY SCHOOL LEVEL

Analysis regarding the practical difficulties encountered by teachers while practising Remedial teaching for Educationally Backward students in Chemistry recorded by teachers revealed that lack of time, rigid time-table and overcrowded classroom are the difficulties recorded by a great majority of teachers. Other practical difficulties recorded are: lack of laboratory facilities,
library facilities, non co-operation from the part of authorities and colleagues and lack of interest on the part of students.

6.14 PROCEEDURES/METHODS ADOPTED BY TEACHERS FOR DIAGNOSTIC TESTING IN CHEMISTRY AT SECONDARY LEVEL

Analysis of the responses of Secondary School Chemistry teachers regarding the procedures adopted for Diagnostic testing revealed that majority of teachers recorded that they are using Diagnostic test. The other methods/procedures reported by teachers are Achievement test, oral test, interview and discussion.

6.15 PROCEEDURES/METHODS ADOPTED BY TEACHERS FOR REMEDIAL TEACHING IN CHEMISTRY AT SECONDARY LEVEL

Analysis of the responses of Secondary School Chemistry teachers regarding the procedures adopted for Remedial Teaching revealed that majority of teachers recorded that they are using Remedial Teaching (by teacher). The other methods reported by teachers are self-learning method, using supplementary Reading materials, peer tutorial, projects, assignments and Activity methods.
6.16 SUGGESTIONS OF TEACHERS FOR THE EFFECTIVE USE OF DIAGNOSTIC TEST IN CHEMISTRY FOR EDUCATIONALLY BACKWARD STUDENTS AT THE SECONDARY SCHOOL LEVEL

Analysis of suggestions of teachers regarding the effective use of Diagnostic test revealed that the major suggestions recorded by the teachers for the effective use of Diagnostic tests are making the time-table more flexible, providing adequate training in diagnostic testing and equipping library with suitable facilities.

6.17 SUGGESTIONS OF TEACHERS FOR THE EFFECTIVE USE OF REMEDIAL TEACHING IN CHEMISTRY FOR EDUCATIONALLY BACKWARD STUDENTS AT THE SECONDARY SCHOOL LEVEL

Analysis of suggestions of teachers regarding the effective use of Remedial Teaching in Chemistry for educational backward students revealed that the major suggestions recorded by the teachers for the effective use of Remedial Teaching are allotment of separate periods for Remedial Teaching, making the time-table more flexible, providing adequate training in Remedial Teaching, equipping library and laboratory with adequate facilities and reducing teacher-pupil ratio.
6.18 SUGGESTIONS AND RECOMMENDATIONS

6.18.1 RECOMMENDATIONS

The recommendations emerging from the major findings are:

(1) The study revealed (Table 5.10 & 5.11) that Remedial Teaching (using Remedial Teaching Materials) is superior to Self Learning Method (using Remedial Teaching Materials) and Lecture Method (using Textual Material). This shows that Teacher Assisted Remedial Teaching can attribute a positive effect on the achievement and hence Remedial Teaching should be given due importance in the curriculum in Chemistry.

(2) It is evident from the analysis that Remedial Teaching Group is superior to Self Learning Group and Lecture Method Group with regard to Delayed Memory Achievement and Retention Power. This indicates that Remedial Teaching Materials can be effectively used in retaining learned facts and concepts. So Remedial Teaching can be recommended to other levels also (Primary, Higher Secondary and College).

(3) It is evident from the analysis that in addition to average and above average students the study can be recommended for students having low Retention Power.
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(4) The study revealed that there is no significant difference between the Achievement scores of boys and girls in the Remedial Teaching Group. It is equally effective for Boys and Girls. Hence it can be implemented in a heterogenous class also.

(5) Analysis of findings revealed that Diagnostic Testing and Remedial teaching are necessary (based on the responses of teachers). Hence necessary steps should be taken to Diagnostic tests and Remedial Teaching materials.

(6) Analysis revealed that majority of teachers are not using Diagnostic tests for identifying the area of difficulty, the nature and extent of difficulty. This may be due to the lack of practice in the preparation of Diagnostic test or due to lack of literature and standardized Diagnostic tests. Hence necessary arrangements should be made to provide training in the preparation of Diagnostic tests and suitable literature related to Diagnostic measures including standardized Diagnostic tests and other reference materials.

(7) Majority of teachers are not practising Remedial Teaching (Table 5.37). This may be due to lack of time and non-availability of suitable Remedial Teaching Materials and
other difficulties related to curricular and administrative aspects. Hence provision should be made to restructure the curricular and administrative aspects for practising Remedial Teaching.

(8) Regarding the availability of resources, resources are not available for Diagnostic testing and Remedial Teaching. Hence necessary arrangements should be made to enhance the availability of resources.

(9) The analysis throws light on the practical difficulties experienced by Secondary School Chemistry Teachers in using Remedial Teaching at the Secondary School Level. Lack of time, rigid time-table, overcrowded classroom and lack of library and laboratory facilities are the major practical difficulties reported by majority of teachers, while practising Diagnostic testing and Remedial Teaching. Hence necessary arrangements should be made to overcome the practical difficulties—Curriculum should be made flexible including time-table, method of teaching and Examination system. Provision should be made to update the knowledge about Diagnostic tests and Remedial Teaching by organising faculty improvement programmes like workshops, seminars, orientation and refresher courses. Library should
be equipped with reference materials, Diagnostic tests, Remedial Teaching Materials and internet facilities.

6.18.2 SUGGESTIONS FOR FURTHER RESEARCH

The study has opened up several avenues for further research in the area of investigation. Some of the possible lines on which further studies can be carried out are given below:

(1) The present investigation is limited to test the effectiveness of Remedial Teaching Materials only on three Topics in Chemistry. It is suggested that Remedial Materials can be prepared in all the topics in Chemistry and the effectiveness can be tested experimentally.

(2) The present investigation was confined to Secondary School Level. Similar studies can be conducted in other levels—Higher Secondary and Degree Level.

(3) The experimental part of the study has been confined to IXth Standard students only for assessing the effect of Remedial Teaching with regard to achievement. Hence similar studies can be conducted to other standards of Secondary School Level (VIIIth and IXth).
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(4) The study has been confined to a limited sample. Hence the study may be replicated on a large sample.

(5) The experimental study has been limited to Kollam district only. To get a complete picture of the effectiveness of Remedial Teaching Materials the study may be conducted by systematic coverage of different districts in Kerala.

(6) Diagnostic test on different subjects at different levels can be prepared.

(7) Similar studies can be conducted in Tribal and Coastal Schools to study the effect of Remedial Teaching on students belonging to Tribal and Coastal areas.

(8) The effectiveness of Remedial Teaching Materials was prepared and tested only in Chemistry. It is suggested that Remedial Teaching Materials on other disciplines should be prepared and tested.

(9) The impact of Remedial teaching on Culturally deprived students can be studied.

(10) A detailed study on the attitude of teachers and educationally backward students towards Diagnostic testing and Remedial Teaching may be conducted.
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(11) A detailed analysis on the effect of Remedial Teaching in attaining various process skills in Science may be attempted.

(12) Effect of Remedial Teaching on Affective and Psychomotor aspects can be investigated.

(13) A detailed study to identify the local resources available for Remedial Teaching in Chemistry can be conducted.

(14) A detailed analysis of the practical difficulties likely to be encountered by teachers while using Diagnostic test and Remedial Teaching can be conducted.

(15) The effectiveness of Remedial Teaching Materials using various electronic media can be studied.

The investigator would feel gratified if the findings of the present study would lead to a better understanding of the Remedial Teaching, help students to learn in a more natural and meaningful way, support curriculum planners to design new curriculum based giving due emphasis on Diagnostic testing and Remedial Teaching, and motivate the researchers to undertake further studies related to this area.

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