AN APPRAISAL OF SECONDARY SCHOOL SCIENCE CURRICULUM OF TRIPURA BOARD OF SECONDARY EDUCATION

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AN APPRAISAL OF SECONDARY SCHOOL SCIENCE CURRICULUM OF TRIPURA BOARD OF SECONDARY EDUCATION

BY

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DECLARATION

I, Ashim Datta, hereby declare that the subject matter of this dissertation is the record of work done by me, that the contents of this dissertation did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the dissertation has not been submitted by me for any research degree in any other University/Institute.

This is being submitted to the Mizoram University for the degree of Master of Philosophy in the Department of Education.

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CERTIFICATE

This is to certify that the dissertation entitled, "**AN APPRAISAL OF SECONDARY SCHOOL SCIENCE CURRICULUM OF TRIPURA BOARD OF SECONDARY EDUCATION**" is the bonafide research conducted by Mr. Ashim Datta under my supervision. Mr. Ashim Datta worked methodically for his dissertation being submitted for the degree of Master of Philosophy in the Department of Education, Mizoram University.

This is to further certify that the research conducted by Mr. Ashim Datta has not submitted an application of this or any other University/Institute.

Dated:

Place: Aizawl (Dr. KRISHNA KANT TRIPATHI)

SUPERVISOR

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ABBREVIATIONS AND ACRONYMS

CBSE : Central Board of Secondary Education

TBSE : Tripura Board of Secondary Education

NCF : National Curriculum Framework

NPE : National Policy on Education

NCERT : National Council of Educational Research and Training

SCERT : State Council of Educational Research and Training

CETE : Certificate in Elementary Teacher Education

T.Ed : Teacher Education

CHAPTER -I

INTRODUCTION

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INTRODUCTION

1.1 **Meaning of Curriculum**:

The word curriculum is adopted from the Latin word “currere” meaning “ to run” and curriculum in its origin referred to running, race course or chariot race. The common dictionary usage of curriculum means courses of study. According to Cunninggham (1990) “Curriculum is a tool in the hands of the Artist (Teacher) to mould his materials (Pupils) according to his ideal (objective) in his studios (school)”. The secondary Education Commission (1952-53) says “It must be clearly understood that according to the best educational thought curriculum does not mean only the academic subjects traditionally taught in the school but it includes the totality of experiences that a child receives at school”.

Curriculum has been defined by different authors in many different ways which have been referred to in the Encyclopedia of Education edited by Hussen (1985).

> “*Curriculum referred as a set of experiences. It is set up in the school for the purpose of disciplining children and youth in group ways of thinking and acting with a sequence of potential experiences*” (Smith et al 1957).

> *“A learner has to undergo with all the experiences by the guidance of the school*” (Foshy 1969).

According to Good (1959) "*The school should endeavor the students by many of qualifying him for graduation or certification or for entrance into a professional or vocational field with help of overall plan of the content materials and instruction*".

1.2 **Components of Curriculum**:

The first thing that comes up in the process of curriculum development is to decide various components of curriculum. Here different authors have different opinions. According to Nichols and Nicholls (1978) the components of curriculum are situation, objectives, selection and organization of content and methods and evaluation.

The principles for developing curriculum require one to prepare a curriculum adapted to the task and talents of the learners, Taba (1945) presented a different sequence with that of Tyler (1950). That are as follows:-

Step I Diagnosis of needs

Step II Formulation of objectives

Step III Selection of content

Step IV Organization of content

Step V Selection of learning experiences

Step VI Organization of learning experiences

Step VII Determination of what to evaluate and the ways and means of doing it.

1.3 **Curriculum change and Principles of curriculum development**:

Some of the basic principles need to be taken consideration while preparing a curriculum. According to Taba, a curriculum also involve some criterion other than objectives such as vitality and significance for selection and organization of the content , the making of proper distinctions between the various levels of content and decision about the level of development to introduce it. It involves further consideration of continuities and sequences in learning and of variations in the capacity to learn. While preparing the curriculum civic needs, learn ability of the learner, varieties of work to be done and their feasibility are to be taken into consideration. As a whole, a balance curriculum should cater to the general needs and diverse aptitude and abilities of children. Moreover, a balance curriculum should be guided by some general principles as follows:-

i. The topic need to be presented sequentially and hierarchically basis and these should follow the principle of concrete to abstract.

ii. The curriculum of an individual subject should co-relate with the other subjects.

iii. The curriculum should be children-centric and should concentrate on need of children and its implicational value.

1.4 **The Secondary School Curriculum of Tripura :**

The Government of Tripura constituted a State curriculum and syllabus committee on the basis of recommendation of the New Education Policy,1986, with a view to improve the curriculum and syllabus at different educational stages. The curricular framers' decided to

make the syllabus more effective by bringing it at par with CBSE and at the same time work on those aspects that is in tandem with the state environment. They also wanted to incorporate certain elements into the curriculum that state and geographic specific.

1.5 Place of Science in the Secondary School Curriculum:

Science is a disciplined way of seeking new knowledge. It is treated as one of the activities that human beings have created to gratify certain needs, interests and fulfillment of all desires. For an education system built upon reasoning, experimentation, logical and problem solving skills, science is considered to be particularly suitable. Hence science takes a prominent place along with other subjects as an essential component of school education. In a world where there is tremendous growth in the amount of scientific knowledge and rapid technological advancement, the curriculum developers realised the importance of instilling a firm understanding about science and technology into the learners. The teaching of science is thus expected to impart training in scientific method, develop scientific attitude and scientific temper (Govt. of India, 1986).

NCERT curriculum and National policy on Education (NCERT, 1988; NPE, 1986, 1992) emphasis on the following objectives for school science education are:

i) To give emphasis to scientific methodology , the processes rather than the content

ii) To provide science which is environment based, locally relevant and meaningful

iii) To encourage an interdisciplinary, integrated view of science.

According to NCERT (1988), "*Science education need to be improved so as to develop in the child well defined abilities. It promotes values in the child such as the spirit of inquiry, creativity, objectivity, the courage to question and aesthetic sensibility. The child should be able to explore and understand the scientific facts, concepts, principles and processes underlying various phenomenon's… he/she should able to identify the resources in the locality and use them properly*".

And According to NCERT (1988), "*the shift in emphasis from product to the process of science and factual information to interesting, relevant and meaningful scientific knowledge should be the main consideration for content identification and rearrangement*".

It has been considered important to equip the learner in understanding, interpreting and dealing with the natural phenomena in a way to develop scientifically literate individuals. The science courses in schools are no more to be taken account of as a body of content to be memorized. It should be able to provide opportunities for learners to develop an understanding of the principles of science and scientific method (NCERT, 1988).

More importantly the scientific methods extend beyond science as a subject and find utility in every individual's life and social aspects. At school level, a new direction has been given in recent years to spread scientific temper as distinct from imparting of scientific knowledge alone. This has given rise to a science-technology-society impetus to the revised curriculum in science education.

In the academic arena curriculum plays a significant role and occupies a central place in modern educational system. It is the means to realize the objectives of education. The

realization objectives of scientific goals of science education depend upon the curriculum framed, prescribed and more importantly how it is implemented and transacted in its natural classroom environment.

A National Curriculum Framework, 1975 by NCERT had suggested that "*The secondary stage science syllabus might be divided into Physical Science, covering physics and chemistry and the Life Sciences, covering botany, zoology and human physiology. An alternative mooted was to offer science as a single integrated subject at secondary stage. Science was offered as 'discipline-wise' courses in the academic stream at the senior secondary stage*".

NCERT recommended a review committee under the chairmanship of Ishwarbhai J. Patel was appointed in June1977 to examine the syllabus and textbooks. The Committee suggested many changes to the syllabus taught in Classes IX and X. After having studied the syllabus and textbooks the committee members proposed that

i. To restructure the scientific concepts as found in the textbook of class IX and X.

ii. Students were to be offered the opinion to choose from two equivalent courses in the secondary stage. The first alternative was to offer science as a single subject that encompassed all it variegated discipline. The second alternative was to offer discipline-wise science course that would consist of biology, physics and chemistry etc.

But authorities were quick to look at the loopholes that the Review Committee's suggested. It raised question on the two model science syllabus as suggested by the committee and subsequently it was abandoned by the CBSE schools.

1.6 The Science Curriculum of CBSE :

The present Secondary school science syllabus of CBSE has been covered five (5) main themes i.e. Chemical substances – Nature and Behaviour, World of Living, Natural Phenomenon, Effects of Current and Natural Resources. It is a core subject with the combination of physics, chemistry and biology

The Secondary school science syllabus designed by the NCERT includes 5 units as follows:-

Unit I Chemical substances – Nature and Behaviour

1. Chemical Reactions
2. Acid, bases and salts
3. Metals and Non-metals
4. Carbon Compounds
5. Periodic classification of elements

Unit II World of Living

6. Life Process
7. Control and co-ordination in animals and plants
8. Reproduction
9. Heredity and evolution

Unit III Natural Phenomenon

10. Light, Reflection and Refraction

11. The Human Eye and The Colourful World

Unit IV Effects of Current

12. Electric Current

13. Magnetic effects of current

Unit V Natural Resources

14. Sources of Energy

15. Our Environment

16. Management of Natural Resources

1.7 The Old Science Curriculum of TBSE :

The Tripura Board of Secondary Education (TBSE) has been conducting 2(two) major Public Examinations since 1981, one is Madhyamik Pariksha (Secondary Examination) and another one is Higher Secondary (+2 stage) Examination. The core curriculum was changed from time to time. In 2006 TBSE finally adopted the syllabi as per NCF, 2000 recommendation. The old science curriculum followed in Tripura schools under study was implemented at the secondary stage starting from the year 2006. The old science curriculum of TBSE comprised of two papers i.e. Physical Science (Physics and Chemistry) and Biology 100 marks each.

The Secondary school Physical Science syllabus designed by the TBSE includes 4 units in Physics (50 marks) and 8 units in Chemistry (50 marks) as follows

Table 1: TBSE Old Physical Science syllabus

Sl. No.	Chapter/ Unit		Marks
1	Sound	Physics	16
2	Current Electricity and Electromagnetism		18
3	Modern Physics		8
4	The Universe		8
5	Chemical Bonding	Chemistry	7
6	Inorganic Acids		10
7	Metals and some important chemical components		10
8	Electronic concept of oxidation and reduction		4
9	Electrolysis		7
10	Carbon and Organic Chemistry		12

The Secondary school Biology syllabus designed by the TBSE includes 6 units/ Chapter as follows.

Chapter-1: Cell and Cell Division

Chapter-II: Reproduction and Heredity

Chapter-III: Evolution

Chapter- IV: Adaptation

Chapter V: Virus, Microbes, Human Diseases and Hygiene

Chapter-VI: Environment, Ecosystem and Conservation

1.8 The New Curriculum of TBSE

The TBSE developed new syllabus in 2015, following the recommendation of NCF 2005, with some variations may be observed in topics and themes at different levels. Previous curriculum has no provision for Science practical. The TBSE has decided to adopt and adapt the syllabus of CBSE for Madhyamik (Secondary) and higher secondary examinations. The secondary examination (Madhyamik) as per new TBSE syllabus was initiated from 2018. For Madhyamik examination there will be five (5) subjects—Language-I (Bengali, Hindi, Kokborok, Mizo, Arabic), Language-II (English), Mathematics, Science (chemistry, physics and Life Science combined) and Social Science (geography, history, economics and civics combined). According to TBSE Secondary school (Class IX and X) comprise five papers as detailed below:

Table 2: The New Syllabus of Secondary Schools of Tripura

Sl. No.	Name of the Subjects	Theory	Internal assessment & Project/practical	Full Marks
1	First Language (Bengali/ Kokborok/ Mizo/ Hindi)	80	20	100
2	English	80	20	100
3	Mathematics	80	20	100
4	Science	80	20	100
5	Social Science	80	20	100

1.9 The New Science Curriculum of TBSE

The present science curriculum followed in Tripura schools under study was implemented at the secondary stage starting from the year 2016. The new syllabus had been framed keeping in view the curricular recommendation of NCF-2005. It was of interest therefore to explore the manner in which the newly implemented science curriculum manifested in the schools and classrooms, the opinion of the teachers and their understanding of the scope of scientific literacy, the support provided for sustaining the science curriculum in terms of resources and textbooks, and the assessment methods followed are also taken into consideration.

Table 3: The New Secondary school science syllabus of the TBSE

Sl. No.	Name of the Topics	Subject
1	Electricity	Physics (27 Marks)
2	Magnetic effects of Current	
3	Light- Reflection and Refraction	
4	Human Eye and Colourful World	
5	Sources of Energy	
6	Chemical reactions	Chemistry (26 Marks)
7	Acids, Bases and Salts	
8	Metals and Non-metals	
9	Carbon compound	
10	Periodic classification of elements	

11	Conservation of natural resources	
12	Life Processes	Biology (27 Marks)
13	Control and co-ordination in animals and plants	
14	Reproduction	
15	Heredity and Evolution	
16	Our Environment	

1.10 **NEED OF THE STUDY**

The National Education Policies (1968, 86, revised 92) observed that secondary science education was facing different problems, such as absence of realistic and life oriented curricular content, attractive textbooks and also lack of library and laboratory facilities. Keeping in view these inadequacies of the curricular content and materials and in order to achieve the objectives state secondary curriculum committee of TBSE recommended that appropriate content and materials should be prescribed which would be useful for the development of science education in the state. The curricular framers' decided to make the syllabus more effective by bringing it at par with CBSE and at the same time work on those aspects that is in tandem with the state environment. Curriculum for science in the old syllabus of TBSE comprised of two papers of 100 marks each. The first paper was composed of physics and chemistry. While the second paper dealt in Biology. Keeping in view the curriculum work load the TBSE has decided to do away with this two paper formula. Under the revised syllabus the biology subject has been clubbed together with physics and chemistry, thus reducing considerable workload for the students. The curricular

framers' further stated that Physical Science (including Chemistry and Physics) and Life Science (including Botany, Physiology and Geology) will be taught in single paper of 100 marks in class IX and X and out of 100 marks 80 marks was devoted to theory and 20 marks would cater to practical. Therefore the researcher wants to know how much TBSE followed CBSE, and how much they are original in their planning? Further it is also important to note the opinion of other stakeholders like teachers and students about the new integrated design of the science curriculum.

Another grave problem with the old curriculum was that there was no provision for science practical. According to John Holman "Learning science without practicals is the equivalent of studying literature without books" (as cited in NCERT, 2006). Laboratory activities help to reinforce the scientific concepts that learned by the students and promote the skills of scientific investigation and communication. Such skills paved away for laboratory activities or experiments to design the actual scientific problem. But most of the secondary schools of Tripura are situated in rural areas which lack basic infrastructure facilities like laboratory and teaching equipment. Such schools don't have even adequate fund to maintain a laboratory. On the other hand, the old teachers are not exposed to such advance content and the new approaches to the teaching of science as there was no provision of lab-work in old curriculum. The researcher wants to know that for the implementation of laboratory practical at secondary level whether the TBSE and Secondary school education department of Tripura Govt. have conducted sufficient orientation programme/ capacity building training for secondary science teachers and whether enough

laboratory equipments, well equipped laboratory room have been made available in the secondary schools of Tripura.

Almost two years had been passed after the implementation of new science curriculum by Tripura board. Perfect laboratories were to be established in all the secondary schools at the time of inception of the new curriculum. Hence any conscious mind might be inquisitive to know what kind of science laboratories had been established in the schools. Since laboratory work did not have any history in Tripura's schools, and teachers were not accustomed to deal with this component. This historical scenario paved the path to this research work.

In line with the foregoing discourse the researcher specify the research questions came in his mind and answered directly or indirectly through this research work.

1.11 RESEARCH QUESTIONS

1. What is the scenario of development of science education in Tripura?
2. How much of the science curriculum of CBSE (declared model) has been followed by TBSE?
3. How much of the science curriculum of TBSE is different from its old science curriculum?
4. What is the perception of teachers and headmasters about the new science curriculum of TBSE?
5. What is the perception of students about the new science curriculum of TBSE?

Keeping in view the discourse here researcher will proceed to answer a few research questions by following the research problem cited as below.

1.12 STATEMENT OF THE PROBLEM

An Appraisal of Secondary School Science Curriculum of Tripura Board of Secondary Education

1.13 OBJECTIVES OF THE STUDY

1. To critically analyze the secondary school science curriculum of TBSE.
    a. To compare the new secondary school science curriculum of TBSE with secondary school science curriculum of CBSE.
    b. To compare the new secondary school science curriculum of TBSE with its previous science curriculum.
2. To study the prospects of the new secondary school science curriculum and challenges in its implementation and transaction in Tripura.
    a. To find out the perception of school teachers of Tripura about the new secondary school science curriculum.
    b. To find out the perception of school headmasters of Tripura about the new secondary school science curriculum.
    c. To find out the perception of students of Tripura about the new secondary school science curriculum**.**

1.14 OPERATIONAL DEFINITION OF KEY TERMS

Curriculum- A curriculum means a collection of all the experience used in a school to achieve the aims of education. In the present study curriculum refers to revised science syllabus, science practical and assessment pattern applicable at the secondary level (IX- X) in Tripura.

Secondary School – Secondary school means that type of school where pupils of age group 13 years to 15 years are reading in the different classes from IX to X.

Tripura Board of School Education - TBSE, established in 1973 by an Act (Tripura Act. No.12) passed by Tripura Legislative Assembly was called Tripura Board of Secondary Education Act, 1973. It started its functioning from the 1st January, 1976. TBSE has been conducting 2(two) major Public Examinations one is Higher Secondary (+2 stage) and another one is Madhyamik Pariksha (Secondary Examination) examination since 1981.

1.15 DELIMITATION

1. The present study is confined to science curriculum for standard X of Tripura Board of Secondary Education.
2. The study will be restricted to one district of state of Tripura.

1.16 METHODOLOGY

Descriptive survey and qualitative analysis method involve in the present study. A detailed report of the method and design of the study is presented in Chapter III

CHAPTER -II

REVIEW OF RELATED LITERATURE

CHAPTER -II

REVIEW OF RELATED LITERATURE

The phrase ‘Review of Literature’ consists of two words review and literature. In research methodology the term literature refers to the knowledge of a particular area of investigation of any discipline which includes theoretical, practical and research studies.

The term review means to organize the knowledge of the special area of research to evolve an edifice of knowledge to show that the proposed study would be an addition to this field. It implies organization and synthesis of knowledge of a particular area of investigation.

Related Studies:

The investigator reviewed and consulted researches related to the investigation. The following reviews have been found to be significant to the proposed research:

Singh (1977) studied on Development of Curriculum in Science for Secondary School in the Maharashtra. The study revealed that the significant difference between the means of achievement of students in terms of knowledge was found significant in three schools, skill was found in all six schools, and application was found in five schools out of six schools.

Banerjee (1981) conducted a study relating to the implementation of the primary school curriculum in Tripura. The researcher collected data from 30 primary schools of Tripura. He found that only twenty percent of the schools had ‘pucca’ building while the other twenty percent were of mixed type and rest sixty percent were ‘kutcha’ building. Classroom accommodation was inadequate in about sixty three percent of the schools.

Almost sixty nine percent of the students were provided mid-day tiffin and twenty percent students received free books. Teaching aids like map, charts and globes were inadequate in all the schools. Twenty one percent of teachers working in the schools were graduates, sixty six percent were matriculates and eighty percent of the teachers were trained.

Biswas (1986) conducted a study on the curriculum for primary education in Bangladesh. The study was conducted with a view to evaluate the primary education in Bangladesh. The study conducted a status survey of primary schools with regard to instructional inputs and other facilities and to study the assessment system and the problems involved in implementing the curriculum. He found that there was a contextual gap between the framing of objectives by the National Educational Commission and the National Curriculum and Syllabus Committee and between the curricular content recommendations by the National Educational Commission and that of the National and Syllabus Committee. It further found that the textbooks were poor with regard to physical aspect, but the teachers' handbooks were of high quality.

Mohanty (1988) conducted a study on 'an appraisal of teaching science in the high schools of Cuttack City' under Utkal University. The study revealed that the present syllabus was very tough and it was very difficult to grasp all the concepts in 10 years of schooling. It was opined that the Board of Secondary Education, Orissa, should appoint more experts in science to improve science syllabus keeping in view the teachers' position, laboratory facilities, etc. It found that schools lacked in equipment and laboratory. The outcomes of learning were not properly assessed by the schools. The science funds were very meager and hence not much could be spend on the development of Science Education.

Majumder (1988) studied with a view to identifying the total system of secondary school education in Calcutta with the objective to make an in depth study of the secondary school system in relation to its significant compounds- schools, pupils, teachers, guardians, curriculum, timetable and environment- in order to locate its points of weakness as well as potentialities. Researcher used a field sample survey which was based on representative number of all types of secondary schools of Calcutta. The data were gathered from primary as well as secondary sources. The study revealed that many changes were brought about in the school education in West Bengal after Independence; which had often been implemented in haste without necessary care and precaution and consequently expected objectives and targets could not be achieved. Curricular and organizational changes created certain gaps and confusion. Pupils faced problems under the pressure of abrupt changes. The educational environment in school was found to be far from satisfactory, lacking in many essential requirements. The relationship among the components under study revealed certain discordant features disturbing the equilibrium of the total system and its smooth functioning.

Mehdi (1988) conducted an investigation with a view to identifying instructional development and social objectives of education at the secondary stage. The study concerned with the instructional, developmental and social objectives at secondary level of education. The data was collected using a questionnaire for teachers from the schools of Delhi for eliciting their opinion about the school curriculum as it was implemented. The finding indicated that the curricula for various subjects were not well balanced and did not help to achieve many of its objectives.

Radhamonyamma (1988) studied on evolving instructional techniques appropriate to the development of various scientific skills among secondary school pupils in Kerala. Researcher prepared an opinionnaire and an achievement test in science for collecting data. The study revealed that whereas the achievement in science as well as acquisition of scientific skill was low, it observed that new evolved method for teaching of scientific skills through tested lesson plans was more effective than the traditional method. Further, the correlation between marks scored in different science subjects was higher for the experimental group as compared to the control group.

Biswas(1989) studied on learning disabilities in critical thinking in some areas of physical science syllabus with a view to find out the detailed pattern of disabilities in some areas of physical science and experiment with innovative teaching methods which could work as remedial tools. The researcher used 250 students of class X from 4 schools of backward areas as sample of the study. The tools used included a diagnostic test, an intelligence test and the Academic Motivation Test. The collected data were treated with F-ratios and the Mann-Whitney U-test. The study found that 23 major patterns of disability were identified, the F-ratio between variance and within classes was significant and the U-value showed improvement in the achievement motivation of the experimental group.

Kar (1990) carried out a research on relationship between attitude towards and achievement in general science of class IX students of Cuttack city to assess the relationship between the attitude and achievement in general science of class IX. The sample of the study comprised 700 students studying in class X from ten high schools; and also included 74 science teachers and some science experts, professors, educationists and headmasters of the schools, who were selected through random stratified sampling method.

The tools used to collect the data were questionnaire, interview schedule, achievement test in science and attitude scale. The collected data were analyzed statistically using measures of central tendency, variability and correlation co-efficient. The study found that the distribution of the attitude score was negatively skewed, that boys were found to be more favorably disposed towards science than girls and there was a positive relationship between attitude and achievement.

Prakash (1990) studied on 'Effectiveness of concrete materials to enhance learning in physical science". Objective of the study was to ascertain whether concretized instruction helps in learning formal level concepts. The concretized instruction for all the four formal level concepts were tried out on class IX students. Tests of multiple choice items was developed and administered to both the groups (students of class IX in two different schools as control and experimental group). The findings of the study revealed that the performance of student's learning by concretized instruction was better than those learning by traditional instruction. It further found that the average increments in marks of the experimental group of students on concert level items were 8.8% and that of formal level items, 8.4%. As the tests comprised of items based on different logical operations and of concrete and formal operational level, the responses of such tests may be used to diagnose the learning difficulties of students. Remedial help can also be provided to them accordingly.

Prakash (1991) studied on curriculum policies planning implementation at the primary school level in Delhi during 1966-76. The study was concerned with curriculum policies planning and implementation at the primary school level in Delhi. The respondent sample consisted of the Municipal Corporation schools of Delhi. The study revealed a

pathetic scenario in MCD schools with various dysfunctional features, which was characterized by lack of teacher initiative, political interference, in effective supervision. It was further marked by substandard pre-service and in-service training of teachers, unusually loaded syllabus and defective teaching of science.

Deshpande (1992) concerned himself with the development of curriculum in mathematics at the secondary stage of education in Maharashtra'. The study looked at the practical aspects of the secondary level mathematics curriculum and its utility for students. It further looked into the psychological considerations and also examined if it links with the primary and secondary level mathematics curricula. It founded that inadequate time allotted per week and lack of proper suggestions about reference materials made the mathematics curricula less effective.

Talukdar (1993) studied on 'Problems of teaching and learning of integrated science in Borne state of Nigeria'. The study found that shortage of equipment; laboratory and instructional materials constitute a major obstacle against integrated science teaching.

Digrumurti (1996) worked on evaluation study of Andhra Pradesh 'X' class Biological Science Text- Book. The findings of the study revealed that;

(a) The Telugu medium teachers had expressed more satisfaction than the English Medium. The class 'X' Biology text-book subject organization was average. The least experienced teachers were more satisfied with the organization of the subject matter in the Biology text-book.

(b) The organization of the subject matter should utilize the knowledge obtained in previous classes as well as experiences of daily life. Study revealed that the textbook did not contain the topics necessary for student purpose.

(c) Teachers must be experienced in In-Service training programme to meet the requirements of them. It also opined that textbooks be supported by suitable illustrations but these illustrations must be clearly leg ended.

Christina *et.al*. (2007) worked on helping elementary pre-service teachers learn to use curriculum materials for effective science teaching.

To address this concern, the authors conducted a study in which 3 teacher educators taught elementary science methods courses incorporating a major focus on curriculum analysis and modification. The study found that;

(a) Analysis of pre-post assessments, classroom artifacts, classroom dialogue and post course interviews indicated that pre-service teachers accurately applied and appropriated a modest set of criteria whose intended meanings most closely matched their own understandings, were most closely aligned with their own goals and criteria or were made accessible through systematic use and attention within the methods sections.

(b) Many did not find the materials analysis criteria useful or comprehensible and based their curricular decisions on their own criteria and

(c) A new theoretical framework and new approaches to better support pre-service teachers' effective participation with curriculum materials was required.

Dey (2011) conducted a study on critical study of science education in the secondary schools of Tripura. The study was concerned with the development of science education in Tripura after independence and implementation of science education curriculum with regard to physical facilities, teacher qualifications and training, teaching aids, laboratory and library. The study found that

(a) Socio-economic status of rural schools was miserable. Their performance in science subject and attitude towards science education were not satisfactory.

(b) It was observed that 81 percent head of schools opined that science text-book was written as per the curriculum and present curriculum was not an overburden to the students. So far curriculum standard was concerned 68 percent schools head opined that it was up-to the National Level.

(c) Libraries were not well equipped with all facilities. Libraries were having shortage of books, journals and magazine etc.

(d) One- third of the schools didn't have any laboratory and fifty percent of schools faced shortage of science practical materials.

(e) In most of the schools, science books were selected by head of the institutions and science teacher together. Sixty percent schools books were of local publication.

Lodh (2011) conducted a study of science curriculum of secondary schools in the state of Tripura. The research work was conducted with a view to:

(a) Study the process of curriculum development for science education of secondary level in Tripura.

(b) Study the status of science curriculum in secondary schools.

(c) Ascertain the process of implementation of science curriculum in secondary schools in Tripura with regard to physical facilities, teacher qualification and training, teaching materials, content etc.

(d) Study the problem of implementation of science curriculum in Tripura.

He found that:

(i) Almost all the science teachers perceived inadequate physical facilities at the secondary schools. The implementation of secondary physical science curriculum properly was marred by lack of furniture, classroom, separate rooms for physical science laboratory and scientific instrument.

(ii) Many teachers didn't find the prescribed syllabus and contents of physical science heavy.

(iii) Forty percent of schools in urban area were well equipped and had running science laboratory but rural part of the state faltered on those aspects.

(iv) Most of the schools didn't have necessary teaching aids and materials required for imparting instruction in physical science.

Kidwai et al. (2013) conducted a study on the policy and practice of public primary curriculum in India. Authors conducted this study in the schools of Morigaon (Assam) and Medak (Andhrapradesh). The study found that:-

(a). Textbooks are most important and accessible tools of education and used as primary reference books for teaching classroom.

(b) Textbook content for many subjects was found to lack in contextualization and textbook content does not match with students' ability, especially those coming from rural schools.

(c) Teachers expressed the need for more training on the use of textbooks and new textbooks should be introduced after sufficient training.

(d) The use and development of teaching learning materials (TLMs) was not prioritized and teaching –learning ideologies often mismatched across different stakeholders.

Rider et al. **(2014)** conducted a study on Teachers' experiences of science curriculum reform. The Enactment and Impact of Science Education Reform (EISER) study included a sample of 22 teachers from 19 schools of England. Teacher's responses were guided by personal aims and biography, internal features of their workplace and external features outside of science. The study found that:-

i) Many teachers emphasized on the need for more scientists for framing curriculum, and the importance of teaching socio- scientific issues which they believed will necessary support the students in their adult life.

ii) Science curriculum reforms provide legitimate space in which teachers can exercise their professional judgement, enabling them to enact external reform policy in ways that reflect the needs of their students.

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CHAPTER III

DESIGN, METHOD AND TOOLS OF THE STUDY

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DESIGN, METHOD AND TOOLS OF THE STUDY

This chapter describes the design, method and tools of the study on different sections as follows:-

a) Broad framework of the study,
b) Critical analysis of Secondary School Science Curriculum of CBSE and TBSE,
c) Method analyzing the load of content,
d) Method of studying facilities for teaching science,
e) Population and sampling procedure,
f) Administration of the tools,
g) Statistical procedures.

Research design is a mapping strategy that helps carry out research work in effective and systematic way. It is essentially a statement of the object, enquiry and the strategies for collecting the evidences, analyzing the evidences and reporting the findings with keeps in view the research questions and research objectives.

3.1 Broad framework of the study:

The present study involved two major strategies. First was to analyse the class X science text- book of TBSE and CBSE and assess the load of content of New TBSE Science text-book. Secondly the study intended to make a survey of the facilities available for teaching

science and challenges for implementation of new science curriculum and also to collect the opinion of students, teachers and headmasters on the existing TBSE science curriculum.

3.2 Critical analysis of Secondary Science Curriculum

The study was conducted in two phases. In phase-I, CBSE, Old TBSE and New TBSE Science Text-Book analysis was done. For this purpose the TBSE Science Text-Book of class X, Bengali and English medium School has been analysed. In second phase survey was done to collect information from the students of class X, those who have already completed class X science curriculum.

3.3 Method of analysing the Load of Content:

To analyse the textbook and to assess the load of content, an analytical table was prepared mentioning distinctly science text-book chapters, the name of the topics and the number of concepts. To find out the connection between the difficulty and disliking, easiness and liking of chapters by students, a questionnaire was prepared.

3.4 Method of studying facilities and challenges for teaching Science:

Facilities for teaching science included 1) Infrastructural support and 2) Academic support. Infrastructural facilities in the schools can be two types, viz. i) The physical inputs like buildings, classroom furniture which constitute the physical existence of a school. ii) Instructional inputs like laboratory, library and other instructional materials, which influence teaching – learning process. Academic supports like training of teachers,

exposure of teachers and teachers' participation in orientation or refresher course were included under the facilities.

3.5 Population and Sampling Procedure:

Population of the study comprises the schools of whole Tripura as part of the work has implication covering whole state. To achieve the objectives of this study the researcher was selected the largest and important district i.e. west Tripura district to conduct this study. The target population for the present study involves different components such as schools, students, headmasters and teachers from three (3) sub-divisions of west Tripura district.

In the present study the simple stratified random sampling technique used to select students from the total population. Here twenty six (26) schools randomly selected to collect data from students, teachers and headmaster.

Description of the sample:

Before taking up the data for interpretation it is worthwhile to know the sample.

Table 4: Distribution of the sample according to Area

Sl. No.	Area	No. of Schools	No. of Students	No. of Science Teachers	No. of Headmasters
1	Urban	14	50	28	14
2	Rural	12	40	22	12
Total		26	90	60	26

3.6 Administration of the tools:

Tools: The tool was administered on the selected sample. The following tools were developed and administered by the investigator for the purpose of data collection from the subjects:

a. Questionnaire for students (Appendix-A)
b. Questionnaire for teachers (Appendix-B)
c. Questionnaire for headmasters (Appendix-C)

Description of Tools:

a) **Preparing the first draft of questionnaire for the students**: The researcher prepared a list of questions based on new science curriculum. Before preparing the questionnaire the researcher discussed with secondary school science teachers and experts. The initial draft copy of the questionnaire was with 26 items. When the questions was prepared then it was presented to 20 students of class x, in order to check if the terms was clear and if the sentence of the questionnaire easily understand by the students. The final copy of the questionnaire contained 19 items related to science curriculum, school, laboratory, liking and disliking of students with regard to science subject, status of home tuition and use of school laboratory and status of science curriculum with special reference to easiness and difficulty level, topics liked or disliked, status of laboratory and observations or doing experiment in the laboratory.

b) **Preparing the first draft of questionnaire for the teachers**: The questionnaire for the science teachers prepared to collect opinion of teachers on new TBSE science curriculum. At the first stage of the study researcher discussed with senior secondary school science teacher and some experts of the secondary curriculum. The initial draft copy of the questionnaire was prepared from the opinion of the secondary school science teachers and experts. The final copy of the questionnaire contained 16 items related to science curriculum, laboratory, science practical, private tuition and refresher course/ orientation course.

c) **Preparing the first draft of questionnaire for the Headmasters:**

The questionnaire for the headmasters intended to collect opinion of teachers on new TBSE science curriculum and overall facilities available in the schools for successful implementation of new science curriculum. The initial draft copy of the questionnaire was with 16 items. During tryout informal discussions with the headmasters provided some ideas to change some the items. The final copy of the questionnaire contained 10 items related to some basic information of school, science teacher's number, science teacher qualification, laboratory, science practical, and library, opinion about existing facilities and refresher course / orientation course in the new curriculum.

3.7 Statistical procedure used:

After collecting all the information it was tabulated and analysed. Simple frequency and percentage calculation was done to interpret data.

CHAPTER–IV

ANALYSIS AND INTERPRETATION OF DATA

CHAPTER–IV

ANALYSIS AND INTERPRETATION OF DATA

This chapter analyses and interprets the data collected through the procedures described in the preceding chapter under the following sections corresponding to the objectives of the study: 1)Comparative analysis of the Secondary School Science Curriculum of TBSE, CBSE and Old TBSE Science Curriculum, 2) Load of content the new science curriculum of class X at the secondary level in Tripura,3) Facilities available and challenges for teaching science, 4) Effect of the new science curriculum over the students. 5) Perception of Science teachers towards new science curriculum 6) Perception of Headmasters towards new science curriculum.

Section 4.1: Critical Analysis of the Secondary School Science Curriculum of TBSE

The primary objective of this study was to critically analyse the secondary school science curriculum of TBSE. The old Science curriculum was withheld by the TBSE in 2016 and replaced by a new curriculum in the same year. The new curriculum was mooted by the ‘Curriculum Framers Committee of Tripura’ in 2015; and it came into effect from January, 2016 through TBSE Admission and Madhyamik Pariksha (Secondary Examination) Regulation, 2015(henceforth TBSE regulation, 2015). The framers of the new curriculum found that there was no provision for science practical in the old syllabus. The committee also felt the need to adapt to the changing times by bringing certain other changes and to bring it at par with CBSE Science curriculum.

4.1.1Comparative analysis of Secondary Science Curriculum of TBSE and CBSE

The Class 10 Science curriculum of CBSE and TBSE has been developed to provide students with basic knowledge of Physics, Chemistry and Biology that they will need to cope with in real life problems using scientific methods and analyse the interactions between Science-Technology-Society and Environment, develop positive towards himself/ herself and society.

Following four criteria were used to compare new science curriculum and text books of TBSE with CBSE.

a) Physical structure of text book
b) General Content
c) Textual Structure
d) Virtual Structure

4.1.1.a: Physical Structure of TBSE and CBSE Secondary Science Textbook:

A few questions mentioned below were to be answered by the assessment of physical structure of the books. It was important to take into consideration the physical structure and layout of a text book for its significance in Education.

i. Was the book layout (cover) user-friendly and easy to use?
ii. Did the general format of the book facilitate learning?

Table 5 (a)

CBSE Secondary Science Text Book	TBSE New Secondary Science Text Book
1. The CBSE class X science book was concise, relevant, up-to date and well -seized book. There was only one book leading to 80marks theory examination. 2. The subject, Science 10, clearly indicated on the front and back cover. 3. The units are color coded on the bottom of the pages. Each units start with a review of the subject matter "What you should recall about" which leads into an introduction of what the student will learn. Each chapter closes with a unit review.	1. The TBSE Class X science book was precise, relevant and up-to date. There were two science books for class X i.e. one book is for physics and chemistry for 53 marks and another book for Biology for 27 marks. 2. The TBSE class 10 science books indicated by different name by different book publishers affiliated by TBSE. There was no authorized publisher by TBSE. 3. Units are color coded on the top of the pages in maximum class X science books. Each chapter closes with a unit review.

4.1.1.b. General Structure of TBSE and CBSE Secondary Science Textbook :-

The general content of a textbook takes many aspects into consideration. It is an important for the content of the textbook to match with the curriculum set by the province for the

specific course. The aim and goals should be clearly outlined for the teachers and students. There should be a good combination of the theory and practical of science.

Table 5(b)

CBSE Secondary Science Text Book	**TBSE New Secondary Science Text Book**
1. Science 10 text-book written as per recommendation of NCF-2005. The text is divided into 16 chapters in the same orders as the curriculum documents and quick look through the table of contents shows each specific outcome for the chapter is adequately covered. In CBSE curriculum there is no specific subject wise units/chapters (Physics, Chemistry and Biology) arrangement. 2. The text book has been written by Professors and members of NCERT. 3. Science text-book developed with the increase of the cognitive level and linked with the 11^{th} and 12^{th} class, and improvised knowledge linked to the 8^{th} and 9^{th} class. 4. CBSE mandated specific time frame for each topic to be covered.	1. TBSE Science 10 text-book also written as per recommendations of NCF-2005. The text was divided into subject wise units in the same orders as prescribed in TBSE regulation, 2015 (5 units in physics, 6 units in chemistry and 5 units in Biology). 2. The text book has been written by Professors, College teachers and school teachers of Tripura and West Bengal. 3. Science text-book developed with the increase of the cognitive level and linked with the 11^{th} and 12^{th} class, and improvised knowledge linked to the 8^{th} and 9^{th} class. 4. TBSE didn't provide specific time frame for each unit to be covered.

4.1.1.c.: Textual Material of TBSE and CBSE Secondary Science Textbook :-

Table 5 ©

Sl. No.	CBSE	TBSE
Curriculum Content	1. The textual content of the topic are accurate in all units, authentic and up to date. 2. In the physics and chemistry Syllabus of CBSE chapter name "Management of Natural Resources" missing of topics like Big Dams: advantages and limitations and The Regional Environment. 3. In the CBSE Biology Syllabus has 5 chapters: Life process; Control and Coordination; How do Organisms Reproduce; Heredity And Evolution; and Our Environment	1. The textual content of the topic are accurate in all units, authentic and up to date. 2. The textual content of physics and Chemistry were same as CBSE but in the CBSE chemistry syllabus chapter name "Sustainable Management of Natural Resources" was named as "Conservation of Natural Resources" in TBSE Chemistry Syllabus. 3. In the TBSE Biology Syllabus was also similar as CBSE, but there was a slight difference in the content and design of the

		two chapters namely "Control and co-ordination in animals and plants" and "Reproduction".
Appropriateness of language	The language is appropriate and effective for all section of learners of the class 10 students.	The language of English and Bengali science text-book is appropriate, easy to understand and effective for all section of learners of the class 10 students. (Data Triangulated with teachers' opinions)
Examples/Activity	CBSE text book have the appropriate examples and activities for the concept.	TBSE text book have the more examples and activities for the students in comparison with CBSE.
Representing Ideas	The ideas included all level of the students slow, average and fast learners. The key ideas were clearly mentioned.	The ideas included all level of the students slow, average and fast learners. The key ideas were mentioned clearly but these were less in number in comparison with CBSE.
Promoting students thinking	Each of the chapters helps in developing the logical reasoning	Each of the chapters helps in developing the logical reasoning

and logical reasoning	and to build the scientific attitude among the students. For example chapter like electricity having Ohm's law which is useful in day to day life, and the chapter like magnetic field of current explained how the motor really work in household. It helps in repairing Fan and Motor etc.	and to build the scientific attitude among the students. Activities given in TBSE books encouraged students to develop their thinking and logical reasoning.

4.1.1.d: Virtual Content of TBSE and CBSE Secondary Science Text-book :-

Visuals are incredibly important in analyzing a text-book. It was encouraging motivation for learning. There should be a good mix of realistic, conventional and hybrid images. Visuals should be a good complement to the textual elements of the book. That's why this parameter was used to judge the new books of TBSE.

Table 6(d)

CBSE Secondary Science Text Book	TBSE New Secondary Science Text Book
1. The visual used in NCERT class 10 science text book are of great quality, make use of vivid colors. 2. There is mix of different types	1. The visual used in TBSE class 10 science text book are of good quality, make use of vivid colours and can be found in abundance in

images used in the text-book: Photos, graphs, illustrations and hybrid photos. 3. Each unit opens with an image that relates to the content within. It is designed to begin students thinking about the ideas and concepts that will explored.	the book. 2. There is mix of different types images more used in the text-book in comparison with CBSE i.e. Photos, graphs, illustrations and hybrid photos. 3. Each chapter opens with an image that relates to the content within. Many of the images were used by the students in the province. They would have seen in their everyday life.

The overall appearance of the science book of CBSE and TBSE are appealing attractive and the printing of the science books are clear and beautiful. Both CBSE and TBSE books were written by the practicing teachers and professors, as it should be always preferred that author would be conversant with latest trends and techniques.

4.1.2 Comparative analysis of New Secondary Science Curriculum of TBSE and Old TBSE Science Curriculum

To compare New Science curriculum and text books of TBSE and old TBSE Science Curriculum three steps are taken into consideration

(A) **Physical Structure of New TBSE and Old TBSE Secondary Science Textbook:-**

There were two papers of 100 marks each i.e. Physical Science (Physics and Chemistry) and Biology of 200 marks. The new science curriculum of TBSE Physical Science (including Physics and Chemistry) and Biology is being taught as a single paper of 100 marks (80 theories and 20 Practical) in class X. Under the new science curriculum the biology subject has been clubbed together with physics and chemistry, thus reducing considerable workload for the students.

(B) **Content Selection and Designing of TBSE and Old TBSE Secondary Science Textbook:-**

The Old Secondary school Physical Science syllabus of TBSE included our chapters in Physics (50 marks), eight chapters in Chemistry (50 marks) and six chapters in Biology (100 marks) where as new science curriculum of TBSE includes 5 chapters in physics (27 marks), 6 chapters in Chemistry (26 marks) and 5 chapters in Biology(27 marks) and thus total 80 marks in theory. In the old science curriculum there was no provision for practical in science but in the new science curriculum 20 marks was assigned to science practical.

In the old TBSE science curriculum chapters included in physics were Sound, Current Electricity and Magnetism, Modern Physics and The Universe where as in

the new science curriculum only one chapter (Current electricity and Magnetism) had been adopted from old science curriculum.

The old chemistry book contained 8 units namely Chemical Bonding, Inorganic Acids, Metals and some important chemical components, Electronic concept of oxidation and Reduction; Electrolysis and Carbon and Organic Chemistry where as in new science Chemistry curriculum only two chapters (Carbon Compounds and Metals and some important chemical components) had been adopted from old science curriculum.

In old Biology book 6 units named Cell and Cell division; Reproduction and Heredity; Evolution; Adaptation; Virus, Microbes, Human Diseases and Hygiene; and Environment, Ecosystem and conservation were part of the syllabus but in new Biology curriculum only three chapters (Reproduction and Heredity; Evolution; and Environment, Ecosystem and conservation) had been adopted from old science curriculum.

(C) **Textual Material of New TBSE and Old TBSE Secondary Science Textbook**

The textual content of the topic of physics named Current electricity and Magnetism of Old science curriculum are 28 concepts whereas this chapter of old syllabus divided into two separate chapters in new science text named as Electricity with 11 concepts and Magnetic effects of Current with 14 concepts.

In Chemistry chapter named as Carbon Compounds with 11 concepts and another chapter named Metals and some important chemical components with 21 concepts in

old science curriculum whereas Metals and Non- Metals with 8 concepts and Carbon compound with 12 concepts are in new science (Chemistry) curriculum.

In Biology chapters named Reproduction and Heredity; Evolution; and Environment, Ecosystem and conservation with 15, 7 and 24 concepts respectively in old science curriculum whereas Reproduction with 8 concepts; Heredity and Evolution with 6 concepts and Our Environment with 7 concepts are in new science (Biology) curriculum.

The science text-book comprise of Physics , Chemistry and Biology in single paper of 100 marks in class X and out of 100 marks 80 marks devoted to theory and 20 marks for practical but the old science curriculum of TBSE comprised of two text-books of 100 marks each. Under the new science curriculum the biology subject has been clubbed together with physics and chemistry, thus reducing considerable workload for the students.

Section 2

4.2 Facilities available for Science Teaching

4.2.1 Infrastructural support:

Infrastructural facility is a major factor in the academic achievement of the students. This can be kept under two types, viz. (i) the physical infrastructural support like classroom and furniture, Blackboard etc. and (ii) academic support in the form of instructional materials which influence teaching learning process like laboratory, library etc.

Table 4: Physical Infrastructural support available in the Sample Schools

Status of classroom and Furniture's, Blackboard etc.

Table 6

Sl. No	Areas	Adequate	Manageable	Poor	Total
1	Urban	5 (35.72)	6(42.85)	3 (21.43)	14(100)
2	Rural	2 (16.67)	4 (33.33)	6 (50)	12 (100)
Total		7 (26.92)	10 (38.46)	9 (34.62)	26 (100)

Figures in the parentheses indicate percentage.

With regard to the status of classroom and furniture table 3 indicates that in total 30 percent of schools have adequate, 38 percent schools have manageable and 35 percent schools have

poor status. In general the status of classroom and furniture in both urban and rural areas were good.

4.2.2 (a) Instructional support (Laboratory)

The basic need of teaching science is laboratory and equipment. Table 4(a), 4(b) and 4 (c) describes the availability of laboratory in the sample schools.

4.2.2.1 Availability and use of Science Laboratory in the sample schools

a) Availability of Science Laboratory

Table 7(a)

Sl. No	Areas	Available	Not Available	Total
1	Urban	11 (78.57)	3 (21.43)	14 (100)
2	Rural	4 (33.3)	8 (66.7)	12 (100)
Total		15(57.69)	11 (42.31)	26 (100)

Figures in the parentheses indicate percentage.

So far as the availability of laboratory is concerned only78.57 percent in the urban areas schools and 33.3 percent schools in the rural areas have laboratory in their schools. It is matter of concern that a total of 42.31 percent schools don't have laboratory to teach science.

b) Position of Equipment in the Laboratory

Table 6(b)

Sl. No.	**Areas**	**Adequate**	**Manageable**	**Poor**	**Total**
1	Urban	5 (35.71)	6 (42.86)	3 (21.43)	14 (100)
2	Rural	2 (16..67)	4 (33.33)	6 (50)	12 (100)
Total		7 (26.92)	10 (38.46)	9 (34.62)	26 (100)

Figures in the parentheses indicate percentage.

With regard to the equipment available in the laboratories out of the schools having this facility only 27 percent schools were found to have adequate equipment, 38 percent to have manageable equipment and 35 percent schools having poor equipment. An analysis of the table indicates that 50 percent of the rural schools have a poor status of equipment. However, the positions of equipment in the laboratory of urban schools are found to be more satisfactory than the rural schools.

c) Mode of use of Science Laboratory

Table 6©

Sl. No.	Areas	Doing science practical in the Lab.	Seeing apparatus in the Lab.	Lab. Is not used	Total
1	Urban	3 (21.43)	8 (57.14)	3 (21.42)	14 (100)
2	Rural	2 (16.68)	5 (41.66)	5 (41.66)	12 (100)
Total		5(19.23)	13(50)	8(30.77)	26(100)

(Figures in the parentheses indicate percentage).

With regard to the use of science laboratory, it is clear from the table that a total of 50 percent schools use the laboratory by allowing the students only to see the apparatus. The rate of such experience with apparatus of children is 57 percent in urban areas as against 42 percent in rural areas.

The basic purpose of science laboratory is to do practical/ experiments in it. But the study unfortunately shows that a total of only 19 percent schools allow to do experiment in the laboratory.

Further it is seriously indicated that 35 percent schools laboratory is not used for practical/ experiments.

4.2.2.2 Availability and use of Science Laboratory according to the student sample

In this context it is important to cross check the data on instructional all support collected from students. The student sample was asked to point out whether laboratory facilities were available in their school and if so what was the mode of using the laboratory.

a) Position of Science Laboratory

Table 7(a)

Sl. No.	Areas	Available	Not- Available	No Res.	Total
1	Urban	32 (61.54)	18 (34.62)	2 (3.84)	52 (100)
2	Rural	14 (36.84)	20 (52.63)	4 (10.53)	38 (100)
Total		46 (51.10)	40 (44.44)	6 (6.66)	90 (100)

Figures in the parentheses indicate percentage.

It is clear that a total of 51 percent of the students expressed that laboratory was available in their schools. The percentage of students who were having laboratory facilities was 61.54 percent in urban area schools and 36.84 percent in the rural area schools.

b) Student Involvement in the Laboratory

Table 7(b)

Sl. No.	Areas	Expt. done by students	Expt. done by teachers	Lab. Equipment brought to the classroom	Expt. Neither done nor seen	Total
1	Urban	8 (15.38)	14 (26.93)	20 (38.46)	10 (19.23)	52 (100)
2	Rural	3 (7.90)	8 (21.05)	15 (39.47)	12 (31.58)	38 (100)
Total		11 (12.22)	22 (24.44)	35 (38.90)	22 (24.44)	90 (100)

Figures in the parentheses indicate percentage

With regard to mode of use of laboratory by the students, the responses were classified into four different categories i.e. experiment done by students, experiments done by teachers, Lab. Equipment brought to the classroom and neither any experiment done nor seen.

Students have conducted science experiment in the laboratory by 12.22 percent. Around 24.44 percent students expressed that experiments are done by the teacher in the laboratory. Around 39 percent students have expressed that laboratory equipment is brought to the classroom for doing experiment. It is remarkable to note that in around 24.44 percent of cases, science experiments are not conducted nor any observation of experiment is made in the laboratory despite having laboratory facilities in their schools.

4.2.2 (b) Instructional support (library):

4.2.2.1 (a) Availability and use of Library Books

Table 8(a)

Sl. No.	Areas	Available	Not Available	Total
1	Urban	12 (85.71)	2 (14.28)	14 (100)
2	Rural	5 (41.66)	7 (58.34)	12 (100)
Total		17 (65.38)	9 (34.62)	26 (100)

Figures in the parentheses indicate percentage.

(b) **Mode of use of Library**

Table 8(b)

Sl. No.	Areas	Reading in the library	Issuing books to take home	Books usually not issued	Total
1	Urban	4 (33.33)	3 (25)	5 (41.67)	12
2	Rural	2 (40)	3 (60)	0	5
Total		6 (35.29)	6 (35.29)	5 (29.42)	17 (100)

Figures in the parentheses indicate percentage.

The position of library as a whole is satisfactory in urban areas schools with 85.71 whereas 41.66 percent in rural schools. So far as the use of library by students is concerned around 35 percent schools in total have facility of reading in the library itself. However, in the rural area percentage of schools issuing books to students is more than that of their urban counterparts.

4.2.2.2 Availability and use of Library according to the student sample

A) Position of library

Table 9

Sl. No.	Areas	Available	Not- available	Total
1	Urban	32 (61.54)	20 (38.46)	52 (100)
2	Rural	14 (36.84)	24 (63.15)	38 (100)
Total		46 (51.11)	44 (48.89)	90 (100)

Figures in the parentheses indicate percentage.

With regard to availability of library facility opinion of students was collected. Around 51 percent of students population have expressed that facility of a library is available to them. It is remarkable to note that in around 63 percent rural schools have no library facility.

4.2.3 Academic Support:

The academic support available to students analyzed in the following includes (a) Teacher support (b) Tutorial support.

4.2.3 (a) Teacher support : Teachers support includes academic and professional qualification of teachers , teaching experience and orientation/ refresher courses attended by teachers.

Table 10(i) **Teachers Sample according to Academic Qualification**

Sl. No.	Area	B.Sc. (Bio)	B.Sc. (Pure)	M.Sc.	Ph.D.	Total
1	Urban	20 (54.05)	15 (40.56)	1 (2.70)	1 (2.70)	37 (100)
2	Rural	12 (52.17)	9 (39.13)	2 (8.70)	0	23 (100)
Total		32 (53.33)	25 (41.67)	3 (5.00)	0	60 (100)

Figures in the parentheses indicate percentage.

Table 10(ii) **Teachers Sample according to Professional Qualification**

Sl. No.	Area	CETE	T.Ed.	B.Ed.	M.Ed.	Untrained	Total
1	Urban	16 (43.24)	5 (13.51)	5 (13.51)	2 (5.40)	9 (24.32)	37 (100)
2	Rural	10 (43.48)	4 (17.39)	2 (8.69)	0	7 (30.44)	23 (100)
Total		26 (43.33)	9 (15)	7 (11.67)	2 (3.33)	16 (26.67)	60 (100)

Figures in the parentheses indicate percentage.

Table 10(iii) **Teachers Sample according to attendance in Refresher course**

Sl. No.	Area	Attended	Not-Attended	Total
1	Urban	11 (29.73)	26 (70.27)	37 (100)
2	Rural	7 (30.43)	16 (69.57)	23 (100)
Total		18 (30)	42 (70)	60 (100)

Figures in the parentheses indicate percentage.

With regard to academic qualification of teachers table 8(i) indicates that most of the teachers having B.Sc. degree out of 53.33 percent having B.Sc.(Bio) and 41.67 percent having B.Sc. (Pure).

In total 43.33 percent teachers having Certificate in Elementary Teacher Education (CETE) from IGNOU and 15 percent teachers having T.Ed.(6 months regular course recognized by Tripura University) in both the rural and urban sample in terms of the professional qualification of teachers, also that two courses are not recognized by the NCTE. It is remarkable to note that only 11.67 percent teachers having B.Ed. degree and 26.67 percent teachers have no professional training.

With regard to attendance in Refresher and Orientation courses, overall 30 percent teachers have got opportunity to join it in both the urban and rural sample. This reflects the need of orientation and refresher courses of teachers.

4.2.3 (b) Tuition Support:

Table 11(i): Use of Private Tuition for Science Subject from student's sample

Sl. No	Areas	Use of Tuition	No Use of Tuition	Total
1	Urban	48 (92.30)	4 (7.70)	52 (100)
2	Rural	32 (84.21)	6 (15.79)	38 (100)
Total		54 (88.89)	10 (11.11)	90 (100)

Figures in the parentheses indicate percentage.

Table 11(ii) **Place of Tuition**

Sl. No.	Areas	Own House	Teachers House	School Premises	Total
1	Urban	19 (39.58)	29 (60.42)	0	48 (100)
2	Rural	8 (25)	18 (56.25)	6 (18.75)	32 (100)
Total		27 (33.75)	47 (58.75)	6 (7.5)	80 (100)

Figures in the parentheses indicate percentage.

With regard to use of private tuition overall 88.89 percent students undergo tuition for science subject, so far as the place of tuition is concerned are students own house, teachers house and the school premises. However, only 11.11 percent students responded that they are not undergoing for private tuition.

With regard to place of private tuition majority number of students by 58.75 percent undergoes tuition to teacher's house whereas only 18.75 percent students of rural areas school students undergo free tuition in school premises after normal classroom work.

With regard to attendance in Refresher and Orientation courses, overall 30 percent teachers have got opportunity to join it in both the urban and rural sample. This reflects the need of orientation and refresher courses of teachers.

4.2.4 Overall Facilities available for teaching science as per opinion of the Headmasters:

Table 12

Sl. No.	Areas	Satisfied	Not Satisfied	No Response	Total
1	Urban	3 (21.43)	10 (71.43)	1 (7.14)	14 (100)
2	Rural	2 (16.67)	8 (66.66)	2 (16.67)	12 (100)
Total		5 (19.23)	18 (69.23)	3 (11.54)	26 (100)

Figures in the parentheses indicate percentage.

Table 11 shows the opinion of the headmasters on the overall facilities available for teaching science. It is clear that 69.23 percent headmasters are not satisfied with the facilities for teaching science available in their respective school. Insufficient infrastructure, lack of laboratory room and instruments, and shortage of science teachers were major factors behind their dissatisfaction.

4.2.5 Opinion of Teachers about the new Secondary Science Curriculum:

To study the opinion of the teachers about the new secondary school science curriculum of TBSE, there have been asked 16 questions in the teachers' questionnaire.

Table13: **Teachers opinion**

Sl. No.	Statement	Opinion/ Responses N=60	
		Agree	Disagree
1.	The new science curriculum has introduced more concepts than previous science curriculum.	52 (86.67%)	8 (13.33%)
2.	The students can understand new science curriculum by themselves.	36 (60%)	24 (40%)
3.	The new science curriculum is surely for the betterment of the students.	60 (100%)	0
4.	The students of class X are already matured to receive the new science curriculum.	40 (66.67%)	20 (33.33%)
5.	The students are unable to follow the curriculum prescribed without help of teachers.	46 (76.67%)	24 (23.33%)
6.	New science curriculum can be easily taught even without a laboratory.	4 (6.67%)	56 (93.33%)
7.	The students are allowed to participate in the laboratory.	40 (66.67%)	20 (33.33%)
8.	The students are facing problem with adequate science equipment/ material scarcity in science laboratory.	48 (80%)	12 (20%)

9.	It is difficult to teach the new science curriculum without adequate facilities of laboratory.	50 (83.33%)	10 (16.67%)
10.	The students of class X do the experiment by themselves.	36 (60%)	24 (40%)
11.	Science teacher explaining the science practical facts and concepts.	51 (85%)	9 (15%)
12.	Science books are prepared as per new curriculum.	48 (80%)	12 (20%)
13.	The students of class X must undergo tuition for doing well in science.	34 (56.67%)	26 (43.33%)
14.	Class teaching is enough to enable a student to understand science curriculum.	38 (63.33%)	22 (36.66%)
15.	A science teacher needs to attend refresher course/ orientation course to be competent in science practical and teaching the new science curriculum.	46 (76.67%)	14 (23.33%)
16.	There is no need for any training for teachers to teach the present science curriculum.	21 (35%)	39 (65%)

Analysis of Table No. 13, it revealed that there are very strong positive responses received from the teachers about new science curriculum for betterment of students. Regarding the new science curriculum has introduced more concepts than previous science curriculum, out of 60 teachers, 52 (86.67%) teachers reported there were changes with more concepts in

new science curriculum. About 40 nos. teachers (66.67%) opined that the students of class X are already matured to receive the new science curriculum but 20 nos. teachers reported in the against of the same.

The analysis revealed that 93.33 percent teachers was disagree that new science curriculum can be easily taught even without a laboratory and 66.67 percent teachers reported that the students are allowed to participate in the laboratory. Most of the secondary schools were facing problem with adequate science equipment/ material scarcity in science laboratory. 56 percent teachers favoured tuition for students for science subjects whereas 44 percent spoke against.

With regard to a science teacher needs to attend in Refresher and Orientation courses, overall 76.67 percent teachers wanted to attend this course to be competent in science practical. This reflects the need of orientation and refresher courses of teachers.

4.3 Load of content of the New Science Curriculum:

This section presents data related to (i) content analysis of class X science Text-Book and apparent load of content (ii) opinion of students on the new curriculum.

4.3.1 Content Analysis and apparent load of content:

As already made clear under chapter I the class X Science curriculum was analysed to assess the contend load at secondary level. Total number of 180 periods (63 periods for physics, 63 periods for chemistry and 54 periods for Biology) were made available in the

school syllabus for completion of the Science course for class X. There were 16 chapters in the text-book.

Table14: **Content Analysis of Secondary School Science Text-Book**

Sl. No.	Name of the Topics	Subject	No. of concept introduced	Periods	Marks
1	Electricity	Physics (27 Marks)	11	18	07
2	Magnetic effects of Current		14	14	05
3	Light- Reflection and Refraction		17	14	08
4	Human Eye and Colorful World		06	09	04
5	Sources of Energy		10	08	03
6	Chemical reactions	Chemistry (26 Marks)	12	08	04
7	Acids, Bases and Salts		10	10	04
8	Metals and Non-metals		08	12	06
9	Carbon compound		12	15	06
10	Periodic classification of elements		07	10	03
11	Conservation of natural resources		11	08	03

12	Life Processes	Biology (27 Marks)	06	10	06
13	Control and co-ordination in animals and plants		18	10	06
14	Reproduction		08	15	05
15	Heredity and Evolution		06	15	07
16	Our Environment		07	04	03
Total				180 Periods	80 Marks

The table indicates that there are 16 chapters in the science text-book which are not uniform to each other in terms of the number of concepts, number of periods and marks distribution.

The science text-book comprise of Physics , Chemistry and Biology in single paper of 100 marks in class X and out of 100 marks 80 marks devoted to theory and 20 marks for practical. In total 161 concepts have been introduced in the new book which ranges 06 concepts at the lowest to 17 concepts at the highest in a chapter.

4.3.2 Opinion of the students on the new science curriculum

Students are the consumers of the curriculum in intended for them. It was therefore, thought proper to seek their opinion with regard to the load of content, which is presented in the following table.

Student's opinion to different Science topics in reference to easiness, difficulty, liking and disliking

Table 15

Sl. No.	Name of the Topics	Easiest chapter	Difficult Chapter	Chapter liking	Chapter disliking
1	Electricity	12	18		
2	Magnetic effects of Current	8	15		
3	Light- Reflection and Refraction	2	48		18
4	Human Eye and Colourful World	16	6		
5	Sources of Energy	53	3	40	
6	Chemical reactions	6	16		
7	Acids, Bases and Salts	2	18		
8	Metals and Non-metals	6	8		
9	Carbon compound	48	2	15	
10	Periodic classification of elements	2	45		10

11	Conservation of natural resources	26	1		
12	Life Processes	4	43		20
13	Control and co-ordination in animals and plants	18	6		
14	Reproduction	14	24	3	22
15	Heredity and Evolution	8	15		
16	Our Environment	46	2	12	

Data have been collected from students in terms of topics appearing either easy or difficult to them and topics either liked or disliked by them. Table 9 presents the topic of the Science text-book and their respective position in order of (i) easiness, (ii) difficulty, (iii) liking and (iv) disliking.

4.3.3.1 Opinion of students on easiness and difficulty in Physics topics

Table 16(a)

Sl. No.	Name of the Chapter/Topics	Easiest chapter	Difficult Chapter
1	Electricity	12 (13.33)	18 (20)
2	Magnetic effects of Current	8 (8.89)	15 (16.67)
3	Light- Reflection and Refraction	2 (2.22)	48 (53.33)
4	Human Eye and Colourful World	16 (17.78)	6 (6.67)
5	Sources of Energy	52 (57.78)	3 (3.33)
Total		90 (100)	90 (100)

Figures in the parentheses indicate percentage.

Table 10(a) indicates that the topic appearing the easiest to students is Source of Energy by 57.78 percent. It is followed by topic such as Human Eye and Colourful World, Electricity, Magnetic effects of Current and Light- Reflection and Refraction. On the other hand the most difficult Physics topic pointed out by students is ‘Light- Reflection and Refraction’ by 53.33 percent.

4.3.3.2 Opinion of students on easiness and difficulty in Chemistry chapter/topics:

Table 16(b)

Sl. No.	Name of the Chapter/Topics	Easiest chapter	Difficult Chapter
1	Chemical reactions	6 (6.68)	16 (17.78)
2	Acids, Bases and Salts	2 (2.22)	18 (20)
3	Metals and Non-metals	6 (6.68)	8 (8.89)
4	Carbon compound	48 (53.33)	2 (2.22)
5	Periodic classification of elements	2 (2.22)	45 (50)
6	Conservation of natural resources	26 (28.87)	1 (1.11)
Total		90 (100)	90 (100)

Figures in the parentheses indicate percentage.

Table 10(b) reveals that the topics named Carbon compound appeared easy by 53.33 percent. It is followed by topic such as Conservation of natural resources, Chemical reactions, Metals and Non-metals and Periodic classification of elements. On the other hand the most difficult topic was Periodic classification of elements by 50 percent in Chemistry to most of the students.

4.3.3.3 Opinion of students on easiness and difficulty in Biology topics

Table 16©

Sl. No.	Name of the Chapter/Topics	Easiest chapter	Difficult Chapter
1	Life Processes	4 (4.44)	43 (47.78)
2	Control and co-ordination in animals and plants	18 (20)	6 (6.67)
3	Reproduction	14 (15.56)	24 (26.67)
4	Heredity and Evolution	8 (8.89)	15 (16.66)
5	Our Environment	46 (51.11)	2 (2.22)
Total		90 (100)	90 (100)

Figures in the parentheses indicate percentage.

Table 10(c) indicates that the topic appear the easiest by 51.11 percent to student is Our Environment. It is followed by topic such as ‘control and co-ordination in animals and plants’, ‘Heredity and Evolution’, ‘Life Processes and Reproduction’. On the other hand the most difficult Biological topic pointed out by students is ‘Life Process’ by 47.78 percent.

Causes of easiness and difficulty of topic as pointed out by students

Table 17(a): Causes of easiness

Sl. No.	Areas	Teacher's explanation was satisfactory	Topics were free from complicated facts	Self-preparation was good	It was based on past experience	No Res.	Total
1.	Urban	15	12	6	5	2	52
2.	Rural	12	7	6	5	0	38
Total		27	19	12	10	2	90

Figures in the parentheses indicate percentage.

Table 26(a) indicates that the topics appeared easy to most of the students because of the quality of teachers presentation and explanation of the facts, concepts etc. The next reason for a topic appearing easy to students is its freedom from complicated facts and concepts. The third and fourth reasons are respectively the quality of self-preparation of students and past knowledge and experience of students.

Table 17(b): Causes of difficulties

Sl. No.	Areas	Topic were full of complicated facts	Lack of good self-preparation	Teacher's explanation was not satisfactory	Lack of past experience	No Res.	Total
1.	Urban	16	10	5	8	1	52
2.	Rural	14	8	2	4	2	38
Total		30	18	7	12	3	90

Figures in the parentheses indicate percentage.

Table 26(b) reveals that the topic appeared difficult to most of the students for the complicated facts and concepts. The second, third and fourth reasons for a topic appearing difficult to students as pointed out by them are respectively lack of good self preparation, unsatisfactory presentation and explanation by teachers and lack of past knowledge and experience.

4.4 A wholistic discussion on the study:

The basic objective of the study was to do the appraisal of new science curriculum of Tripura board. The new secondary school science curriculum of TBSE was as standard as National curriculum i.e. CBSE science curriculum. As one of the objectives of the study was to compare the new secondary school science curriculum of TBSE with its old science curriculum, in the old science curriculum there was no provision for practical in science but in the new science curriculum 20 marks was assigned to science practical. Under the new

science curriculum the biology subject has been clubbed together with physics and chemistry, thus reducing considerable workload for the students.

The study has revealed that the load of content in the new science curriculum is not considered as burden by the students and science teachers. Regarding support system namely infrastructure, instructional and academic support. Present study examined the all the supports available to the secondary schools of Tripura to actualize the new science curriculum. The infrastructure support like buildings, laboratory and furniture's etc were found satisfactory level, whereas instructional support and academic support were not found satisfactory. So far as the availability of laboratory is concerned only 78.57 percent in the urban areas schools and 33.3 percent schools in the rural areas have laboratory in their schools. It is matter of concern that a total of 42.31 percent schools don't have laboratory to teach science. This finding should be interpret with caution sounded by Naik (1999) and Dey (2011) that lack of science laboratory may affect the successful implementation of science curriculum and the academic achievement of the students.

In general science teachers of Tripura are found to have a favourable opinion towards the new science curriculum. The science teachers of Tripura have a lesser experience to refresher/ orientation courses in science.

Headmasters of Tripura opined on the overall facilities available for teaching science. It is clear that 69.23 percent headmasters are not satisfied with the facilities for teaching science available in their respective school.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMDENDATION

CHAPTER V

FINDINGS, CONCLUSION AND RECOMMDENDATION

This chapter presents the findings, conclusion and recommendation of the study.

5.1 Restatement of the problem:

Dr. Radhakrishna says, “Science is the major instrument of social change”. According to Miller(1996), “ Ideally learning of science should result in understanding of the contents and processes of sciences, utilization of the scientific knowledge for enhancing public welfare”. Science forms an important part of school curriculum all over the world. That is why much emphasis was put on the teaching of science in NPE (1986) and NCF (2005). Accordingly school science curriculum has been revised and upgraded at the National level. Tripura Board of Secondary Education has followed CBSE and has introduced a new curriculum in the Secondary schools of Tripura. But adequate steps have not been taken from authorities’ portion to provide desirable facilities for teaching of new science curriculum. Some of the teachers feel incompetent and handicapped to teach the new science curriculum satisfactorily. Hence, the study, “**An Appraisal of Secondary School Science Curriculum of Tripura Board of Secondary Education”.**

5.2 MAJOR FINDINGS OF THE STUDY

1. **Findings related to the comparative analysis of secondary science curriculum of TBSE and CBSE**

A. General Content

- The science curriculum of TBSE has been divided into two books. The first book consists of physics and chemistry for 53 marks and the second book Biology for 27 marks (theory examination). While the CBSE science curriculum consisted of only one book leading to 80marks theory examination.
- The TBSE science books bearing different names by different publishers were approved by TBSE. There was no authorized government publisher like SCERT or the board itself. Whereas the CBSE textbooks were published by NCERT.
- In CBSE curriculum the units/chapters were not sequentially arranged. The units in Physics, Chemistry and Biology lap and overlap one another. But the TBSE text was divided into subject-wise units.
- More varied images i.e. Photos, graphs, illustrations and hybrid photos could be discerned in the TBSE science text-books in comparison to their CBSE counterparts.
- The language used in the TBSE science textbooks had been found simpler than CBSE.
- The CBSE science textbook was cost friendly. The TBSE science textbooks were comparatively costlier, since published by private publishers.

- The CBSE and the new TBSE science text-books both were attractively presented and found to be student friendly in terms of graphics and content design.
- CBSE mandated specific time frame for each units in science textbook to be covered. But in the TBSE science curriculum, no such time frame was specified.

B. Textual Content

- The broader content design of physics and Chemistry was same in CBSE and TBSE. But some chapters had been titled with different names. For example, the chapter entitled "Sustainable Management of Natural Resources" in the CBSE chemistry syllabus named as "Conservation of Natural Resources" in the TBSE.
- The TBSE Biology Syllabus was found to be similar with CBSE biology Syllabus, but there was a slight difference in the content and design of the two chapters namely "Control and co-ordination in animals and plants" and "Reproduction".
- TBSE text books had more examples and activities for the students in comparison with the CBSE.
- The TBSE text-books had considerable number of solved example and practice exercises as compared to the CBSE.

2. **Findings related to the comparative analysis of Secondary Science Curriculum of New TBSE and old TBSE**

- The previous science curriculum of TBSE comprised of two text-books i.e. physical science and biology of 100 marks each but in the new science curriculum it is being taught as a single paper of 100 marks (80 theories and 20 Practical).

- Under the new science curriculum, the biology subject had been clubbed together with physics and chemistry, thus reducing considerable workload for the students.
- In the previous science curriculum there was no provision for practical in science but in the new science curriculum 20 marks has been assigned to science practical.
- The previous secondary school physical science syllabus of TBSE included four chapters in physics (50 marks), eight chapters in chemistry (50 marks) and six chapters in biology (100 marks) where as new science curriculum of TBSE includes 5 chapters in physics (27 marks), 6 chapters in chemistry (26 marks) and 5 chapters in biology (27 marks) and thus total 80 marks in theory.

3. **Findings related to the Infrastructural support**

- In terms of infrastructural support to schools i.e. 'pucca' schools, furniture and blackboard, a partial satisfaction with it had been noted. The number of schools with adequate, manageable, poor furniture had been found to be 30 percent, 38 percent and 32 percent respectively.

4. **Findings related to the Laboratory**

- So far as the instructional support like science laboratory is concerned, the study presents a gloomy picture. It was found that only 58 percent of schools had laboratory facilities. The conditions in rural areas were worse.
- In terms of number of equipments, 35 percent of schools were found to be poor, 38 percent schools manageable and 27 percent schools adequate.

- The use of laboratory was mostly in the form of seeing the apparatus in the laboratory rather than experimenting with it.
- In the studied sample, 47 percent of students availed facilities of laboratory in school. Moreover, only15 percent claimed to experience actual experiments with those apparatuses inside the laboratory.

5. **Findings related to the use of Library**

- Only 65 percent of schools in the state had library facilities.
- Only 31 percent of students were allowed to carry home the library books.
- Facility of reading in the library was available only in 30 percent of the schools. It was a matter of concern that in 39 percent schools, books are normally not issued.

6. **Findings related to the Academic support**

a. Teachers Qualification and Training:

- Almost 95 percent of the teachers had been found to possess B.Sc. degree which is the basic qualification for secondary school teachers
- A dismal number of just of 12 percent teachers had B.Ed. degree
- 43.33 percent of in service teachers had undertaken CETE from IGNOU and15 percent of in service teachers had certificates in T.Ed.(6 months regular course recognized by Tripura University) as mandated by the School Education Department. CETE and T.Ed were however not recognized by the NCTE.
- The study revealed that there is a need for providing refresher courses, orientation courses on science practical and in-service training to the teachers, especially from rural areas.

b. Use of Tuition

- The study revealed that eighty nine percent students depend on private tuition for science. Most of the students were found to be taking tuition for science in teacher's home.

7. **Findings related to the overall facilities available for teaching science as per opinion of the Headmasters**

- With regard to overall facilities available for teaching science, around 70 percent of the headmasters were not satisfied with existing scenario. Insufficient infrastructure, lack of laboratory room and instruments, and shortage of science teachers were major factors behind their dissatisfaction.

8. **Findings related to the attitude of teachers towards new science curriculum**

- The study revealed that there are very positive responses received from the teachers about new science curriculum.
- About 86.67% teachers reported that the new science curriculum incorporated more concepts in comparison with the old curriculum.
- 66.67 percent teachers reported that the students were allowed to participate in the laboratory. The secondary schools were facing problem with adequate science equipment/ material scarcity in science laboratory and this was directly co-related to the participation of students in laboratory experiments.
- Overall 76.67 percent teachers wanted to attend Refresher and Orientation courses to be competent in science practical.

9. **Findings related to the load of content of the New Science Curriculum from students**

- An analysis of the content shows that the sixteen(16) chapters presented in the new science text book are not uniform to each other in terms of the number of concepts and number of the marks distribution in physics, chemistry and biology.
- So far as load of content in the new science curriculum is concerned, it is not considered to be a burden by students, science teachers and headmasters.
- Students perceived that certain contents in physics, chemistry and biology were easy but some topics were difficult.
- A study of the opinion of the students reveals that science is the second best subject liked by students.

5.3 CONCLUSION

The present study shows that the new curriculum is not considered to be a burden by the teachers as well as the students. The present study also shows that the laboratory facilities of teaching science in secondary schools of the state are very poor. This brings in the question of alternative approaches to teaching science which may include use of no cost and low cost teaching aids, use of improvised science equipment etc. It has been found that the new science curriculum of TBSE with more examples, activities and exercise woks makes it more interesting in comparison to the CBSE science curriculum. It has further been found that while the old TBSE syllabus was burdensome and quite lengthy with topics that the students could not relate to, there was a demand for new curriculum that would

fulfill the gaps and lapses. It also found that the teachers didn't have minimum professional eligibility of B.Ed degrees. This in turn affects the teaching learning process and is a big concern that the government must act upon.

The dynamics of curriculum development process demand participation of the students, teachers and members of the society. It also requires the organizers of curriculum to take into consideration both the immediate and distant needs of the society. It is thus mandatory on the part of teachers, students and member of the society to be familiar with the modus operandi of the curriculum. But ironically in Tripura neither the students nor the teachers in general nor the members of the community get a scope to participate in the process of development of curricula. So is the case with the new science curriculum. The most unfortunate part is that teachers themselves do not know as to where they can participate during the process of curriculum development. The curriculum is the handy work of the experts of Tripura Board of Secondary Education, SCERT, some selected professors of science department and a few privileged teachers and this has to be accepted by teachers as well as students. That is why the curriculum does not take into consideration the poor status of laboratory facilities or lack of exposure of rural teachers to the new developments in the concerned field.

5.4 RECOMMENDATIONS

- Curriculum planning should include all the basic elements of a curriculum namely situation, objectives, content, method and evaluation.
- The students, teachers and community members should be involved in framing the curriculum.
- Teachers' Handbook and Practical Manual for secondary school teachers' should be provided as they can exert a considerable influence on how the course is taught.
- The possible methods of teaching should be suggested along with the presentation of the content.
- Every school should have library and laboratory facilities. Without science practical, science curriculum becomes boring and burdensome.
- Every school must have qualified science teachers with professional training like B.Ed. and D.l.Ed. in secondary school level.
- Uniformity should be maintained in presentation of the new concepts and if required concept should be presented in a progressive order.
- A text book of science should adequately be illustrated to make the materials self-explanatory.
- There should be a process of continuous research and feedback to improve upon the existing curriculum.
- Teacher's education programmes like refresher and orientation course should be planned to enhance teachers' competencies in executing the curriculum potential.

5.5 SUGGESTIONS FOR FURTHER STUDY

The present study is a holistic appraisal of the new science curriculum in the secondary schools under Tripura Board of Secondary Education.

- The present study had not included in its scope the work load of science teacher, principles of text book preparation, role of school supervisor and administrators, guidance and counseling activities, training need in evaluation technique. Hence there is a wide scope of research in the area of curriculum development, specially the science curriculum.
- Research should be carried out on science curriculum in the higher secondary and primary level.
- Extensive study should be conducted on the preparedness of the teachers and acceptability of the upgraded curriculum to both students and teachers.
- Most of the primary school teachers have a high school certificate qualification which is inadequate to teach the modern development in sciences. A study may be proposed to ascertain the training needs of primary school teachers teaching science.
- Comparative study may be done about the present scenario of science curriculum between different states of North-Eastern region.
- At the end, interdisciplinary approach should be welcomed in curriculum research. Studies may be attempted to find out mutual relationship between sciences, science related and other subjects.

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BIBLIOGRAPHY

1. A. E. Bestor. (1995). *The restoration of learning: A program for redeem the unfulfilled promise of American Education*. New York: Knopf.
2. A. R. Deshpande. (1992). *An enquiry into the development of curriculum in mathematics at the secondary stage of education in Maharashtra State*. Maharastra.
3. Abd-El-Khalick, F.,&BouJaoude, S. (1997).*An exploratory study of the disciplinary knowledge of science teachers*. In P. Rubba, P. Keig, & J. Rye (Eds.), Proceedings of the 1997 Annual International Conference of the Association for the Education of Teachers in Science (pp. 89-133). Pensacola, FL: Association for the Education of Teachers in Science.
4. Belth, K. (1965). *Education as a Discipline*. Boston: Allyn and Bacon, Inc.
5. Biswas, A. (1989). *Learning disabilities in critical thinking in some areas of physical science: diagnosis and prevention.* Ph.D (unpublished), University of Kalyani, Edn.
6. Christina V. Schwarz, Kristin L. Gunckel, Ed L. Smith,. (2007). "Helping elementary preservice teachers learn to use curriculum materials for effective science teaching." *SCIENCE TEACHER EDUCATION*
7. D.K. Kar. (1986). *A study of relationship between attitude and achievement in general science of class IX students of Cuttack City* Ph.D. Eduction..Utkal University, Cuttack.Unpublished Ph.D. Thesis.
8. Digrumurti.(1996). Evaluation study of Andhra Pradesh 'X' class Biological Science Text-Book.*The Eduational Review, Vol.CII, No.10.*
9. H Taba. (1962). *Curriculum Development: theory and practice*. New York: Harcourt Brace Jovanovic.

10. Huma Kidwai, Denise Burnette, Shreyanka Rao, Seema Nath, Monisha Bajaj, & Nirupam Bajpai. (2013). The Policy and Practice of Public Primary Curriculum in India. *WORKING PAPERS SERIES, Paper No. 11*(August).
11. J.C. Banarjee. (1981). *Primary Education Renewal and Developmental Activities in Community Education and Partcipation*.Agartala, Tripura: State Primary Curriculum Department Cell.
12. L Tanner, D. T. (1975).*Curriculum Development: Theory into Practice*. New York: Macmillan.
13. Lachiver, G., & Tardif, J. (2002).Fostering and Managing Curriculum Change and Innovation.*Proceedings - Frontiers in Education Conference*, *2*, F2F-7.https://doi.org/10.1109/FIE.2002.1158168
14. Majumdar, T.R. (1988). *Secondary school education in calcutta: a study of the total system*. Unpublished Ph.D. thesis.Calcutta University.
15. Mehdi, Baqer (1988) "*Instructional development and social objectives of education at the secondary stage*"
16. S. Maclure. (1971). *Styles of Curriculum Development*. USA: Allerton Park.
17. A. Nicholls, S. N. (1972). *Developing a Curriculum a practical Guide*. Landon: Allen & Unwin.
18. H. Taba. (1970). *Curriculum Development Theory and Practice*. New York: Atlanta.
19. R.W.Tyler. (1949). *Basic Principles of Curriculum and Instruction*. Landon: The University of Chicago Press.

20. H. E. Mitzel. (1982). *Encyclopedia of Educational Research* (5th Edition). New York: MacMillan.

21. MESW. (1953). *Report of Secondary Education Commission 1952-53*. New Delhi: Ministry of Education and Social Welfare.

23. B.P. Darji. (1967). *Curriculum Development in Secondary Schools*. Baroda: A Report of All India.

24. Mohanty, S. (1988). "*An Appraisal of teaching science in the high schools of cuttack city*" ; Ph.D. Thesis Utkal University, 1988. 5th survey of Educational Research.

25. N.B. Biswas. (1986). *A study of the curriculum for primary education in Bangladesh.* Ph.D. Edn. M.S.U University.Unpublished Ph.D. Thesis.

26. National Council of Educational Research and Tranning (NCERT).(1991). *Science and mathematics education for the future*. NCERT, New Delhi.

27. National Council of Educational Research and Tranning (NCERT).(1988). *National Curriculum for elementary and secondary education- a framework*. NCERT, New Delhi.

28. A.H.U. Talukdar. (1993). Problems of teaching and learning of integrated science in Borne state of Nigeria. *A Quarterly Journal of Science Education, Vol.XCII. No.3*.

29. National Policy of Education(NPE). (1986, Rev. 1992).*National Policy of Education*.Ministry of Human Resource and Development, Department of Education, New Delhi.

30. NCERT(2011). National study on ten year School curriculum. Retrieved from http://ncert.nic.in/rightside/links/national_curriculum.pdf

31. Prakash,Vidhya.(1991) "*An investigation into curriculum policies, planning and their implementation at the primary school level in Delhi during 1966-76*." Ph.D, Edu.JamiaMilliaIslamia.

32. L. Brady. (1995). *Curriculum Development* (5th Edition). Sydney: Prentice-Hall.

33. Radhamonyamma. (1988). *Evolving instructional techniques appropriate to the development of scientific skills among secondary schools in Kerala*. An unpublished Doctoral thesis in Education University of Kerala. Thiruvananthapuram, Kerala.

34. Ryder, J., & Banner, I. (2013).School Teachers' Experiences of Science Curriculum Reform.*International Journal of Science Education*, *35*(3), 490–514. https://doi.org/10.1080/09500693.2012.665195

35. W. J. Best. (n.d.). *Research in Education*. New Delhi: Prentice Hall of India Private Ltd.

36. Singh, U.S. (1977). *Development of a curriculum in science for secondary Schools in the State of Maharashtr*a, Ph.D. Edu., Bom.University.

37. T. Hussen. (1985). *The International Encyclopaedia of Education*. Newyork: Pergamon Press.

38. TBSE (2016). Notice on new syllabus for class ix and x. Retrieved from http://tbse.in/new/PDF/Notice_29_03_2016.pdf

39. TBSE (2016).Syllabus of class-x. Retrieved from http://tbse.in/new/syllabus.html

40. NCERT (2006).*Strengthening a national system of education in a pluralistic society*. Retrieved from http://www.ncert.nic.in/departments/nie/dse/deptt/activities/pdfs/Strengthening_Science_finalised.pdf

41. NCERT(2005).National curriculum framework 2005. Retrieved from http://epathshala.nic.in/programmes/national-curriculum-frameworks/

42. MHRD(1998).National policy on education, 1986 (as modified in 1992). Retrieved fromhttp://mhrd.gov.in/sites/upload_files/mhrd/files/document-reports/NPE86-mod92.pdf

43. CBSE(2006). Syllabus of class X. Retrieved from https://www.cbsesyllabus.in/class-10/science-class-10-syllabus

44. NCERT. (2006). *Science Textbook for Class X*. New Delhi: National Council of Educational Research and Training (NCERT).

45. NCERT. (2006). *Science Textbook for Class IX*. New Delhi: National Council of Educational Research and Training (NCERT).

PARTICULARS OF THE CANDIDATE

NAME OF CANDIDATE : ASHIM DATTA

DEGREE : M.Phil.

DEPARTMENT : Education

TITLE OF DISSERTATION : An Appraisal of Secondary School Science Curriculum of Tripura Board of Secondary Education

M.Phil. REGISTRATION NO. & DATE : MZU/M.PHIL./482 of 26/04/2018

DATE OF ADMISSION : 17/08/2017

APPROVAL OF RESEARCH PROPOSAL :

1. BOS : 23.04.2018
2. SCHOOL BOARD : 26.04.2018
3. DUE DATE OF SUBMISSION : 31.07.2019
4. EXTENSION (If any) : Yes, One Semester (Till, 31/07/2019)

Head

Department of Education

BIODATA

Name: Ashim Datta

Father's Name: Bisweswar Datta

Address: Village- Ramnagar, PO- Agartala, DIST- West Tripura, PIN- 799001

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Educational Qualification:

Class	**Board/ University**	**Year of Passing**	**Division/Grade**	**Percentage**
X	Tripura Board of Secondary Education	1997	I	68.44
XII	Tripura Board of Secondary Education	1999	I	70.10
B. Sc	Tripura University	2002	II	50.83
M.Sc. Physics	Tripura University	2004	I	60.30
B.Ed	Tripura University	2006	I	68.10
M.Ed	Tripura University	2007	I	61.83
UGC-NET Education	UGC	June-2015	Qualified	

Other Relevant Information:

Seminars:

Presented a paper titled "Awareness about Right to Information of Secondary School Students of Tripura" in IQAC, UGC sponsored National Seminar "Right to Information in Indian Democracy: Conception, Perception, and Future Road-Map" organized by AMBS College, Amarpur, 24-25 August, 2018.

Workshops:

Attended a workshop- cum Training Program on "Research Ethics, Plagiarism and Reference Management" organized by Department of Library and Information Science, Mizoram University, Aizawal and INFLIBNET Centre Gandhinagar, Gujarat, 11-13 April,2018.

APPENDICES -A

QUESTIONNAIRE FOR THE STUDENTS

Dear Students,

Please feel free to respond, as it is not your examination. Kindly read it carefully and try to fill up it. If you find any trouble you may take the help of your teachers.

Name of the students:_____

Name of the school: _____

Class: _____ Age: _____ Boy/ Girl: _____

Total marks obtained in the last examination _____

Marks obtained in the subject of science in last examination _____

Questionnaire

1. Write the name of the subject which you like the most_____

2. The name of your school subjects are given below: First you mention the name of the subject what you like the most by marking (✓) in the brackets. Likewise write the names of other subject in a descending order i.e. (1,2,3,4,5)

   English ( ) Bengali / Kokborok ( ) Science ( ) Mathematics ( ) Social Studies ( )

3. Do you avail private tuition in Science? Yes/ No

4. If yes, where do you avail it?
   i) At own home_____
   ii) Teacher's home/Coaching centre_____
   iii) In the school _____
5. How many hours do you spend for reading science in tuition?
   i) In the morning _____
   ii) In the evening_____

6. Is there any science laboratory in your School? Yes / No

7. If yes, please put tick mark(✓) in the bracket against the appropriate answer.

   I) Do you experiment yourself in the laboratory? ( )

   II) Your teacher takes the help of experiment and use apparatus while taking class in the laboratory. ( )

   III) Your teacher comes to the class with science apparatus to demonstrate. ( )

   IV) Neither you nor your teacher do experiment and observation. ( )

8. What classroom activities are performed by your science teacher in teaching science?

   i) Teacher demonstrates and explains facts. Yes /No

   ii) Teacher explains facts and concepts. Yes / No

   iii) Experimentdone by students. Yes / No

   iv) Teacher dictates and give notes. Yes ?No

   v) Student read out the books. Yes ?No

   vi) Teacher read out the books. Yes ?No

9. Is there library in your school? Yes / No

10. If yes, what are the types of book issued to you?

    i) Course Book ( )

ii) Story Book ( )

iii) Science reference book ( )

iv) News Daily ( )

v) Science Magazine ( )

11. Mention the most difficult chapter and topic of your class X Science Curriculum.

Physics_____

Chemistry_____

Biology_____

12. Please mention by putting a tick mark(✓) against the appropriate reason which makes it difficult.

i) Due to complex facts. ( )

ii) Teachers had not taught properly. ( )

iii) You had not read it well. ( )

iv) You had less capacity to grasp. ( )

v) Any other (please write below)

---

13. Write the name of easiest chapter of your class X Science Curriculum.

Physics_____

Chemistry_____

Biology_____

14. What are the probable causes of its easiness? Please put tick mark (✓) against appropriate box.

    i) Due to less complex fact. ( )

    ii) Teachers had taught well. ( )

    iii) You had read it well. ( )

    iv) You had prior ideas ( )

    v) Any other (please Mention)

    _____

15. Write the name of the chapter and topic which you like the most in Class X Science Curriculum.

    _____

    _____

16. Write the name of the chapter and topic which you donot like at all.

    _____

    _____

17. Are you capable of explaining to your juniors any chapter of Class X Science text? Yes / No

    If yes, write down the name of chapter & topic

    _____

18. Is there any smart class and science related teaching aids available in the school?

Yes / No

If yes,

i) Teachers had used teaching aids. Yes / No

ii) Type of teaching aids used in science teaching like model, chart, audio-visual

etc._____

iii) Teachers had used computer smart class. Yes / No

iv) Any other thing…….

……..

19. You can write below anything about new science curriculum which is not included in above mentioned points.

APPENDICES –B

QUESTIONNAIRE FOR TEACHERS

Dear Sir/Madam

Questionnaire is completely meant for research purpose, relating to new science curriculum and facilities for teaching science. Facts collected from you through this instrument shall be treated statistically in strict confidence. Please respond freely and frankly.

First furnish your personal data as required in this form below and then move to the questionnaire part of it. Please respond as per the direction is given with each unit.

Thank you.

Personal Data

Name :_____
Address:_____

Name of the School:_____

Area: Rural/ Urban: _____
Qualification:_____

Age:_____ Sex:_____

Teaching experience as a Science Teacher: _____

Number of Science refresher / orientation course attended: _____

Number of Seminar/ Workshop attended:_____

Any other professional development activity_____

DIRECTION: Find below some statements regarding Science Curriculum. Please say whether you Agree or Disagree by putting a tick mark (✓) against the statement.

Sl.No.	Statement	Opinion	
		Agree	Disagree
1.	The new science curriculum has introduced more concepts than previous science curriculum.		
2.	The students can understand new science curriculum by themselves.		
3.	The new science curriculum is surely for the betterment of the students.		
4.	The students of class X are already matured to receive the new science curriculum.		
5.	The students are unable to follow the curriculum prescribed without help of teachers.		
6.	New science curriculum can be easily taught even without a laboratory.		
7.	The students are allowed to participate in the laboratory.		
8.	The students are facing problem with adequate science equipment/ material scarcity in science laboratory.		
9.	It is difficult to teach the new science curriculum without adequate facilities of laboratory.		
10.	The students of class X do the experiment by themselves.		
11.	Science teacher explaining the science practical facts and concepts.		
12.	Science books are prepared as per new curriculum.		
13.	The students of class X must undergo tuition for doing well in science.		
14.	Class teaching is enough to enable a student to understand science curriculum.		
15.	A science teacher needs to attend refresher course/ orientation course to be competent in science practical and teaching the new science curriculum.		
16.	There is no need for any training to teach the present science curriculum.		

APPENDICES -C

QUESTIONNAIRE FOR THE HEADMASTER

Dear Sir/Madam,

This questionnaire has 10 items, relating to new science curriculum and facilities for teaching science in your school. Your valuable opinion is solicited on each of the items. Kindly go through each item carefully and give your response in the given space. Your opinion will be kept confidential and shall be used for research statistically for further improvement of teaching of science.

1. Name of the School_____
2. Area: Rural/Urban_____
3. Number of science teacher_____
4. Academic and Professional qualification of science teachers:

   Qualification:

   B.Sc(Pure)_____B.Sc(Hons)_____M.Sc._____Ph.D_____

   Professional Qualification:

   CETE_____T.Ed._____B.Ed._____M.Ed._____
5. Arrangement taken for science teachers to familiarize new Science curriculum. (Training/ orientation course/workshop etc.)

   _____
6. How many science teachers have attended refresher/orientation course on the New Science Curriculum_____
7. Is there any secondary science laboratory in your school? Yes/ No

   If yes

   a) How it is equipped? Adequate/ Manageable/Poorly

   b) How is the laboratory used by the students?

   i) seeing apparatus ii) Doing practical iii) Laboratory is not used.

c) Total number of rooms allotted for science laboratory for class IX and X students._____

d) Number of science practical classes allotted for class X students in a week. _____

e) Number of students at a time can do science practical._____

f) Time allowed for science practical per day. _____

8. How do you feel about the new science curriculum?

a) It is necessary burden on the students. Yes/ No

b) It is unnecessary burden on the students. Yes/ No

c) It is not at all burden. Yes/ No

d) Any other (Please Mention) _____

9. Is there a library in your school? Yes/ No

If Yes

a) What is the number of science books?
i) Text Books_____
ii) Refresher Book_____
iii) Journals_____
iv) Others_____

b) What kind facilities?
i) Reading in the library
ii) Issuing books to take home.
iii) Books usually not issued.

10. Are you satisfied with the existing facilities available in your school in teaching science? Yes/ No

11. Any other issue, in your opinion, to be solved on urgent basis.

APPENDICES –D

TRIPURA BOARD OF SECONDARY EDUCATION

SUBJECT: SCIENCE (Class-X) SYLLABUS (Effective from 2017)

COURSE STRUCTURE (SYLLABUS): THEORY: One Paper
Time: 3 Hours Total Marks: 80
Group - A [Physics & Chemistry] and Group - B [Biology]

Sl. No.	Name of the Topics	Subject
1	Electricity	Physics (27 Marks)
2	Magnetic effects of Current	
3	Light- Reflection and Refraction	
4	Human Eye and Colourful World	
5	Sources of Energy	
6	Chemical reactions	Chemistry (26 Marks)
7	Acids, Bases and Salts	
8	Metals and Non-metals	
9	Carbon compound	
10	Periodic classification of elements	
11	Conservation of natural resources	
12	Life Processes	Biology (27 Marks)
13	Control and co-ordination in animals and plants	
14	Reproduction	
15	Heredity and Evolution	
16	Our Environment	

Syllabus for Group - A

Physics

Unit I : Electricity (18 Periods) (07 Marks)

Electric current, potential difference and electric current. Ohm's law; Resistance, Resistivity, Factors on which the resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its applications in daily life. Heating effect of electric current and its applications in daily life. Electric power, Interrelation between P, V, I and R.

Unit II : Magnetic effects of Current (14 Periods) (05 Marks)

Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's Left Hand Rule. Electromagnetic induction. Induced potential difference, Induced current. Fleming's Right Hand Rule, Direct current. Alternating current: frequency of AC. Advantage of AC over DC. Domestic electric circuits.

Unit III :Light - Reflection and Refraction (14 Periods) (08 Marks)

Reflection of light by curved surfaces; Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, mirror formula (Derivation not required), magnification. Refraction; Laws of refraction, refractive index. Refraction of light by spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification. Power of a lens; applications of spherical mirrors and lenses.

Unit IV : Human Eye and Colourful World (09 Periods) (04 Marks)

Functioning of a lens in human eye, defects of vision and their corrections; Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

Unit V : Sources of Energy (08 Periods) (03 Marks)

Different forms of energy, conventional and non-conventional sources of energy: Fossil fuels, solar energy; biogas; wind, water and tidal energy; Nuclear energy. Renewable versus non-renewable sources of Energy.

Chemistry

Unit VI : Chemical reactions (8 Periods) (04 Marks)

Chemical Equation, Balanced chemical equation, implications of a balanced chemical equation, types of chemical reactions: combination, decomposition, displacement, double displacement, precipitation, neutralization, oxidation and reduction.

Unit VII : Acids, Bases and Salts (10 Periods) (04 Marks)

Their definitions in terms of furnishing of H+ and OH– ions, General properties, examples and uses, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of sodium hydroxide, Bleaching powder, Baking soda, washing soda and Plaster of Paris.

Unit VIII : Metals and Non-metals (12 Periods) (06 Marks)

Properties of metals and non-metals, reactivity series, formation and properties of ionic compounds, basic metallurgical processes, corrosion and its prevention.

Unit IX : Carbon compounds (15 periods) (06 Marks)

Covalent bonding in carbon compounds. Versatile nature of carbon. Homologous series. Nomenclature of carbon compounds containing functional groups (halogens, alcohol, ketones, aldehydes, alkanes and alkynes), difference between saturated hydrocarbons and unsaturated hydrocarbons. Chemical properties of carbon compounds (combustion, oxidation, addition and substitution reaction). Ethanol and Ethanoic acid (only properties and uses), soaps and detergents.

Unit X : Periodic classification of elements (10 periods) (03 Marks)

Need for classification, Modern Periodic table, Gradation in Properties, Valency, Atomic number, metallic and non-metallic properties.

Unit XI : Conservation of natural resources (8 Periods) (03 Marks)

Management of natural resources. Conservation and judicious use of natural resources. Forest and wild life, coal and petroleum conservation. Examples of People's participation for conservation of natural resources.

The Regional environment: Big dams: advantages and limitations; alternatives if any.
Water harvesting. Sustainability of natural resources.

Syllabus for Group - B

Biology

Unit I : Life Processes (10 Periods) (6 Marks)

'Living being', Basic concept of Nutrition, Respiration, Transport and excretion in plants and animals.

Unit II : Control and Co-ordination in animals and Plants

(10 Periods) (6 marks)

Tropic movements in plants- Phototropism, Geotropism, Hydrotropism, Chemotropism; Immediate response to stimulus; Introduction to plant hormones- Auxin, Gibberellin, Cytokinin, Abscisic acid (ABA)-their sources and function in relation to growth and movement ;Control and co-ordination in animals: Nervous system; Voluntary, involuntary and reflex action; Chemical coordination- Animal hormones.

Unit III : Reproduction (15 periods) (5 marks)

Reproduction in animals and Plants (asexual and sexual); Reproductive health- Need and methods of family planning; Safe sex vs. HIV/AIDS; Child bearing and women's health.

Unit IV : Heredity and Evolution (15 periods) (7 marks)

Heredity; Mendel's contribution: Laws of inheritance of traits; Sex determination: Brief introduction; Basic concepts of Evolution.

Unit V : Our Environment (4 periods) (3 marks)

Ecosystem, Environmental problems, Ozone depletion, waste generation and their solutions, biodegradable and non-biodegradable substances.

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