

EFFECTIVENESS OF A PROGRAMME TO ENRICH LEXICAL CONTENT IN BIOLOGY AT THE SECONDARY LEVEL

**A
Dissertation Submitted
to the
Sardar Patel University, Vallabh Vidyanagar
in partial fulfillment of the Requirement for the
Degree of Master of Education**

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April, 2017**

CERTIFICATE

This is to certify that the work incorporated in the dissertation bearing the title **EFFECTIVENESS OF A PROGRAMME TO ENRICH LEXICAL CONTENT IN BIOLOGY AT THE SECONDARY LEVEL** submitted by **Anupriya Pandey** comprises the result of independent and original investigations carried out by him. The materials that have been obtained (and used) from other sources have been acknowledged in the dissertation.

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Master of Education

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CHAPTER – I

INTRODUCTION

1.0 Introduction

” The more one considers the matter, the more reasonable it seems to suppose that lexis is where we need to start from, the syntax needs to be put to the service of words and not the other way round.” (Widdowson in Lewis, 1993: 115)

Teachers provide the knowledge, develop skills and attitudes among students to learn and modify their behaviour. The students at school learn subjects of different nature. These subjects help them to develop their language ability, scientific attitude, computation, computer literacy and so on.

Science education is the mixture of Physics, Chemistry and Biology. An essential element of science instruction is content literacy. Teachers need to address vocabulary in order to improve literacy specific to science subject. Learning vocabulary during independent reading is very inefficient for students with reading difficulties, vocabulary and word learning skills must be taught. (Jitendra, Edwards, Sacks, and Jacobson, 2004)

Biology is a scientific subject that has its origins in the need of human beings to know more about themselves and the world around them. It is the theory of life, its origins, evolution, forms and conditions. Biological contexts are often complex and studied at various levels, from the individual molecule to global ecosystems. Aspects of Biological science range from the study of molecular mechanisms in cells, to the classification and behaviour of organisms, how species evolve and interaction between ecosystems.

Students learning Biology at Secondary and Higher Secondary Schools found it difficult. As a result their understanding of the concepts has become minimal. The major reason behind this issue is due to lack of conceptual understanding about Biological vocabulary. In order to understand the concepts of any field of knowledge and education, it is necessary to use appropriate languages and specific ways of explaining, relating, representing, debating and communicating them. The practices of reading and writing which are essential to the learning of any discipline cannot be learned until the student experiences situations. (Carlino, 2005). The teachers of

Biology had been focused for many years on helping students to utilize their written words in an interpretative way, and not as a labeling system that involves an endless list of processes, structures, and molecules. (Sutton, 2003). Thus, difficulties in learning Biology affect students' achievement. In addition, the difficulty makes students less motivated to learn the subject. As a result, it is hard for them to achieve a good result at their studies. These difficulties are caused by misconceptions, finding relation between Biology topics and the nature of the topic in general. For example, students do not understand the structure of the chromosome in a cell nucleus and its role in Genetic activities (Cimer, 2012; Kubika-Sebitosi, 2007). Therefore, it is hard for the student to learn it since they do not have the skill to learn the specific topics.

There are many research studies that are conducted to find solutions for the difficulty in learning Biology. In order to learn Biology effectively, students have to make connections between different topics (Law & Lee, 2004). Further, they have to be able to answer any question within their learning activities. This is the skill to produce and validate ideas (Lawson, 2001, Mumford, 2010). Some students do not have the skills which makes them have trouble studying Biology. The student struggle is caused by their inability to describe the concepts of Biology and they need skills to learn Biology. They have to be trained to think, describe and evaluate concepts. Therefore, they need to think creatively, since creativity is a skill to formulate a problem, find out an answer, evaluate and disseminate it to others (Torrance, 1969). Students who have the skill will have an advantage to understand the concept, because they can evaluate ideas and produce solutions for actual problems.

Without some knowledge of vocabulary, neither language production nor language comprehension would be possible. Thus the growth of vocabulary knowledge is one of the essential pre-requisites for language acquisition and this growth of vocabulary knowledge can only be possible when teachers employ effective vocabulary teaching and learning strategies.

1.1 Making Sense of Learning Biology

Science time in schools is often limited, and as a result teachers find it difficult to include science vocabulary instruction to help students make sense of text. In

addition, teachers are often eager to teach content, and consequently provide only a brief introduction of science terms.

Through hands-on inquiry instruction, students can develop context-based content knowledge along with language development. Lee, Buxton, Lewis, & LeRoy identify inquiry-based Science instruction as beneficial to students in the following ways: a) students participate in activities as they learn vocabulary, b) students work collaboratively and interact with others about Science content, and c) hands-on activities offer students written, oral, graphic, and kinesthetic forms of expression. Coupled with science activities, intentional and explicit vocabulary instruction can benefit vocabulary and literacy development as they learn Science content. As students combine science experiences with discussions of words' uses and meanings, their vocabulary and content knowledge can grow.

In order for students to develop scientific literacy, they need to gain a knowledge of Science content and practice scientific habits of mind. Knowing Science vocabulary supports the development of these understandings. As Wellington and Osborne point out, "Science teachers are (among other things) language teachers."

By using scientific terms and phrases during Science activities, Science educators can model scientific thinking and questioning, including the doubts and dilemmas that are part of making sense of the world. The more opportunities we provide for students to experience scientific endeavors, the more natural their scientific talk will develop. Teachers can maximize these opportunities by beginning with very young students.

1.2 Concept of Biology

The Science which deals with the study of living objects is called Biology, literally meaning "**the study of life**". Biology is such a broad field, covering the minute workings of chemical machines inside our cells, to broad scale concepts of ecosystems and global climate change. Biologists study intimate details of the human brain, the composition of our genes, and even the functioning of our reproductive system. Biology is the science of life. Biologists study the structure, function, growth, origin, evolution and distribution of living organisms. There are generally considered

to be at least nine “umbrella” fields of Biology, each of which consists of multiple subfields.

- Biochemistry: the study of the material substances that make up living things
- Botany: the study of plants, including agriculture
- Cellular biology: the study of the basic cellular units of living things
- Ecology: the study of how organisms interact with their environment
- Evolutionary biology: the study of the origins and changes in the diversity of life over time
- Genetics: the study of heredity
- Molecular biology: the study of biological molecules
- Physiology: the study of the functions of organisms and their parts
- Zoology: the study of animals, including animal behavior

Biology is needed to mankind ever since the origin of man. Therefore, this branch of Science stands first in order of studies in compared to other branches of Science. Since, origin of life man is eager to know various phenomenon of life processes such as health, diseases, birth, growth and death. However, man depends on plants and animals for their food, shelter clothing and so on which are immediate needs of life, coming from Biology.

1.3 Nature and Scope of Biology

Following are the nature and scope of Biology.

- Biology is a branch of science that deals with the study of life. Hence, it is also called life science.
- The simple curiosity of human beings to observe nature and the human basic instincts for survival and gathering food probably had a role in the birth and development of Biology.
- Biology helps us to know about the diversity in the living world and the ways by which it can be preserved.
- Biology helps us to know more about ourselves.

- Biology is such a vast field that it encompasses the study of various aspects of living organisms as well as their interactions with the non-living components. Hence, the study of these different aspects form different branches of Biology.
- Biology has two primary branches - Botany, the study of plants and Zoology, the study of animals.
- In Botany as well as Zoology, one can recognize classical (or pure) branches, interdisciplinary branches and applied branches.
- Classical branches largely provide knowledge in the respective areas of study. Some classical branches include Taxonomy (classification), Morphology (study of external form), Anatomy (study of internal structure), Histology (study of tissues), Cell Biology (Study of cells) etc.
- Interdisciplinary branches indicate the relationship of Biology with other branches of Science. Some common interdisciplinary branches are Biophysics, Biochemistry, Biometry and Bioinformatics. Psychology and Sociobiology are interdisciplinary branches involving Biology and Social Sciences.
- Applied branches enable us to apply the knowledge gained from different areas to be used for welfare of man, animals and plants. These include branches like Agriculture, Animal husbandry, Dairy, Poultry, Entomology, Aquaculture, Food technology and Biotechnology.
- Applied branches provide career opportunities for students pursuing Biology as a subject at the class 12 level.

1.4 Objectives of Teaching Biology

Following are the objectives of teaching Biology.

1. To acquire Knowledge of the concepts, models, theories and working methods of Biology, and also an understanding of their development.
2. To analyse and find answers to subject-related questions, and to identify, formulate and solve problems.
3. To reflect on and assess chosen strategies, methods and results.

4. To plan, carry out, interpret and report field studies, experiments and observations, and also the ability to handle materials and equipment.
5. To develop Knowledge of the importance of Biology for the individual and society.
6. To use knowledge of Biology to communicate, and also to examine and use information.

1.5 Significance of Learning Biology

Following is the significance of learning Biology at Secondary level.

a. Biology helps us understand the big picture

The study of Biology connects us to the world we are living in and reminds us of our interconnectedness with all other life forms. It develops awareness of the significance of New Zealand's unique fauna and flora and distinctive ecosystems. It provides opportunities to learn about the processes of all living things. What students learn is directly relevant to our species and environment.

b. Biology is at the heart of many social and economic issues

By studying biology, students learn to make more informed decisions about their own health and about significant biological issues such as genetically modified crops, the use of antibiotics, and the eradication of invasive species. Biology helps students to recognise the importance of agriculture and horticulture and potentially to contribute to its future.

Biologists help in and maintain breeder of new varieties and more efficient/productive plants and animals. Biologists contribute to medical and biotechnological advances.

c. Biology is at the forefront of ecological issues

Biologists are also at the cutting edge of ecological conservation research. By studying Biology, students become much more aware of Ecological issues, and better able to debate situations where exploitation of the environment (for example, for farming, mining, or energy production purposes) clashes with conservation objectives, or where we need to develop more sustainable ways of using our natural resources (for example, soil, land, or water).

d. Learning in biology opens up career opportunities

The following non-exhaustive list suggests the diversity of careers into which graduates in biological science go:

Agronomist, Animal Behaviour Scientist, Animal Welfare Officer, Biochemist, Biotechnologist, Cheese Production Supervisor, Conservation Biologist, Environmental Analyst, Environmental Ecologist, Environmental Manager, Environmental Officer, Fisheries Scientist, Food and Drink Technologist, Forestry Technician, Genetics Technician, Marine Biologist, Meat Biochemist, Medical Sciences Technician, Nursery Grower, Plant Pathologist, Plant Physiologist, Quarantine Officer, Research Manager, Secondary School Science Teacher, Zoologist.

1.6 Challenges in learning Biology

Biology covers some topics that are considered difficult to learn. Cimer (2012), explained that, the nature of the topic, teachers' style of teaching, students' learning habit, students' negative feelings and attitudes towards the topic and lack of resources were the main cause of students' concern to study Biology. Any improvement that is related to learning habit, teaching style and attitude will help students to learn Biology. Moreover, it is possible that it can alleviate the difficulties caused by the nature of the topics and lack of resources.

Students learn Biology at secondary level as a branch of Science. They face difficulties in memorizing vocabulary, understanding of its meaning and concept. As a consequence, students find it difficult learning Biology at Higher level. According to Kubika-Sebitosi (2007), the student's difficulty in learning Biology at university level is derived from their misconception about concepts of Biology in their Secondary School. Research states that, secondary school students find it difficult about their understanding of the Genetic concepts. They did not have a clear idea about the role of gene in a cell of an organism. They did not have a coherent conceptual framework about Cell and Gene. Based on the finding, it can be concluded that students could not find any correlation between the structure of cell, including the chromosome and DNA as the part of the cell structure that contain the gene itself, with the genetic trait of any organism.

The idea of misconception by Kubika-Sebitosi (2007) is supported by Oztap, Ozay & Oztap (2003), in their survey that, Biology Teachers need to explain the dynamic nature of some Biological process. Further, it showed that they recognized difficulties in teaching topics of Biology. For example, cell division process consists of two different processes. Therefore, appropriate methods of teaching is required, moreover, the use of supporting materials, like model, graph, video and laboratory activities can be used to overcome these difficulties, although it did not necessarily mean that it increased students' creativity. Therefore, the solution for the learning difficulty is not only about providing learning support material, but also the skill that will help students to overcome their own problem.

1.7 Concept of Vocabulary

Vocabulary is generically defined as the knowledge of words and word meanings. More specifically, we use vocabulary to refer to the kind of words that students must know to read increasingly demanding text with comprehension (Kamil & Hiebert, 2005). It is something that expands and deepens over time. The NRP's synthesis of vocabulary research identified eight findings that provide a scientifically based foundation for the design of rich, multifaceted vocabulary instruction. "Vocabulary refers to the words we must know to communicate effectively. In general vocabulary can be defined as oral vocabulary or reading vocabulary. Oral vocabulary refers to words that we use in speaking or recognize in listening. Reading vocabulary refers to words we recognize or use in print," (Armbruster, Lehr, & Osborn, 2003, p.34). The development of the vocabulary concerns the breadth, or amount of words contained in an individual vocabulary, as well as the depth, or amount of knowledge about the semantics of words (Ouellette, 2006)

Graves (2000, as cited in Taylor, 1990) defines vocabulary as the entire stock of words belonging to a branch of knowledge or known by an individual. He also states that the lexicon of a language is its vocabulary, which includes words and expressions. Krashen (1998, as cited in Herrel, 2004) extends Graves' definition further by stating that lexicon organizes the mental vocabulary in a speaker's mind. An individual's mental lexicon is that person's knowledge of vocabulary (Krashen, 1998, as cited in Herrel, 2004). Miller (1999, as cited in Zimmerman, 2007) states that

vocabulary is a set of words that are the basic building blocks used in the generation and understanding of sentences. According to Gardener (2009, as cited in Adger, 2002) vocabulary is not only confined to the meaning of words but also includes how vocabulary in a language is structured: how people use and store words and how they learn words and the relationship between words, phrases, categories of words and phrases (Graves, 2000, as cited in Taylor, 1990) Cummins (1999, as cited in Herrel, 2004) states that there are different types of vocabulary:

Reading vocabulary: This refers to all the words an individual can recognize when reading a text.

Listening vocabulary: It refers to all the words an individual can recognize when listening to speech. This includes all the words an individual can employ in writing.

Speaking vocabulary: This refers to all the words an individual can use in speech.

Lexicon also refers to a reference book containing an alphabetical list of words with information about them and can also refer to the mental faculty or power of vocal communication (McCarthy, 1990, as cited in Taylor, 1990). According to McCarthy (1990, as cited in Taylor, 1990) the role that mental lexicon plays in speech perception and production is a major topic in the field of psycholinguistics and neurolinguistics.

Celce-Murcia and Larsen Freeman (1999) define lexicon as a mental inventory of words and a productive word derivational process. They also state that lexicon does not only comprise of single words but also of word compounds and multi-word phrases (Celce- Murcia and Larsen Freeman, 1999). According to Celce-Murcia and Larsen Freeman (1999) lexical units function at three levels: the level of the individual word, word compounds and co-occurrences and conventional multi-word phrases. Nations and Waring (2000, as cited in Adger, 2002) on the other hand, classify vocabulary into three categories: high frequency words, general academic words and technical or specialized words. Academic comprehension improves when students know the meaning of words. Words are the building blocks of

communication. When students have a great vocabulary, the latter can improve all areas of communication, namely speaking, listening, reading and writing.

The National Reading Panel (NICHD, 2000) identified vocabulary as one of five major components of reading. Its importance to overall school success and more specifically to reading comprehension is widely documented (Baker, Simmons, & Kame'enui, 1998; Anderson & Nagy, 1991). The National Reading Panel (NRP) stated that vocabulary plays an important role both in learning to read and in comprehending text: readers cannot understand text without knowing what most of the words mean. "Teaching vocabulary will not guarantee success in reading, just as learning to read words will not guarantee success in reading. However, lacking either adequate word identification skills or adequate vocabulary will ensure failure" (Biemiller, 2005).

Vocabulary learning strategy (VLS) is an approach which facilitates vocabulary learning and has attracted considerable attention. It is a movement away from teaching- oriented approach toward one that is interested in seeing how actions of learners might affect their acquisition of vocabulary (Schmitt, 2002). Strategies can help learners both in discovering the meaning of a word, and consolidating it and are specially needed when they are encouraged to learn independently (Celce-Murcia, 2001).

Vocabulary learning strategies (VLS) are intuitively appealing to teachers and learners. It has also become a popular research topic among researchers in the last two decades. Recent years have seen two books (Gu, 2005; Takač, 2008) and a number of articles on learner's deliberate and strategic efforts in learning vocabulary (e.g., Barcroft, 2009; Tseng & Schmitt, 2008). Most research so far has demonstrated a meaningful relationship between vocabulary learning strategies and learning results either through a correlational approach (e.g., Fan, 2003; Gu & Johnson, 1996; Kojic-Sabo & Lightbown, 1999) or by establishing strategy similarities and differences among learners with different degrees of success (Gu, 1994, 2003a; Moir & Nation, 2002).

Largely two types of learning outcome measures have been used: language proficiency and vocabulary. Those who use the general language proficiency measure

tend to find positive and significant correlations between VLS and language proficiency. For example, Mizumoto and Takeuchi (2008) investigated the effect of VLS on TOEIC performance among a group of Japanese students and found that, among a group of variables, “vocabulary learning strategies as a whole had the greatest influence on TOEIC scores” (p. 17). Gu and Johnson (1996) used both a general proficiency measure and a vocabulary size measure.

The overwhelming majority of vocabulary measures in VLS studies have been some type of passive vocabulary size measure, in other words, the number of words a learner can recognize. A number of active vocabulary measures have been proposed (Laufer, 1998; Laufer & Nation, 1999; Meara & Bell, 2001; Meara & Fitzpatrick, 2000).

1.8 Significance of learning vocabulary

Vocabulary plays an important role in understanding the subject. The habit of reading develops the vocabulary and its meaning in different context. Students having more vocabulary show better performance in studies. Even, learning new vocabulary helps in enhancing language. It also helps in provoking thoughts of an individual while expressing ideas.

Research suggests that vocabulary is enormously important to children’s development, especially in reading. Moreover, it indicates that children with larger vocabularies have higher school achievement in general (Smith, 1941, cited in Beck, McKeown, and Kucan, 2002) and higher reading achievement in particular (Anderson and Freebody, 1981; Graves, 1986; Stahl, 1998). In fact, people with larger vocabularies even have higher IQs (Bell, Lassiter, Matthews, and Hutchinson, 2001; Hodapp, and Gerken, 1999)! Teachers can have a real impact on children’s vocabulary knowledge. Research shows that teachers can do things that significantly increase children’s vocabularies (Baumann, Kame’enui, and Ash, 2003; Blachowicz and Fisher, 2000; National Reading Panel, 2000; Stahl and Fairbanks, 1986), and by doing so children’s reading comprehension will also improve (National Reading Panel, 2000; Stahl, 1998).

Process for Teaching Vocabulary

Marzano's six steps for teaching new words can be used with all students. Use the first three steps to introduce new words to students. The next three steps give students multiple exposures of the new word for review and retention.

The six steps are as follows:

Step 1: Explain—Provide a student-friendly description, explanation, or example of the new term. (This is where the teacher explicitly states the definition that will make sense to her/his students.)

Step 2: Restate—Ask students to restate the description, explanation, or example in their own words. (Students could add the term to their notebooks or to a chart in the classroom, followed by the following step.)

Step 3: Show—Ask students to construct a picture, symbol, or graphic representation of the term. (If possible, ask students to come up with an antonym or synonym to the new word.)

Step 4: Discuss—Engage students periodically in structured vocabulary discussions that help them add to their knowledge of the terms in their vocabulary notebooks. (Have students use new words in oral sentences or use the new words in questions you ask your students.)

Step 5: Refine and reflect—Periodically, ask students to return to their notebooks to discuss and refine entries. (When another new word comes up, try to mention previously learned words as similar or different.)

Step 6: Apply in Learning Games—Involve students periodically in games that allow them to play with new terms. (Examples to try: Jeopardy, Name that Word, Bingo, and Concentration.) **Many games and activities can be found on this**

1.9 Devices to learn vocabulary in Biology

a) Peg word method

Through peg word method unrelated items can be remembered easily by relating them to easily memorized items which act as pegs or hooks. Peg word method has two stages. At first students are asked to remember 10 number-rhyme pairs like one is bun or John, two is shoe, three is tree. In the second stage the students are asked to visualize the word and try to link it to rhyming words. The words are, therefore, learned in a composite picture of the given word and the peg (Roediger, 1980; Groeger, 1997; Mirhassani and Eghtesadei, 2007). For example if the first word to be learned is "exploration", its peg can be "John" and after its meaning is defined to the students, they can form a mental picture in which "John is doing oil explorations", if the second one is "feature", its peg according to the rhyme pairs can be "shoe" and the students can form a mental picture in which some people are talking about the features of a kind of shoe.

b) The key word method

Key word method according to Hulstijn (1997) requires three stages. At first An L1 or L2 word that has acoustic similarity to the target word is given to the learner to act as the key word. In the second stage the learner is asked to make an association between the target word and the keyword. Finally he is asked to make a mental image of the combination of the keyword and the target word. For example the word "shear" means to cut the wool off a sheep and it is acoustically similar to the Persian word ریش (shir), lion in English. It can be given to the learner as the keyword and then he is asked to associate them in a mental picture. The learner may associate them in this way: A Shir (lion) is shearing a sheep.

c) The loci method

Loci method is actually the oldest mnemonic device. Using this method entails imagining a very familiar place like a room or a house and then associating each new word to a part of it to be remembered (Eysenck, 1994; Mirhassani and Eghtesadei, 2007). In other words, the students take an imaginary walk along their familiar places, and retrieve the items they have put there. As people's experiences are different, students may come up with different pictures (Thomson, 1987). For example if the

new words to be learned are era, artificial, mission , sample, mass, density, disturb, distant, the familiar location can be the moon and the mental picture formed may be "It is the robot era. There are some robots with artificial hands and legs. They are on a mission on the moon. They are collecting a mass of sample rocks to examine their features and density. No one can disturb them because they are in a distant area". They all must be seen as a mental and imagined picture by the students.

d) Spatial grouping

The idea behind this method is that instead of writing words in a column, students can be asked to form patterns like a triangle with them. Writing words in the form of patterns help them recall the words better (Holden, 1999). As they remember the pattern, they can remember the parts which are signed by the words.

e) The finger method

Through this method students can be asked to associate each word with a finger. This method is especially useful with children to learn numbers, days of the week and month of the year (Holden, 1999). New words are usually paired with their definitions or equivalents. They can be, however, better, learned if they are paired with pictures (Thompson, 1987). Gians and Redman (1986) believe that objects and pictures can facilitate recall. Wright (1989) also believes that meaning can not be derived only from verbal language. Pictures and objects not only can be used to give meaning and information but they also can be used to the motivation and interest of the students. Using this method, a picture can be used to make the meaning of the word clear. It can sometimes be accompanied by its definition. This method can, however, be used with concrete words and usually with elementary or pre-intermediate students.

f) Visualization or imagery

Instead of using real pictures, this method allows a word to be visualized. The learner imagines a picture or a scene which is associated with the target word. Abstract words can be learned through this method by relating them to a visual picture (Holden, 1999; Thompson, 1987; Mirhassani and Eghtesadei, 2007). Visualization can be an aid in vocabulary learning (O'Malley and Chamot, 1990). If the new word is "exploration", the learner may come up with this mental picture "A scientist is using special drills for

oil exploration” by relating it to the picture of a scientist. Again the students may come up with different pictures because people’s experiences are different. Its difference with the method of loci is that in visualization for each word a picture or a scene is imagined while in the method of loci all of them are related to a familiar place and seen as an imaginary walk through that place.

g) Grouping or semantic organization

As organized materials are easier to store in and retrieve from long-term memory, to organize the words in some fashion will enhance their recall (Anderson, 2000; Thomson, 1987). If the target words to be remembered are, for example, dog, cat, chair, sofa, table, milk, eggs and butter they can be organized and remembered under three categories: animals (for dog and cat), furniture (for chair, sofa and table) and food (for milk, egg and butter). In this way learners have the advantage of better recall than when they all are learned in a list, because if they can remember one word, they will be able to remember the rest (Mirhassani and Eghtesadei,2007).

h) Story-telling or the narrative chain

In this method the learner links the words together by a story. At first he should associate the target words with a topic or some topics, then he should connect them by making up a story containing the words (Thompson, 1987; Holden, 1999; Mirhassani and Eghtesadei, 2007). This method is especially useful for high level students.

i) Physical response method

According to this method the learner should move his body or parts of his body in a certain way that illustrates the meaning of the word. If the target word is tiptoe, for example, the student can get up on his tiptoe and move across the room. It can be imaginary too. It means that he can imagine the action of moving on his tiptoe (Thompson, 1987; Holden, 1999). Thompson (1987) especially believes that if the information of a word or a sentence is enacted it can yield better understanding and recall.

j) Physical sensation method

This strategy is devised by Oxford and Scarcella (1994). Through this method the learner associates the new word to a physical sensation. For example learner can feel cold when he learns the word frigid.

1.10 Rationale of the Present Study

Traditional Biology lessons have often begun with teachers presenting students with Biology vocabulary words and asking them to write the words, find the definitions in a dictionary or the glossary of the textbook, match the words to definitions, or use the words in a sentence. In this model of instruction, words are often presented in isolation and students are tested on the words alone, without application to concepts.

Earlier those students', who were "taught" this way, remembered how little these practices contributed to their conceptual development. These traditional strategies stem from the assumption that students absorb the meanings of many Biology terms simply by writing the words and their definitions. To many English-speaking students Biology words seem like a new language, and to English language learners, these words are a new language.

The job of Biology education is to teach students how to use thematic patterns of Biology to communicate meanings, "talking Biology" to solve problems in writing or speaking about issues in which Biology is relevant.

Students' difficulties in learning Biology have been studied by various researchers across the world (Johnstone and Mahmoud, 1980; Finley et al., 1982; Tolman, 1982; Anderson et al., 1990; Seymour and Longdon, 1991; Jennison and Reiss, 1991; Lazarowitz and Penso, 1992; Bahar et al., 1999). Many concepts or topics in Biology, including water transport in plants, protein synthesis, respiration and photosynthesis, gaseous exchange, energy, cells, mitosis and meiosis, organs, physiological processes, hormonal regulation, oxygen transport, genetics, Mendelian genetics, genetic engineering, and the central nervous system can be perceived as difficult to learn by secondary school students. Tekkaya et al. (2001) also found that hormones, genes and chromosomes, mitosis and meiosis, the nervous system, and mendelian genetics were considered difficult concepts by secondary school students. Experiencing difficulties

in so many topics in Biology negatively affects students' motivation and achievement (Özcan, 2003).

Students' difficulties with many topics in Biology have stimulated researchers to investigate why students experience such difficulties and how to overcome these difficulties. There are many reasons why students have difficulties in learning Biological concepts (Lazarowitz and Penso, 1992; Tekkaya et al., 2001; Çimer, 2004; Zeidan, 2010). The nature of Science itself and its teaching methods are among the reasons for the difficulties in learning Science, while according to Lazarowitz and Penso (1992), the Biological level of organization and the abstract level of the concepts make learning Biology difficult.

Moreover, overloaded Biology curricula, the abstract and interdisciplinary nature of Biological concepts, and difficulties with the textbooks are the other factors preventing students from learning 62 Educ. Res. Rev. Biology effectively (Chiapetta and Fillman, 1998; Tekkaya et al., 2001). Chiapetta and Fillman (1998) state that overloaded Biology curricula may not contribute to students' achievement and lead them to learn the material through memorization. This, of course, prevents meaningful learning. Designing learning environments while ignoring students' interests and expectations causes several learning problems as well as decreasing their interest in Biology (Yüzbaşılioğlu and Atav, 2004; Roth et al., 2006; Zeidan, 2010). Fraser (1998) indicates that there is a close relationship between students' perceptions of their classroom learning environment and their success. Osborne and Collins (2001) also report that students' diminishing interest in learning Science was due to the curriculum content being overloaded and not generally related to working life, the lack of discussion of topics of interest, the absence of creative expression opportunities, the alienation of Science from society and the prevalence of isolated science subjects.

Another reason reported by many researchers, is that due to the nature of Biological Science, Biology learning is generally based on memorization. Biological Science includes many abstract concepts, events, topics and facts that students have to learn. This makes it hard for students to learn them (Anderson et al., 1990; Efe, 2002; Özcan, 2003; Çimer, 2004; Saka, 2006; Durmaz, 2007).

Teachers' styles of Biology teaching and teaching methods and techniques may also be factors that affect students' learning in Biology (Çimer, 2004). Students are not happy with the way that Biology is taught, they may show disinterest in and negative attitudes towards Biology and its teaching. From this perspective, there appears to be a clear need for further and deeper insight into the lexical content that may not cause low achievement in Biology.

Also, in addition to determining the factors that negatively affect students' learning in Biology, understanding students' views on what makes their learning lexical content in Biology is crucial, as many researchers suggest that in order to improve the quality of teaching and learning lexical content in school, students' views must be taken into consideration by researchers, teacher educators, schools and teachers. They argued that, what students say about teaching and learning lexical content in Biology is not only worth listening to but provides an important perhaps the most important foundation for thinking about ways of improving teaching, learning and schools.

For instance, Phoenix (2000) states that student views of teaching may reflect the ways that they learn best. Indeed, schools that acknowledge the significance of student views have found that these views can make a substantial contribution to classroom management, to learning and teaching, and to the school as a social and learning place (Macbeath et al., 2000). It is thought that how students perceive the learning environment in Biology affects their attitudes towards Biology and its learning (Çakıroğlu et al., 2003; Telli et al., 2009). Therefore, understanding Secondary School Students' perceptions of Biology will help policymakers, teachers and teacher educators plan more effective learning activities related to lexical content that can help students learn Biology better and have more positive attitudes towards it.

Stahl (2005) stated, "Vocabulary knowledge is knowledge; the knowledge of a word not only implies a definition, but also implies how that word fits into the world." Consequently, researchers and practitioners alike seek to identify, clarify, and understand what it means for students "to know what a word means." The sheer complexity of vocabulary acquisition, as evidenced by reviewing critical components such as receptive vocabulary versus productive vocabulary, oral vocabulary versus

print vocabulary, and breadth of vocabulary versus depth of vocabulary (Kamil & Hiebert, 2005) raise questions worthy of further research. Other factors such as variations in students' vocabulary size (Anderson & Freebody, 1981; Nagy, 2005), levels of word knowledge (Dale, 1965; Graves & Watts-Taffe, 2002), as well as which words are taught (Beck et al., 2002; Biemiller, 2005) and how word knowledge is measured (Biemiller, 2005) must all be considered in shaping our understanding of vocabulary acquisition. Further, to enrich content understanding of content vocabulary along with academic vocabulary is equally essential. Academic vocabulary is used across all academic disciplines to teach about the content of the discipline; e.g. Students who study chemistry are required to know the chemistry concepts. According to Marzano (2004, as cited in Adger, 2002) academic vocabulary includes general academic terms such as analyze, infer and conclusion. It enables students to understand the concepts and content taught in schools; it is critical for students to have a deep understanding of the content vocabulary in order to understand the concepts expected throughout the content standards (Schmidt, 2005, as cited in Zwiers).

Academic vocabulary is the language that is used by teachers and students for the purpose of acquiring new knowledge and skills which includes learning new information, describing abstract ideas and developing student's conceptual understanding ' (Chamot and O'Malley, 2007 as cited in Herrel, 2004). 2008). Academic vocabulary helps students to convey arguments and facilitate the presentation of ideas in a sophisticated manner. It prepares students for academic success by helping them preview, learn and practice vocabulary from Academic Word Lists (Cummins, 2002, as cited in Zwiers, 2008). According to Cummins (2002, as cited in Zwiers, 2008) the main barrier to student comprehension of texts and lectures is low academic vocabulary knowledge, due to the sub technicality of the academic language. He points out that academic vocabulary is based on more Latin and Greek roots than the daily spoken English vocabulary. Cummins (2000, as cited in Zwiers, 2008) also states those academic lectures and texts use longer and more complex sentences than are used in spoken English. Cummins (2002, as cited in Zwiers, 2008) suggests 10 that academic vocabulary contributes to the development of Cognitive Academic Language Proficiency (CALP) in ELLs which enables them to apply the

language, using abstractions in a sophisticated manner. It also enables them to think and use language as a tool for learning.

Therefore, the aim of the present study is to enrich lexical content in Biology to make Biology concepts easier to comprehend through various strategies or methods that can make Biology learning more effective.

1.11 Statement of the Problem

The title of the study was

EFFECTIVENESS OF A PROGRAMME TO ENRICH LEXICAL CONTENT IN BIOLOGY AT THE SECONDARY LEVEL

1.12 Operationalization of the Terms

The following terms were operationalized for the present study.

(a) Effectiveness

According to Oxford Dictionary the term Effectiveness means, ‘the degree to which something is successful in producing result; success.’

In the present study the term ‘Effectiveness’ means to enrich lexical content in Biology at the secondary level.

(b) Lexical

According to the Oxford Dictionary the term Lexical means, ‘Relating to the words or vocabulary of a language.’

In the present study Lexical means words or vocabulary relating to the Biological concepts at secondary level.

(c) Content

According to the Business Dictionary. Com the term Content means, ‘Text matter of a document or publication in any form.’

In the present study Content means text matter in the Biology concepts at secondary level.

(d) Biology

According to the Business Dictionary.com the term Biology means, the science of life or living matter in all its forms and phenomena, especially with reference to origin, growth, reproduction, structure, and behavior.

In the present study Biology means, subject at secondary level containing lexical content to be enriched.

e) Secondary Level

Secondary level means students studying in STD IX and X. In the present study students studying in STD X is considered as a secondary level.

1.13 Objectives of the Study

Following were the objectives of the present study.

1. To study the effectiveness of the programme to enrich lexical content in Biology at the Secondary Level
2. To study the effectiveness of the programme to enrich lexical content in Biology in context to gender (Male and Female)

1.14 Variables of the study

The variables of the present study are as below

a) Independent variables

Programme (Devices to enrich Lexical Content)

Secondary Independent Variable

b) Gender

- i. Male
- ii. Female

b) Dependent variables

- i. Achievement Score (Pre- test and Post- test)

ii. Reaction Scale

1.15 Hypotheses of the Study

Following were hypotheses of the present study.

1. There will be no significant difference between mean Pre-test scores and Post-test scores of students through a programme to enrich lexical content in Biology at the secondary level.
2. There will be no significant difference between mean Pre-test scores and Post-test scores of girls through a programme to enrich lexical content in Biology at the secondary level.
3. There will be no significant difference between mean Pre-test scores and Post-test scores of boys through a programme to enrich lexical content in Biology at the secondary level.
4. There will be no significant difference between mean Post-test scores of girls and boys through a programme to enrich lexical content in Biology at the secondary level.
5. There will be no significant difference between mean Pre-test scores of boys and girls through a programme to enrich lexical content in Biology at the secondary level.
6. There will be no significant difference between the observed frequencies and expected frequencies through a programme to enrich lexical content in Biology at the secondary level

1.16 Delimitation of the study

Following were the delimitations of the present study.

- a) The study was delimited to the students of Std. X of Bharatiya Vidya Bhavans School, Narsanda.
- b) The study was delimited to the root terms of Biology till STD X.

1.17 Scheme of Chapterization

The dissertation has been divided into five chapters. The scheme of chapterization is as follows:

Chapter-1: Introduction

This chapter begins with an introductory note of the problem of the study it also states the objectives of the study, delimitation of the study, operationalization of the terms, hypothesis of the study and rationale of the study.

Chapter-2: Review of related literature

This chapter focuses on two parts: theoretical framework and research review. It includes a theoretical background of the study undertaken and different studies reviewed to understand and strengthen the present work.

Chapter-3: Research Methodology

This chapter focuses on the research methodology adopted in the present study. It describes in detail the research design selected for the present study, tools used and procedure adopted for data collection and data analysis.

Chapter-4: Data analysis and interpretation

In this chapter the data collected through the experiment have been analyzed and presented in tabular as well as in graphical forms. Interpretation based on findings have been presented and discussed in the light of the present study.

Chapter-5: Findings, Implications and Conclusion

The last chapter deals with the finding, implications and conclusions drawn from the study. It also presents some suggestions for the future studies. The chapter ends with reflective notes by the researcher on the research.

CHAPTER – II
REVIEW OF RELATED LITERATURE

2.0 Introduction

Review of related literature is the summary of the previous research which provides evidence of familiarity to the researcher with what is already known. Review of related literature is systematic identification, location, analysis and report of documents containing information related to research topic. Theoretical and research based reviews provide the researcher valuable guidance and suggestions to carry out the research. It also serves as a solid foundation for the study. A review of related literature is a most essential aspect in research. It helps the researcher in understanding and defining the problem accurately and systematically. Valuable information obtained in the process helps in planning of the study. Review of related literature is one of the significant aspects of research. It enables the researcher to get acquainted with the work done in the concerned areas. It helps to explore the needs of research in unknown and unexplored areas. It develops insights into the methodological aspects of the research.

2.1 Objectives of the Review of Related Literature

The followings are the objectives of the review of related literature.

- To understand various aspect and scope of the research thoroughly
- To study the researches which have been done before the current research
- To decide proper hypothesis, objectives, methodology of research
- To have a proof on the part of the investigator show that the investigator knows what type of study is done in the same field
- To have a proper guideline to implement the practical work
- To have appropriate guidance to complete the present research
- To provide vast outlook regarding to the subject
- To avoid repetition of research done
- To find out novelty of present research

2.2. Importance of the Review of Related Literature

The review of the related literature is an important requirement of actual planning on the bases of which the execution of any research work can be done. The review of related literature becomes a friend, philosopher and guide for the researchers.

The research for a reference material is a time consuming but very fruitful phase of any research. The researcher feels ease and clear in taking decision for the present study from the past research. It helps the researcher to avoid useless repetition in their research work. The researcher will get an idea about what sources are available in the field of study, which are most essential for the study, where and how to use them. In short, it enables the researcher to get insight into the problem on hand. The study of related literature also gives an idea about the different approaches, methods, tools and equipments, Identification of problem, selection of samples, statistical techniques, evaluation and measurement of the research work already done and major findings of the previous research work. Thus, the review of related literature provides some insight regarding some points and limitations of the previous studies, broaden the horizon of knowledge.

In other words, review of related literature work as a lighthouse for the researcher.

In the present study the researcher has reviewed various books, dissertation, articles, journals, theses, and web sites as a reference material which are as follow.

2.3. Review of Past Studies

2.3.1 Research Studies Conducted on Vocabulary Instructions and Vocabulary Enrichment

1. Taheri, A. A. & Davoudi, M. (2016). conducted study on ‘The Effect of the Keyword Method on Vocabulary Learning and Long-Term Retention’

The present study investigated the effect of the keyword method of vocabulary teaching on the learning and long term retention of vocabulary in a normal EFL classroom context. Fifty elementary EFL students were selected and assigned into experimental and control groups. The experimental group received vocabulary instruction using mnemonic

keyword method and the control group received conventional memorization-based instruction of the same vocabulary items. Each group took two post-tests, one test immediately after instruction and one test two weeks later. Paired and independent samples t-tests were run on the data and the results indicated that participants in the keyword group outperformed the memorization group significantly in both their learning and retention of the vocabulary items. The results of the study support the effectiveness of the establishment of mental links and images, through the use of mnemonic strategies, for the vocabulary learning and retention of elementary level EFL learners.

2. National Behaviour Support Service (NBSS), (2014). conducted study on ‘The Vocabulary Enrichment Programme: An Intervention to Improve Vocabulary Skills with First Year Students’

This research project aimed to evaluate if the programme would be successful in improving the oral vocabulary skills of first year students in Irish post primary schools in areas of socioeconomic disadvantage. Four hundred and seven first year students from six NBSS partner schools participated with three hundred and nineteen students from four schools receiving the intervention in September 2013 and the remaining eighty-eight students from two schools acting as controls and receiving the intervention later in the same academic year. All students were assessed pre-intervention and post-intervention on standardized measures of oral language. Teachers were comprehensively trained by, and provided with weekly support from, the NBSS senior speech and language therapist (SLT). The programme was delivered in regular English or literacy classes twice a week for 12 weeks. Quantitative findings demonstrate significant improvement on all five raw score vocabulary measures for the intervention group more than the control group (word classes receptive ($p=0.028$); word classes expressive receptive ($p=0.026^*$); word classes expressive Improvement on standardized tests of language indicates that this intervention, targeting vocabulary strategies and skills, improves students’ overall oral receptive and expressive language skills.

3. Safa, M. A. (2013). conducted a study on ‘**The Effect of Mnemonic Key Word Method on Vocabulary Learning and Long Term Retention**’

Most of the studies on the key word method of second/foreign language vocabulary learning have been based on the evidence from laboratory experiments and have primarily involved the use of English key words to learn the vocabularies of other languages. Furthermore, comparatively quite limited number of such studies is done in authentic classroom contexts. The present study inquired into the effect of using mnemonic key word method of vocabulary instruction on the learning and retention of vocabulary over long term in a normal EFL classroom context. Fifty^{5th} grade primary school students were selected and randomly assigned into experimental and control groups. The experimental group received vocabulary instruction using mnemonic key word method and the control group received classic memorization based instruction of the same vocabulary items. The two groups took three posttests a day, two weeks, and a month after the last treatment session. A MANOVA analysis was run on the data and the results indicated that subjects in the key word group outperformed the memorization group at a significant level in both their learning and retention of the newly learnt vocabularies. The results of the study underscore the efficacy of the establishment of mental links and images for the vocabulary learning and retention of novice and beginning level EFL learners. It further implies that mnemonic devices like key word method should be given prompt attention by both EFL material developers and practitioners as a potentially effective strategy for vocabulary teaching, learning and long term retention at the early stages of second or foreign language development.

4. Amiryousefi, M. (2011). conducted a study on ‘**Mnemonic Instruction: A Way to Boost Vocabulary Learning and Recall**’

Traditionally, vocabulary was neglected in language teaching programs and curriculums for the sake of grammar and other parts of language. Nowadays, however, researchers have realized that vocabulary is an important part of language learning and teaching and worthy of attention and research. A proliferation of studies done on vocabulary can be taken as a proof to it. Students are, however, reported to frustrate when they face with new words, since they have difficulty retaining them. This paper provides information on

how mnemonics devices can be used to solve this problem and to improve vocabulary learning, boost memory and enhance creativity.

5. Mokhtar, N. H. (2011). conducted study on ‘**The Effectiveness of Storytelling in Enhancing Communicative Skills**’

Storytelling is not limited to entertainment but can also be used as an effective teaching tool in a language classroom. This study is to identify the effects of storytelling on students’ language aspects of communication skills and to evaluate the extent to which storytelling helps in enhancing students’ communication skills. The findings show that storytelling has beneficial effects on reading skills by students being able to associate meanings and emotions with words. Students also develop their vocabulary and learn when and where to use certain words and phrases.

6. Stahl, S. (2005). conducted study on ‘**Four Problems with Teaching Word Meanings and What to do to make Vocabulary an Integral Part of Instruction**’.

“Vocabulary knowledge is knowledge; the knowledge of a word not only implies a definition, but also implies how that word fits into the world.” Consequently, researchers and practitioners alike seek to identify, clarify, and understand what it means for students “to know what a word means.” The sheer complexity of vocabulary acquisition, as evidenced by reviewing critical components such as receptive vocabulary versus productive vocabulary, oral vocabulary versus print vocabulary, and breadth of vocabulary versus depth of vocabulary raise questions worthy of further research. Other factors such as variations in students’ vocabulary size, levels of word knowledge, as well as which words are taught and how word knowledge is measured must all be considered in shaping our understanding of vocabulary acquisition.

7. Blachowicz, C.L.Z. & Fisher, P. (2004). conducted study on ‘**Building Vocabulary in Remedial Settings: Focus on Word Relatedness Perspectives**’.

Structural analysis of a word draws the student’s attention to the individual units of meaning in the word, also known as *morphemes*. A free morpheme, or root word, can stand alone (e.g., *cut*), while a bound morpheme needs to be attached to another morpheme (e.g., *ing*, *un*), and two free morphemes can combine to form a compound

word (e.g., *airplane*). In the beginning stages of reading, rapid and automatic word analysis is essential for developing decoding and fluency skills; at this level, the purpose of word analysis is to identify (sound out) the word. The focus of word analysis for vocabulary is on the meaningful parts of a word to help determine its overall meaning. Some students may not realize that they can use their knowledge about how to divide words into parts to figure out word meanings. There are numerous sources for lists of common root words and affixes (suffixes and prefixes); an internet search can produce useful examples. Two publications to consult for how to teach word parts are “*Morphemes for Meaning*” by Jane Greene, and “*Vocabulary Through Morphemes*” by Susan Ebbers.

8. Baumann, J.F., Kame’enui, E.J., & Ash, G. (2003). conducted study on ‘Research on Vocabulary Instruction’

In its analysis of the research on vocabulary instruction, the National Reading Panel (2000) found that there is no one best method for vocabulary instruction, and that vocabulary should be taught both directly and indirectly. Direct instruction means teaching specific words, such as pre-teaching vocabulary prior to reading a selection. It is estimated that students can be taught explicitly some 400 words per year in school. Another example of direct instruction involves the analysis of word roots and affixes (suffixes and prefixes). However, one cannot teach students all of the words they need to learn. Vocabulary instruction must therefore also include indirect instruction methods, such as exposing students to lots of new words and having them read a lot. Indirect instruction also includes helping students develop an appreciation for words and experience enjoyment and satisfaction in their use.

9. Texas Reading Initiative (2002). conducted study on ‘Promoting Vocabulary Development: Components of Effective Vocabulary Instruction’

The amount of students’ reading is strongly related to their vocabulary knowledge. Students learn new words by encountering them in text, either through their own reading or by being read to. Increasing the opportunities for such encounters improves students’ vocabulary knowledge, which in turn improves their ability to read more complex text. “In short, the single most important thing you can do to improve students’ vocabulary is

to get them to read more”. Students should read different types of text at different levels, including text that is simple and enjoyable, and some that is challenging. As noted above, students will not be able to comprehend text that has too many unfamiliar words (more than 10%); on the other hand, students will not encounter many new words if they read text that is below grade level.

Word consciousness means having an interest and awareness of words. Word consciousness involves awareness of word structure, including an understanding of word parts and word order. Students need to become aware of how written language is different from everyday conversation by drawing their attention to the distinctive structures of written language such as compound and complex sentence structures, phrasing within sentences, how punctuation is used to signal phrasing, and paragraph structure. Word conscious students enjoy learning new words and engaging in word play. One way to promote word consciousness is to point out examples of vivid descriptions, interesting metaphors, similes and other forms of figurative language, and plays on words. Ask students to select examples of exciting use of words when they read and save them in a journal or share them with other students. Teachers should take advantage of opportunities to develop student interest in words, the subtle meanings of words, how to have fun with words, and how words and concepts are related across different contexts. Students benefit from hearing language that incorporates the vocabulary and syntax (sentence structures) in high-quality written English. Literate written English uses words and grammatical structures in ways that may be new to many students, and reading good literature aloud exposes students to many genres of written English.

10. Beck, I.L., McKeown, M.G., & Kucan, L. (2002). conducted study on ‘Bringing Words to Life: Robust vocabulary instruction’

Although it is impossible to specifically teach all of the new words students must learn each year (between 2,000 to 3,000), it is useful to provide direct instruction in some words. This includes pre-teaching key vocabulary prior to reading a selection. It is estimated that students can be taught explicitly some 400 words per year in school. Teachers must remember that direct instruction of specific words is only one component of effective vocabulary instruction. What words should the teacher choose for direct

instruction? Teachers should focus on words that are important to the text, useful to know in many situations, and that are uncommon in everyday language but recurrent in books. The following guide was adapted from J.D. Cooper and used in the Texas Reading Academy.

11. Coady, J. & Huckin, T. (1997). conducted study on ‘Second Language Vocabulary Acquisition. USA: Cambridge University Press’.

French (1983) believes that vocabulary has been neglected in the past decades because 1) those who were involved in the teacher-preparation programs during the past few decades felt that grammar should be emphasized more than vocabulary, 2) specialists in methodology believed that students would make mistakes in sentence construction if too many words were learned before the basic grammar had been mastered, and 3) those who gave advice to teachers said that word meanings can be learned only through experience and cannot be taught in the classroom. More recently, however, a number of researchers have become interested in vocabulary instruction. They have awakened to the realization that vocabulary is an important area worthy of effort and investigation. It has, consequently, gained popularity in the general field of English language teaching and learning. There is now general agreement among vocabulary specialists that it is at the heart of communicative competence.

12. Laufer, B., & Nation, P. (1995). conducted study on ‘Vocabulary size and use: Lexical richness in L2 written production’.

The overwhelming majority of vocabulary measures in VLS studies have been some type of passive vocabulary size measure, in other words, the number of words a learner can recognize. A number of active vocabulary measures have been proposed. However, none of these has been able to satisfactorily measure active vocabulary size. One of the most widely used measures of active vocabulary so far is arguably Laufer and Nation’s (1995) Lexical Frequency Profile (LFP), which sketches the profile of a learner’s active vocabulary use by providing the percentage of words used that belong to the first 1,000 most frequently used words, the percentage of the second 1,000 words, that of the Academic Word List, and that of words that do not fall into the lists compared. Probably

due to this lack of a single satisfactory measure of active vocabulary, practically no VLS study has looked at how strategies are related to the growth of active vocabulary.

2.3.2 Research Studies Conducted on English Vocabulary

1. Ebrahimi, M. & Omid, A. (2015). conducted study on ‘Comparative Effect of Presenting Vocabularies in Semantically Related and Unrelated Sets on Iranian EFL Learners’ short Term Retention’

Teaching vocabulary in semantically related sets is common practice among EFL teachers. This research was conducted to investigate the effectiveness of teaching vocabulary items through related and unrelated set to elementary Iranian EFL students. It investigated two types of clustering, semantically-related sets, semantically unrelated sets, and their effectiveness in Persian -speaking learner’s retrieval at the end of each session. To this end, an experimental approach using two groups of participants (i.e. experimental and control) was employed. The experimental group was taught using related vocabulary instructional method while the control group was taught using unrelated clustering method. Then they were asked to complete a recall matched post-test immediately after the study phase to measure the impact of both techniques on learning. In analyzing the data, the statistical techniques of ANCOVA and T-test were utilized. Results of this matching test showed that participants recalled more words from the unrelated list than from the semantically related list. And words from the semantically related list were the least to be recalled by all participants. So, the results manifested that, while both techniques successfully help the learners to acquire new words, presenting words in unrelated sets seems to be more effective, and this represented the preference of semantically unrelated clustering over instructing words in related sets during short period of time.

2. Ahour,T. & Berenji, S. (2015). conducted study on ‘A Comparative Study of Rehearsal and Loci Methods in Learning Vocabulary in EFL Context’

Effective learning in foreign language settings depends on acquiring a large number of vocabularies. This study intended to compare two vocabulary learning methods known as

loci and rehearsal methods to find out which one leads to better retention and recalling of words. Employing a quasi-experimental research, 80 learners from two intact classes in Islamic Azad University, Osku Branch, Iran, were randomly selected as the experimental and control groups. For the purpose of vocabulary learning, the experimental group trained in loci method while rehearsal strategy training was used in the control group. At the end of each session of the treatment, multiple-choice vocabulary tests were used to measure whether the participants can recall the lexical items from their short-term memory. A delayed multiple-choice posttest of vocabulary was also used in order to compare vocabulary learning among two groups four weeks after the treatment. Implementing Independent Samples t-test, the results indicated that experimental group was better than control group in retention and recalling of lexical items in immediate posttest. It was also found that the loci method was more effective than rehearsal in permanency of lexical items in long term memory.

3. Piribabadi, A. & Islamic, A. (2014). conducted study on ‘**Method Instruction on ESP Vocabulary Learning**’

The present study examined the effect of the keyword method and word-list method instruction on ESP vocabulary learning across proficiency levels. Two groups of students at Islamic Azad University of South Tehran branch were selected with the total population of 120 Industrial engineering intermediate students with an average age of 21. The students of each class were divided into two different homogeneous groups, the upper-intermediate level and the lower- intermediate level, based on their scores on the Oxford Placement Test. Each class was instructed through a specified method of vocabulary learning, i.e. the keyword method and word-list method, for an equal time of four weeks. Following both treatments, a multiple-choice test was administered to each class as the post-test to find out the ESP students' vocabulary knowledge. The results of the study indicated that the upper-intermediate learners who received the keyword method instruction out performed the upper-intermediate learners who received the word-list method. In addition, the lower-intermediate level students in the keyword method group had better performance than those in the word-list method. Moreover, regardless of the proficiency level of the students, all of the students in the keyword method group obtained higher scores than those in the word-list method group. The results of the study

revealed that the keyword method instruction has superiority over the word-lists method in learning ESP vocabulary regarding the proficiency level of the students.

4. ShabanWafi, N.M. (2013). conducted study on ‘The Effectiveness of Using Animated Pictures Program in Learning English Vocabulary among the Fifth Graders in Gaza’

The study aimed to investigate the effectiveness of using animated pictures program in learning English vocabulary among the fifth graders in Gaza. The target domains were productive and receptive. To answer the questions of the study, the researcher adopted the quasi experimental approach. The sample of the study consisted of (64) students distributed into two groups. One of the groups represented the control group of (32) students, and the other represented the experimental one of (32) students. The groups were randomly chosen from a purposive sample from Haifa primary school for girls. The animated pictures program was used in teaching the experimental group while the traditional method was used with the control one in the second term of the school year (2012-2013). An achievement vocabulary test was designed and validated to be used as a pre and post test in acquiring vocabulary in the English language for the fifth graders. The data of the study were analyzed using t-test independent sample, which was used to determine significant differences between the groups. Effect size technique was used to measure the effect size of the animated pictures program on the experimental group in each domain of the test. The results indicated that there were statistically significant differences between both groups in favor of the experimental one, in receptive vocabulary, productive vocabulary and the total score due to the animated pictures program. Effect size technique indicated a large effect of the Animated pictures program in improving receptive vocabulary, productive vocabulary and the total score for the experimental group. This result reflects the effectiveness of using animated pictures program in developing vocabulary.

5. Mohammed, O.N. & Abdelrahman, B. (2013). conducted study on ‘The Effect of Teaching Vocabulary through Semantic Mapping on Efl Learners’ Awareness of Vocabulary Knowledge at al Imam Mohammed Ibin Saud Islamic University’

The purpose of this study was to investigate the effect of semantic mapping as an instructional strategy for teaching vocabulary items to EFL learners at Al Imam Mohammed Ibin Saud Islamic University and to explore the effect of this strategy on EFL students’ achievement of lexical items. The sample of the study consisted of 50 male students enrolled in two sections, which were randomly selected from four sections and were randomly assigned to both experimental and control groups. Therefore, a quasiexperimental mode of inquiry was adopted in this study since the sample was chosen intentionally, but its assignment on the groups was carried out randomly. The experimental group studied the lexical items via semantic mapping strategy, and the control group studied them in the traditional method. A vocabulary pre-test was given to both groups at the beginning of the study to make sure that they were equivalent and homogenous. At the end of the experiment, the same test was given to the experimental and control groups to investigate the effect of semantic mapping strategy on EFL students’ achievement of lexical items. The results revealed significant differences between the experimental and control groups in favor of the experimental group. The experimental group received semantic mapping, but the control group did not receive this treatment. The results of the study, based on statistical analysis, indicated that the experimental group outperformed the control group in vocabulary learning. It can be suggested that semantic mapping can be used as an efficient methodology for teaching vocabulary, a technique which is effective for EFL learners.

6. Soleimani, H. Akbar, M. (2013). conducted study on ‘The Effect of Storytelling on Children's Learning English Vocabulary: A Case in Iran’

Vocabulary appears to be the heart of language especially by children. The purpose of this study was to examine whether storytelling can affect children's vocabulary learning in English. Thirty one Iranian preschool students from two different preschools with the same language system and the same level of English proficiency participated in this study. All of the students were six years old and had learned English as a foreign

language. This study employed a one group pretest posttest quasi-experimental design; the pretest and posttest were the same with 30 vocabulary picture test items related to both students' current course book vocabulary items which were familiar to them and the new items related to the story book. For data analysis, paired t-test was used and it was revealed that storytelling might enhance the achievement of vocabulary items, and consequently it might bring up a positive effect on children's vocabulary learning.

7. Anjomafrouz, F. & Tajalli, G. (2012). conducted study on ‘Effects of Using Mnemonic Associations on Vocabulary Recall of Iranian EFL Learners over Time’

Effects of using mnemonic associations on vocabulary recall of Iranian EFL learners were investigated in two separate experiments with adolescents and adults. In each experiment, the students were divided into two groups of experimental (mnemonic) and control (rote). Using a number of predesigned (the researcher-designed) associations as models, the students of the mnemonic groups were trained to generate mnemonic associations of their own for the new vocabulary words they had chosen to learn. Then, their use of the initial (previously student-designed) and the new self-designed associations was assessed by giving four recall tasks. The students of the rote groups, on the other hand, were instructed to learn the words through memorization and repetition. The data analyzed revealed that using mnemonic associations led to significantly better performance of the adult students when comparison was made with an external control group (rote group) and better performance of both adult and adolescent groups when comparison was made with an internal control group (when students used no association in mnemonic group). Furthermore, the higher performance of mnemonic groups who frequently reported using initial associations revealed that these had a significant role at vocabulary recall of students. Finally, mnemonic method significantly affected the vocabulary recall of adult students for both receptive and productive learning.

8. Al-Zahrani, M.A. (2011). conducted study on ‘The Effectiveness of Keyword-based Instruction in Enhancing English Vocabulary Achievement and Retention of Intermediate Stage Pupils with Different Working Memory Capacities’

The current study aimed at investigating the effectiveness of keyword based instruction in enhancing English vocabulary achievement and retention of intermediate stage pupils

with different working memory capacities. The study adopted a quasi experimental design employing two groups (experimental and control). The design included an independent variable (keyword method), two dependent variables (vocabulary achievement and vocabulary retention) which were measured by the achievement vocabulary test and a classification variable (working memory capacity) which was measured by working memory tasks. The sample of the study consisted of 3 rd intermediate grade pupils from two intermediate schools in Taif (N=96). The pupils were divided into two groups experimental and control. The experimental group (N=47) was taught the vocabulary of the first term of English language book of 3 rd intermediate grade through keyword method. The control group (N=49) was taught the same vocabulary through traditional method. The two group's scores were analyzed using Two-way ANOVA. Results revealed that keyword method had a positive effect on the learners' vocabulary achievement and retention. Also, results showed that pupils with high WMC were better than pupils with medium and low WMC in both vocabulary achievement and retention. Finally, the results revealed that the interaction between keyword method and WMC had a main effect on both dependent variables (Vocabulary achievement and retention)

9. Faid, M. (2011). conducted study on ‘The Effectiveness of Using a Suggested Program Based on Games and Visuals on Enriching English Vocabulary of First Grade Prep School Students’

This study researched the effects of using games on students' vocabulary in the language classroom. An English vocabulary test investigated the students' English vocabulary level. The sample was 64 students at El Khairia prep school in Beni- Suef, Egypt. They were divided into two groups, 32 students for the experimental group and 32 students for the control group. A content analysis was performed for the first year prep graders. A list of necessary vocabulary was prepared. An achievement test was prepared according to the previously mentioned vocabulary list . An English vocabulary program based on games and visuals was prepared and administered on the experimental group of 30 students. It was found that there were statistical differences between the mean scores of the experimental and control groups as regards the English vocabulary test after the

experiment in favor of the experimental group. The study suggested that more attention should be given to teaching vocabulary by using untraditional methods such as audio visual aids to motivate students to gain more vocabulary items. This paper seeks to contribute to the process of making vocabulary instruction more particularized, pedagogical, and practical by examining the relationship between specific aspects of enriching vocabulary and using games and visuals.

10. Baleghizadeh, S. & Ashoori, A. (2010). conducted study on ‘**The Effect of Keyword and Word List Methods on Immediate Vocabulary Retention of EFL Learners**’

The present study was an attempt to compare the effect of keyword and word list methods on immediate retention of English vocabulary in a natural classroom setting. Two intact classes from a junior high school in Astara, Iran were randomly assigned to one of the two learning conditions: keyword and word list. A meaning recall test was administered immediately at the end of the second session of the treatment. Results showed that the keyword method produced better recall compared to the word list method, suggesting a promising educational value for its utility.

11. Hirsch, E.D. (2003). conducted study on ‘**Reading Comprehension requires knowledge – of Words and the World: Scientific Insights into the Fourth-Grade Slump and the Nation’s Stagnant Comprehension Scores**’.

One of the oldest findings in educational research is the strong relationship between vocabulary knowledge and reading comprehension. Word knowledge is crucial to reading comprehension and determines how well students will be able to comprehend the texts they read in middle and high school. Comprehension is far more than recognizing words and remembering their meanings. However, if a student does not know the meanings of a sufficient proportion of the words in the text, comprehension is impossible. Vocabulary experts agree that adequate reading comprehension depends on a person already knowing between 90 and 95 percent of the words in a text. Knowing at least 90 percent of the words enables the reader to get the main idea from the reading and guess correctly what many of the unfamiliar words mean, which will help them learn new words. Readers who

2 do not recognize at least 90 percent of the words will not only have difficulty comprehending the text, but they will miss out on the opportunity to learn new words.

12. Adger, C.T. (2002). conducted study on **‘What Teachers Need to know about Language’.**

Vocabulary teaching and learning is a constant challenge for teachers as well as students because historically there has been minimal focus on vocabulary instruction in the ESL classroom. Due to this, an increased emphasis on vocabulary development is crucial for the English language learner in the process of language learning. English speaker enters nursery school knowing at least 5,000 words while the average English language learner may know 5,000 words in his/ her native language but only a few words in English. The reality is that native speakers continue to learn new words while English language learners face the double challenge of building that foundation and closing that language gap

13. Chall, J.S., & Jacobs, V.A. (1983). conducted study on **‘Writing and reading in the Elementary Grades: Developmental Trends among Low-SES children’**

Vocabulary is one of five core components of reading instruction that are essential to successfully teach children how to read. These core components include phonemic awareness, phonics and word study, fluency, vocabulary, and comprehension. Vocabulary knowledge is important because it encompasses all the words we must know to access our background knowledge, express our ideas and communicate effectively, and learn about new concepts. “Vocabulary is the glue that holds stories, ideas and content together... making comprehension accessible for children.”. Students’ word knowledge is linked strongly to academic success because students who have large vocabularies can understand new ideas and concepts more quickly than students with limited vocabularies. The high correlation in the research literature of word knowledge with reading comprehension indicates that if students do not adequately and steadily grow their vocabulary knowledge, reading comprehension will be affected.

2.3.3: Researches Conducted on Science, Science Vocabulary and its Strategies

1. Yuliya, A. & Thomas, T. R. (2014). conducted study on ‘Developing Science-Specific, Technical Vocabulary of High School Newcomer English learners’

This paper reports on the curriculum development stage for a larger science–literacy intervention for secondary school newcomers enrolled in an urban US school. After providing background to the study, we review literature on effective vocabulary instruction and report on the *Science Vocabulary Support* program development, refinement, and preliminary effectiveness evaluation in a sample of 92 emergent bilinguals. Results indicated that pre-to-post gains in student vocabulary retention were statistically ($p < .005$) and practically ($d = .59$) significant. These results, corroborated by weekly quizzes and interview and observational data, highlight the merit of specifically targeting science-specific, technical vocabulary for instructional interventions.

2. Gott, R., and Duggan, S. (1996). conducted study on ‘Practical work: Its role in the Understanding of Evidence in Science’

Except practical works that are less frequent than traditional settings, several restrictions in traditional learning could be recognized. First, the time limitation does not facilitate obtaining data and their analyses. Second, Biology curricula, at least in Slovakia, indirectly favor memorization facts. Third, classrooms (for biology settings) do not provide a natural environment for obtaining data. Thus, students’ logical understanding and curiosity cannot be supported and they cannot get opportunities to deal with nature. In contrast, constructivist theory frames learning as an active, continuous process whereby students construct meaning based on prior ideas and experiences through physically and mentally acting on objects. There are several studies, which reported the significance and effectiveness of the theory on students’ learning of environmental subjects.

3. Selim, M. A., and Shrigley, R. L. (1983). conducted study on ‘The Group Dynamics Approach: A Socio Psychological Approach for Testing the Effect of Discovery and

Expository Teaching on the Science Achievement and Attitude of Young Egyptian Students'

Current curricula of various countries are endorsed to engage students in biology/science to use inquiry-based approach. This approach supports students' natural interest in science; students are engaged to make their own questions, test hypotheses and gather and present information from various sources. In contrast, traditional learning involves memorization of facts, which often results in students' negative attitudes toward science.

2.4 Distinguishing Features of the Present Study

Following were the distinguished features of the Study

1. Majority of the past studies were conducted on vocabulary enrichment in language where as present study focused on vocabulary enrichment in Science especially Biology.
2. The past studies were mainly conducted to enrich vocabulary of elementary and primary grades students whereas present study focused on vocabulary enrichment of Secondary grade students.
3. Mainly in the past studies Group approach, Storytelling, Reading Comprehension were used to enrich vocabulary whereas in the present study different activities such as root words and their meanings, articles and so on were used to enrich vocabulary in Science.
4. Past studies were mainly qualitative in nature where as present study is both qualitative and quantitative in nature.

2.5 Conclusion

This chapter presents reviews of related studies. Through these studies, the researcher came to know about the research procedure, different tools, suggestions and findings of the studies on the value inculcation and professional development. The next chapter discusses the research methodology adopted for the present study.

CHAPTER - III

RESEARCH METHODOLOGY

3.0 Introduction

Design is an essential step in the process of research. It plays a crucial role in the success of the study and also provides supports to the investigator. Research design is a blue print on the paper like an architect's plan. The purpose of a research design is to impose controlled restrictions on observations of natural phenomena. It guides the investigator throughout the study. The factor that most often differentiates between a good and a poor research is not the funds available, the size of sample or sophistication of the statistics, but it is the care and thought that goes into the research plan. According to Burroughs (1975), "The hypotheses formulated act as a guide to what one is proposing to test. The purpose of the design is to show how to do it. The data needs to be collected in a way that valid conclusion and results may be drawn. There are many elements to be taken into consideration at this stage not all of which are compatible."

Thus, a reliable research cannot just happen. It is not the fruit of a few hours or days. It encompasses number of operations, carried out with patience, accuracy and industriousness for months and years. For such a long process, planning demands utmost care and insight. The product of research depends upon the quality of its design. A good research work cannot be done if the design has faults. Therefore, proper design is needed for valid analysis. Certain fundamental steps of research design must be given due importance when it proposed to be used. The operation of the design, that is planning must be carried out with patience and accuracy.

3.1 Research Design

The present study is experimental study and quantitative type. In the present study the researcher had use Single group pre-test post-test design. Attempts were made by the researcher to use Effectiveness of a programme to enrich Lexical content in Biology at the Secondary Level.

3.2 Population of the Study

The population is the scope of the study i.e. the unit where generalization with respect to the finding of the study can be made. The population for the present study

comprised of the STD X English Medium Students of CBSE schools studying in the year 2016-17.

3.3 Sampling Technique and Sample

Sample is the working unit of the research. It is a group of subjects that the researcher works and interacts with.

In the present study the researcher had use convenient sampling technique for selecting the sample. Researcher used this technique as it is the only CBSE English medium school nearby her locality and easy to approach the school.

The sample for the present study comprised of the STD X Students of Bharatiya Vidya Bhavan's School, Nadiad studying in the year 2016-17. The total sample comprised of 67 students of STD X. The sample distribution is given in the table 3.3.1

Table 3.3.1 : Sample distribution

Sr. No.	School Name	Boys	Girls
1.	Bhartiya Vidya Bhavans, Nadiad	33	34

3.4 Tools for the Study

Tools help the researcher to interact with the subjects and get their responses. In the present study, the researcher used three major tools. The tools were Achievement Tests (Pre-test and Post-test), Activities (Programme), Feedback Form.

3.4.1. Procedure for the Construction of Tools

Research tools help researchers to collect data. They help the researchers to collect qualitative as well as quantitative data. Researcher gave research tools to teacher educators teaching Science and also language teacher educators for validation process. The descriptions of the research tools for the present study are mentioned below.

a) Achievement tests

The researcher constructed Achievement Tests (Pre-test and Post-test). The main aim was to know the achievement of students learning terminology of Biology Concepts. The researcher constructed the Pre-test and Post-test based on Biology concepts from Science and Technology subject of STD X. The items were both objective and subjective in nature. The test was of 30 marks. The test items were fill in the blanks, match the following, Splitting the terms into the root word and writing their meaning. After getting the views from the teachers of Biology and gave to the experts for their valuable comments and suggestions. After incorporating the comments and suggestions of the experts the tool was modify. The final form of the Pre-test and Post-test was administered on the selected sample.

b) Activities (Programme)

After analyzing the Pre-test the researcher developed the activities (programme). The major aim was to implement this programme consisting activities and power point presentations to enrich lexical content in Biology concepts. The activities were paragraphs, articles, words and its meaning, **Greek and Latin Root Words for Biology**

The researcher gave the activities and PowerPoint presentations to the experts for their comments and suggestions. After incorporating their comments and suggestions researcher intervened the programme on the selected sample.

c) Reaction Scale

The researcher constructed Reaction scale to get the reaction of the students about the programme. The reaction scale comprised of both open ended and closed ended items. The five point rating scale was used for closed ended items i.e .Not at all, Rarely, Sometimes, Most of the times and always. The scale was given to the experts for their suggestions and comments. After incorporating their views the researcher modified the tool and implemented at the end of the programme.

3.5. Data Collection Procedure

Following procedure was carried out by the researcher for the data collection.

3.5.1 Tools Preparation

The researcher prepared questionnaire based on Pedagogy used in teaching Science, Classroom interaction and application in daily life and informally administered the test on Science Teachers to know which Biology concepts can be taught to make student learn difficult terms. Then the researcher read the textbooks, magazines, journals to deepen her own understanding of Biology concepts of STD X. The researcher prepared teaching learning material such as power point presentation and games or activities. This was followed by construction of an achievement test and a reaction scale.

3.5.2 Tool Validation

The researcher gave the constructed tools to the experts for their valuable suggestions and comments. In all 10 experts were given the above mentioned tools for the validation.

Experts' Comments and Suggestions

1. The programme (Activities) designed were relevant to the topic.
2. There are few grammatical errors that needs to be corrected.
3. Incorporate the activities that are innovative such as reviewing articles and find the lexical meaning of the term.
4. Appreciated the test items.
5. Appreciated hard work of researcher to find the root words and its meaning for the Biological terms

3.5.3 The Experiment

The researcher had an informal talk with the science teachers regarding difficulties that are faced by the students learning Biology. On the basis of information collected from the school teachers the researcher had constructed Achievement tests (Pre-test and Post-test), Programme and reaction scale. The researcher administered the Pre-

test to know the understanding of the selected terms of Biology concepts from Standard X. In this stage researcher conducted the experiment on 67 students of STD X of Bharatiya Vidya Bhavan's School, Nadiad. The researcher implemented programme using Power point presentation and activities to teach selected terminology of Biology concepts. The researcher administered the post-test to know the effectiveness of the program on students of STD X learning terminology of Biology concepts. The researcher gave reaction scale to know students responses about the programme.

Table 3.5.3.1: Session wise Details of the Activities Conducted

Days	Sessions	Time
Day – 1	Administered Pre-test	1 hour
Day – 2	Finding difficult words from the Paragraph	45 min
Day – 3	Finding difficult words from the Paragraph and give its meaning	45 min
Day – 4	Learning Difficult Words through Game	45 min
Day – 5	Learning Difficult Words through Game	45 min
Day – 6	Power-point presentation	45 min
Day – 7	Worksheet	45 min
Day – 8	Article	45 min
Day – 9	Administered Post-test	1 hour
Day – 10	Administered Reaction Scale	30 min

3.6 Data Analysis

The researcher analyzed the collected data using t-test, Chi square (χ^2) and Percentage Analysis and interpreted the result.

3.7 Conclusion

The current chapter focused on the design and methodology of the research, tools, employed for data collection, construction of tools and detailed description of conduction and execution of the programme. The next chapter comprises analysis and interpretation of data.

CHAPTER – IV

DATA ANALYSIS AND INTERPRETATION

4.0 Introduction

The analysis of data is an important process that empirically supports the experiment carried out by the researcher. Data analysis and interpretation covers only the required and relevant information to be used for the generalizations.

This chapter of the dissertation concentrates on the statistical analysis and interpretation of the data collected. The focus is on the statistical parameters working in data processing. A detailed account of various statistical measurements of central tendency, Rank correlation coefficient, standard deviation and coefficient of variation were adopted. Moreover, the t-test was used for verifying statistical significant mean difference between scores of pre-test and post-test.

The analysis was viewed objectively, along with the statistical analysis of the data collected from pre-test and post-test. Simultaneously, qualitative analysis was also observed in terms of students' response and their active participation in the classroom.

4.1 Hypotheses Testing and Interpretation

Effectiveness of a program to Enrich Lexical content in Biology at the Secondary Level was found with reference to certain variables like achievement level, gender. Descriptive statistics of Pre-test and Post-test were computed. To test the hypotheses t - test was computed. Details of hypotheses testing are given below.

4.1.1. Hypothesis – 1

There will be no significant difference between the mean achievement scores of pre test and post test to Enrich lexical content in Biology at Secondary level.

To study the Effectiveness of a programme to enrich Lexical content in Biology at the Secondary Level on Achievement, the Achievement Test in Biology was used as Pre-test and Post- test to obtain data and descriptive statistics and t – test were computed. Results of descriptive statistics and t – test are presented in the Table.

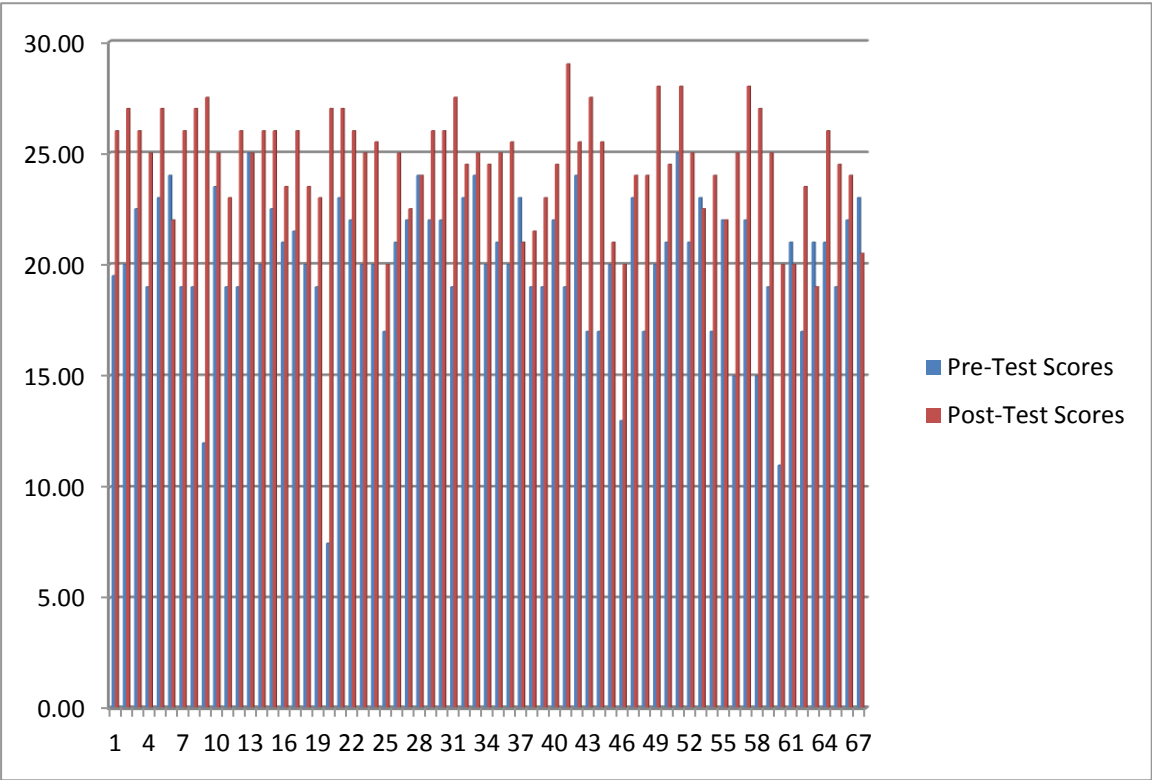
Table 4.1.1: Analysis of Pre-test and Post-test- Mean, SD, SE_D, r, df and ‘t’ value

Tests	No of Students	Mean	SD	SE _D	r	df	t-value
Pre-test	67	20.05	10.60	0.71	0.961	66	6.42
Post-test	67	24.61	5.13				

Interpretation

The computed t value 6.42 is greater than that of the table t value 1.28 at 0.01 levels and 1.64 at 0.05 levels for 66 degree of freedom. The calculated r value is 0.961; hence there is positive high correlation between the mean achievement scores of Pre-test & Post-test.

Therefore, the Null hypothesis is rejected. There will be no significant difference between the mean achievement scores of pre test and post test is rejected. It means that, there is significant difference between the mean achievement scores of Pre-test & Post-test. Thus, Effectiveness of a Programme to Enrich Lexical content in Biology at the Secondary Level was found effective.



Graph 4.1.1: Pre-test and Post-test scores to Enrich lexical content in Biology at Secondary level.

4.1.2. Hypothesis – 2

There will be no significant difference between mean Pre-test scores and Post-test scores of girls to Enrich Lexical content in Biology at the Secondary level.

To study the Effectiveness of a programme to Enrich Lexical content in Biology at the Secondary Level on Achievement, the Achievement Test in Biology was used as Pre-test and Post- test to obtain data and descriptive statistics and t – test were computed. Results of descriptive statistics and t – test are presented in the Table.

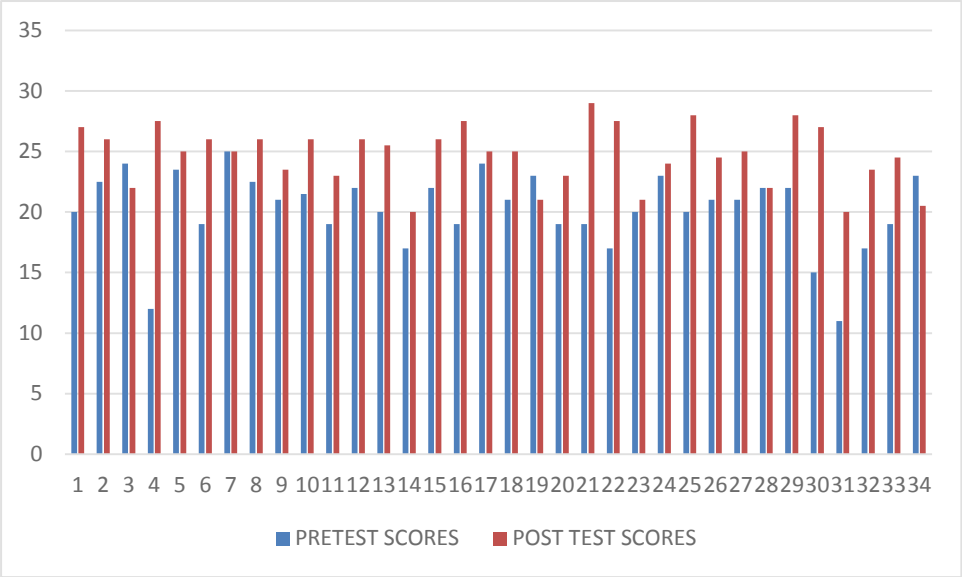
Table 4.1.2: Analysis of Pre-test and Post-test- Mean, SD, SE_D, r, df and ‘t’ value

Group	No of Students	Mean	SD	SE _D	r	df	t-value
Pre-test	34	20.20	3.12	0.61	0.14	33	7.40
Post-test	34	24.72	2.41				

Interpretation

The computed t value 7.40 is greater than that of the table t value 2.44 at 0.01 levels and 1.69 at 0.05 levels for 34 degree of freedom. The calculated r value is 0.145; hence there is positive high correlation between the mean achievement scores of Pre-test & Post-test of girls.

Therefore, the Null hypothesis is rejected. There will be no significant difference between the mean achievement scores of pre test and post test of girls is rejected. It means that, there is significant difference between the mean achievement scores of Pre-test & Post-test of girls. Thus, Effectiveness of a Programme to Enrich Lexical content in Biology at the Secondary Level was found effective.



Graph 4.1.2: Pre-test scores and Post-test scores of girls to Enrich Lexical content in Biology at the secondary level.

4.1.3. Hypothesis – 3

There will be no significant difference between mean Pre-test scores and Post-test scores of boys to Enrich lexical content in Biology at the Secondary level.

To study the Effectiveness of a programme to enrich Lexical content in Biology at the Secondary Level on Achievement, the Achievement Test in Biology was used as Pre-test and Post- test to obtain data and descriptive statistics and t – test were computed. Results of descriptive statistics and t – test are presented in Table

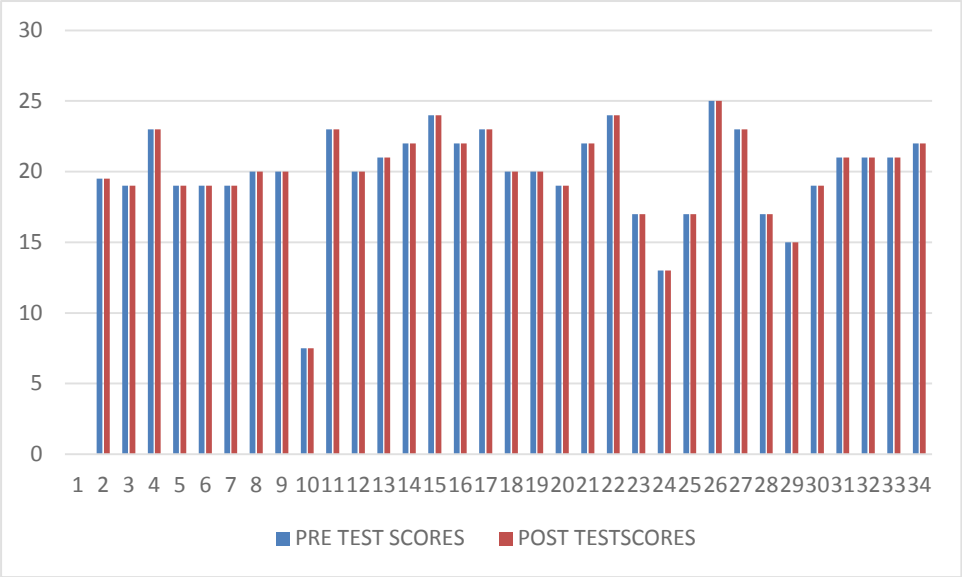
Table 4.1.3: Analysis of Pre-test and Post-test- Mean, SD, SE_D, r, df and ‘t’ value

Group	No of Students	Mean	SD	SE _D	r	df	t-value
Pre-test	33	19.90	3.37	1.1	0.09	32	4.19
Post-test	33	24.51	5.70				

Interpretation

The computed t value 4.19 is greater than that of the table t value 2.44 at 0.01 levels and 1.69 at 0.05 levels for 33 degree of freedom. The calculated r value is 0.09; hence there is positive high correlation between the mean achievement scores of Pre-test & Post-test of boys.

Therefore, the Null hypothesis is rejected. There will be no significant difference between the mean achievement scores of pre test and post test of boys is rejected. It means that, there is significant difference between the mean achievement scores of Pre-test & Post-test of boys. Thus, Effectiveness of a Programme to Enrich Lexical content in Biology at the Secondary Level was found effective.



Graph 4.1.3 : Pre-test and Post-test scores of boys to enrich lexical content in Biology at the secondary level

4.1.4. Hypothesis – 4

There will be no significant difference between mean Post-test scores of girls and mean Post-test scores of boys to enrich Lexical content in Biology at the Secondary level.

To study the Effectiveness of a Program to Enrich Lexical content in Biology at the Secondary Level on Achievement, the Achievement Test in Biology was used as Pre-test and Post- test to obtain data and descriptive statistics and t – test were computed. Results of descriptive statistics and t – test are presented in Table

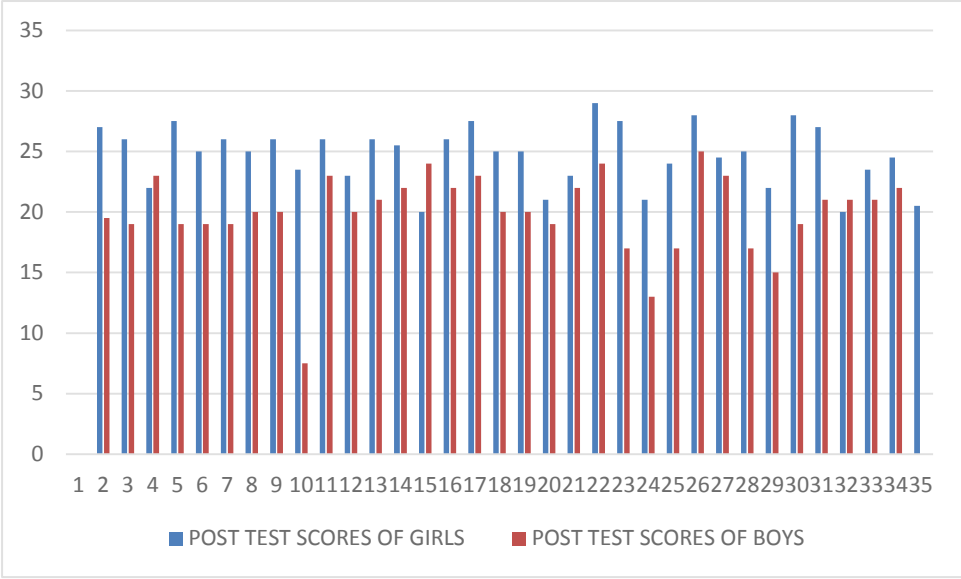
Table 4.1.4: Analysis of Pre-test and Post-test- Mean, SD, SE_D, df and ‘t’ value

Group	No of Students	Mean	SD	SE _D	df	t-value
Boys	33	24.51	5.70	1.07	65	0.19
Girls	34	24.42	2.41			

Interpretation

The computed t value 0.19 is smaller than that of the table t value 2.32 at 0.01 levels and 1.64 at 0.05 levels for 65 degree of freedom.

Therefore, There will be no significant difference between the mean achievement scores of Post-test of girls and boys is not rejected. It means that, there is no significant difference between the mean achievement scores of Post-test of girls and boys is accepted. Thus, both the groups of boys and girls are equal even after the intervention programme.



Graph 4.1.4: Post-test scores of girls and Post-test scores of boys to Enrich lexical content in Biology at the Secondary level

4.1.5. Hypothesis – 5

There will be no significant difference between mean Pre-test scores of boys and mean Pre-test scores of girls to Enrich lexical content in Biology at the Secondary level.

To study the Effectiveness of a programme to Enrich Lexical content in Biology at the Secondary Level on Achievement, the Achievement Test in Science and Technology was used as Pre-test and Post- test to obtain data and descriptive statistics and t – test were computed. Results of descriptive statistics and t – test are presented in Table

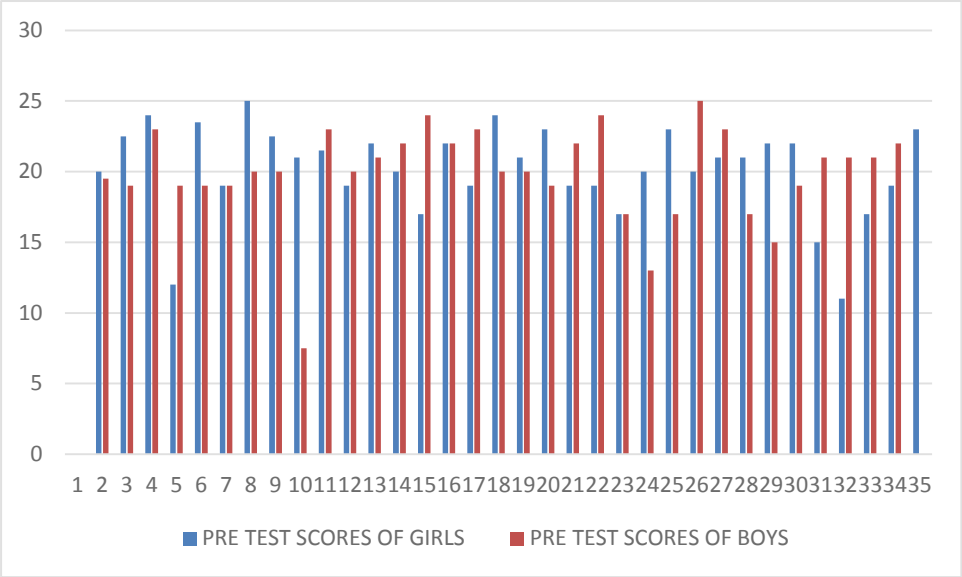
Table 4.1.5: Analysis of Pre-test and Post-test- Mean, SD, SE_D, df and ‘t’ value

Group	No of Students	Mean	SD	SE _D	df	t-value
Boys	33	19.90	3.37	0.79	65	0.37
Girls	34	20.20	3.12			

Interpretation

The computed t value 0.37 is smaller than that of the table t value 1.28 at 0.01 levels and 1.64 at 0.05 levels for 66 degree of freedom.

Therefore, the Null hypothesis that, there will be no significant difference between the mean achievement scores of Pre test of boys and Pre-test of girls is not rejected. It means that, there is no significant difference between the mean achievement scores of Pre-test of boys and girls is accepted. Thus, both the groups of boys and girls are equal before the intervention programme.



Graph 4.1.5: Pre-test scores of boys and mean Pre-test scores of girls to Enrich lexical content in Biology at the Secondary level

4.2 Data Analysis and Interpretation

Prior to commencing the research through the intervention, the researcher had formulated a null hypothesis, i.e. “There will be no significant difference in the observed frequencies and frequencies expected against equality hypothesis on various statements of scale”.

To test the hypothesis on each statement frequencies and χ^2 (chi-square) was calculated and then % analysis was done to get a more precise picture of responses.

Reaction of the students were analyzed in terms of frequencies, percentage responses, χ^2 they have been presented below

STATEMENT-1: The programme was useful to understand Biological Concept.

TABLE 4.2.1 Analysis of responses of Students on statement-1

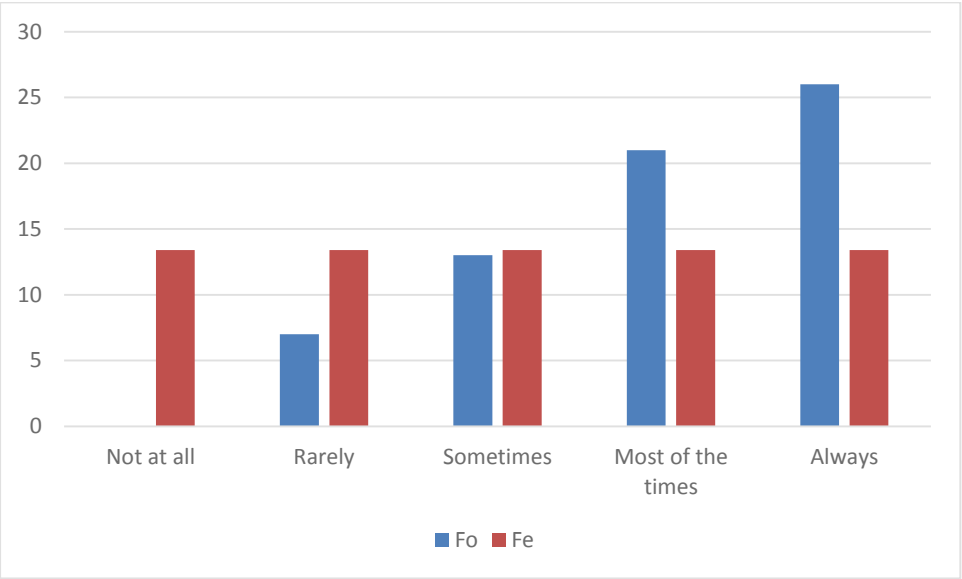
	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	7 (10.4%)	13 (19.4%)	21 (31.3%)	26 (38.8%)	32.62 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

Interpretation

38.8 % of Students said that the programme was always useful to them to understand the Biology Concepts, while 31.3% of the Students said that the programme was Most of the time useful to them to understand the Biology concepts. 19.4% of Student said that the programme was sometimes useful to them to understand the Biology concepts, while very few i.e. 10.4% of Students said that the programme was rarely useful to them to understand the Biology concepts. Thus, for majority of the students programme was found to be effective to enrich lexical content in Biology at the Secondary level.

The computed χ^2 Value 32.62 is greater than that of table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and the programme was useful to understand Biological Concept.



Graph4.2.1: The programme was useful to understand Biological Concept.

STATEMENT-2: Activities were interesting in understanding Biology concept.

TABLE 4.2.2 Analysis of responses of Students on statement-2

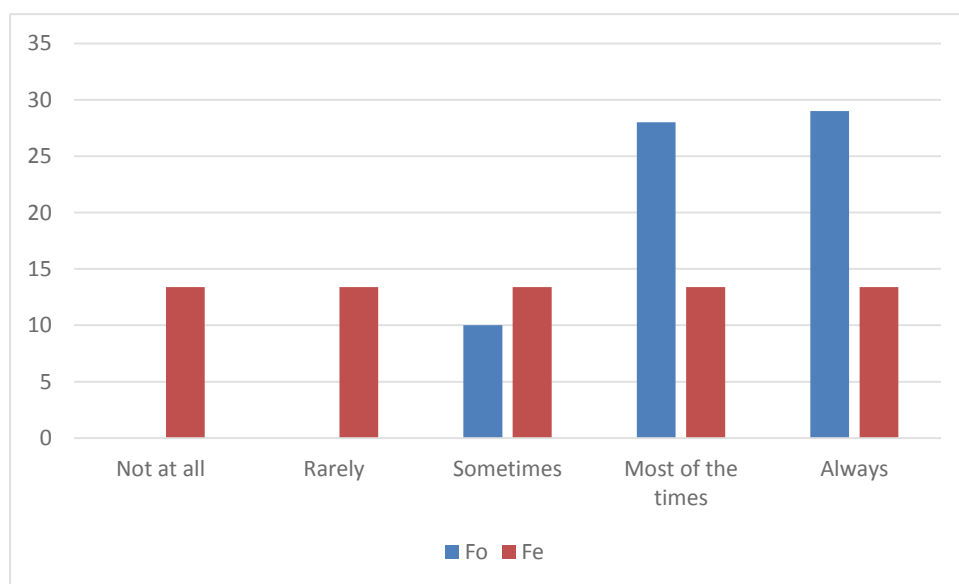
	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	-	10 (14.9%)	28 (41.7%)	29 (43.2%)	61.73 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

Interpretation

43.25% of Students said that they found activities given by the researcher were interesting in understanding Biology concepts. While 41.7% of Students said that most of the times activities were interesting in understanding Biology concepts. 14.9% of the Students said that activities were sometimes interesting in understanding Biology concepts. Hence, majority of students said that activities given by researcher were interesting to understand Biology concepts.

The computed χ^2 value 61.73 is greater than that of the table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and Activities were interesting in understanding Biology concept.



Graph4.2.2: Activities were interesting in understanding Biology concept.

STATEMENT-3: Terminology taught was useful to correlate Biology concepts with daily life.

TABLE 4.2.3Analysis of responses of Students on statement-3

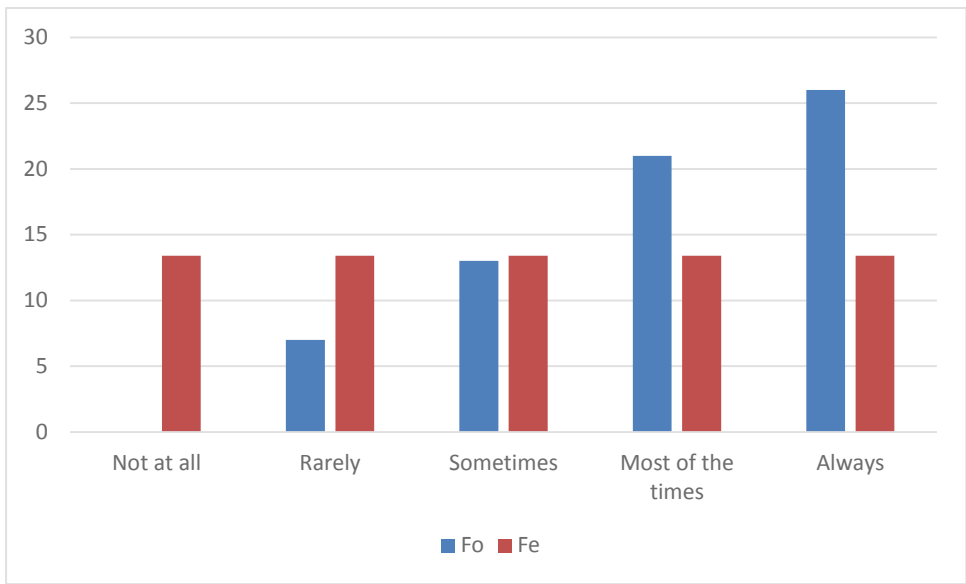
	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	7 (10.4%)	13 (19.4%)	21 (31.3%)	26 (38.8%)	32.62 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

Interpretation

38.8% of the Students were able to correlate the Biology concepts with daily life. 31.3% of the Students were able to correlate Biology concepts most of the times with daily life and 19.4% of the Students were able to correlate Biology concepts sometimes with the daily life. 10.4% of the Students were able to correlate Biology concepts rarely with the daily life. Therefore, the majority of the Students were able to correlate Biology concepts with daily.

The computed χ^2 value 32.62 is greater than that of the table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and Terminology taught was useful to correlate Biology concepts with daily life.



Graph4.2.3: Terminology taught was useful to correlate Biology concepts with daily life.

STATEMENT-4: The Programme was useful to learn Biology subject comfortably.

TABLE 4.2.4 Analysis of the responses of Students on statement-4

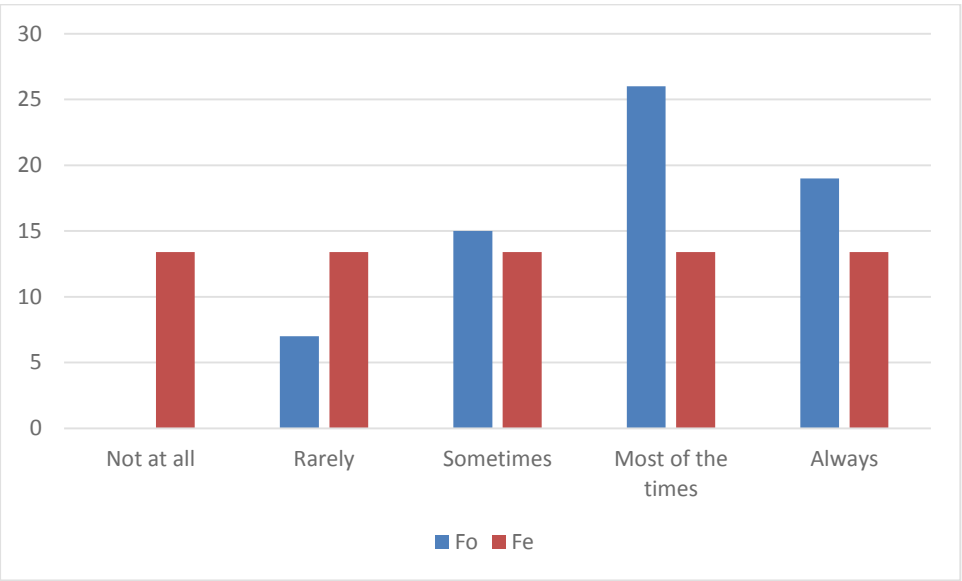
	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	7 (10.4%)	15 (22.3%)	26 (38.8%)	19 (28.3%)	30.83 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

Interpretation

38.8% of the Students said that most of the time they learned Biology concepts comfortably. 28.3% of the Students said that they always learned Biology subject comfortably. 22.3 % of the students reacted that sometimes they learnt Biology concepts comfortable. Whereas 10.4% of the students said that they rarely learnt Biology concepts. Therefore, majority of the Students learned Biology subject comfortably through the programme.

The computed χ^2 value 30.83 is greater than that of the table χ^2 value 13.27at 0.01 level for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and the Programme was useful to learn Biology subject comfortably.



Graph4.2.4: The Programme was useful to learn Biology subject comfortably

STATEMENT-5: Learning Terminology through different activities has developed your understanding.

TABLE4.2.5 Analysis of responses of Students on statement-5

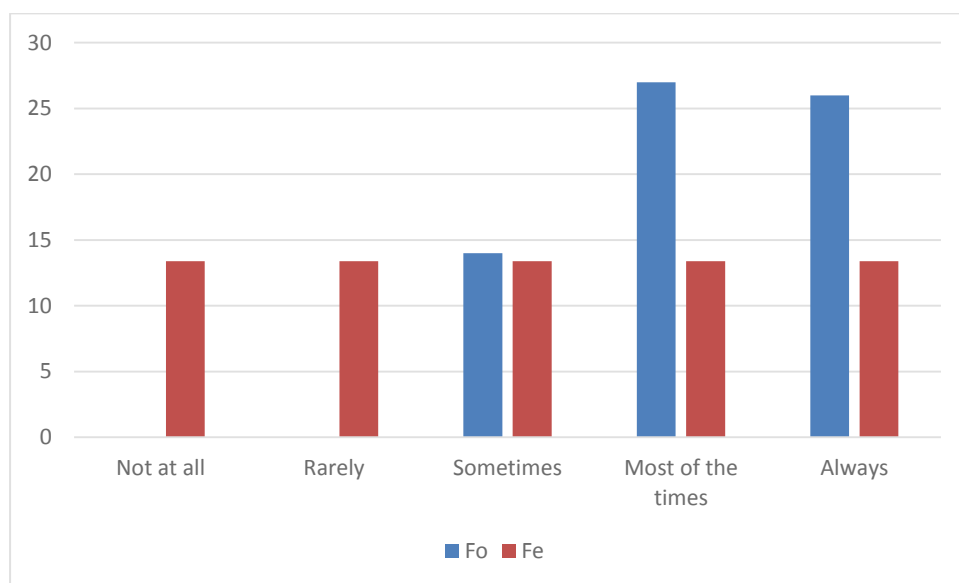
	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	-	14 (20.8%)	27 (40.2%)	26 (38.8%)	52.47 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

Interpretation

38.8% of the Students said that when they developed understanding of Biology concepts, 40.2% of the Students said that most of the times the programme developed their understanding of Biology. Thus, the learning Biology through different activities has developed the understanding of Biology among the Students.

The computed χ^2 value 52.47 is greater than that of table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and Learning Terminology through different activities has developed understanding among students.



Graph4.2.5: Learning Terminology through different activities has developed your understanding.

STATEMENT-6: Learning root words was interesting and joyful experience.

TABLE 4.2.6 Analysis of responses of Students on statement-6

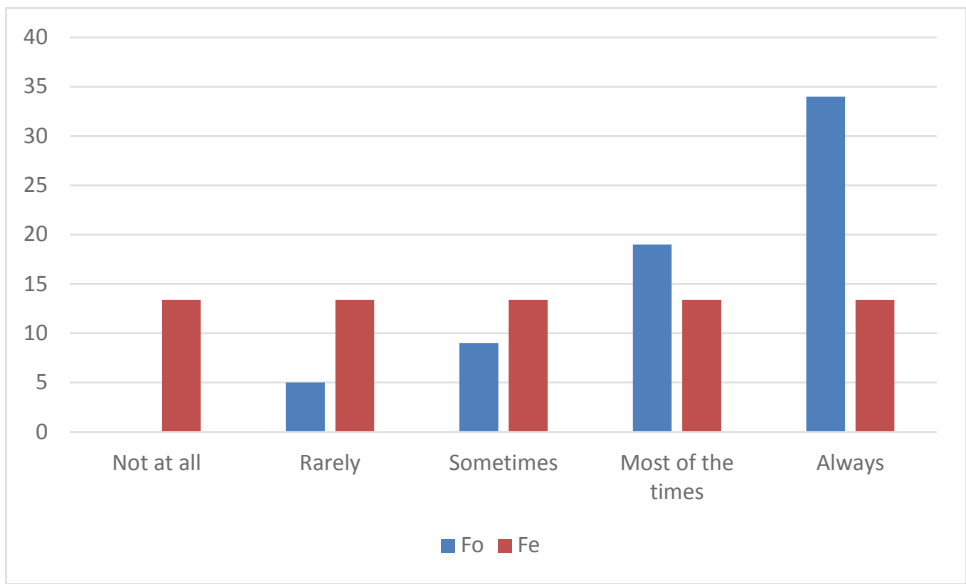
	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	5 (7.4%)	9 (13.4%)	19 (28.3%)	34 (50.74%)	54.11 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

Interpretation

50.74% of the Students said that Biology learning through root words was interesting and joyful experience. 28.3% of the Students said that most of the times learning root words were interesting and joyful experience. 13.4 % of the students reacted that sometimes learning root words were found interesting and joyful experience, 7.4 % of the students said that they found rarely interesting root words and joyful experience. Thus, Learning root words through various activities was interesting and joyful experience for Students.

The computed χ^2 value 54.11 is greater than that of table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and Learning root words was interesting and joyful experience for students.



Graph4.2.6: Learning root words was interesting and joyful experience.

STATEMENT-7: Learning Biology by playing games is better than learning Biology by traditional method.

TABLE4.2.7 Analysis of responses of Students on statement-7

	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	-	15(22.3%)	26(38.8%)	26(38.8%)	50.68 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

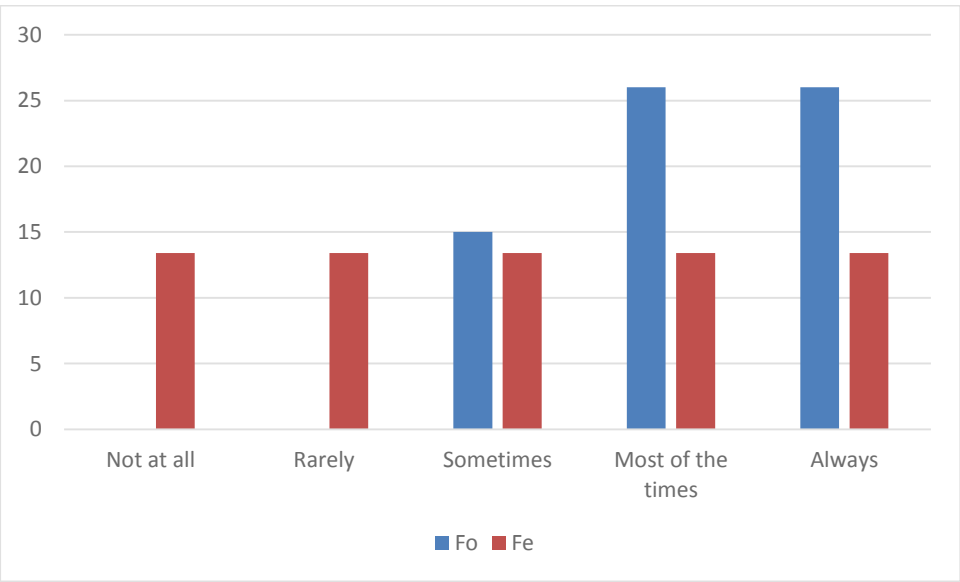
Interpretation

38.8% of the Students said that Learning Biology by playing games is better than learning Biology by traditional method. 38.8% of the Students said that most of the times Learning Biology by playing games is better than learning Biology by traditional method. 22.3% of students said that sometimes Learning Biology by

playing games is better than learning Biology by traditional method. Thus, learning Biology through games is better than learning Science by traditional method.

The computed χ^2 value 50.68 is greater than that of table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and Learning Biology by playing games is better than learning Biology by traditional method.



Graph4.2.7: Learning Biology by playing games is better than learning Biology by traditional method.

STATEMENT-8: Researcher’s explanation has facilitated understanding.

TABLE 4.2.8 Analysis of responses of Students on statement-8

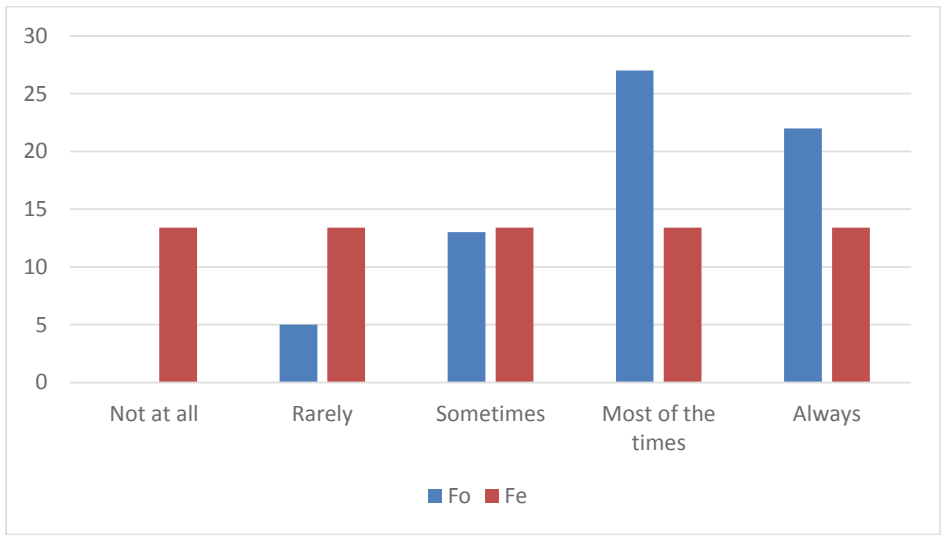
	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	5(7.4%)	13(19.4%)	27 (40.2%)	22(32.8%)	38 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

Interpretation

32.8% of the Students said that explanation given by the researcher has always facilitated their understanding. 40.2% of the Students found that explanation given by the researcher has most of the time facilitated their understanding. 19.4% of the Students found that explanation given by the researcher has sometimes facilitated their understanding. 7.4% of the Students found that explanation given by the researcher has rarely facilitated their understanding. Therefore, majority of the students said that explanation given by the researcher has facilitated their understanding.

The computed χ^2 value 38 is greater than that of table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and Researcher’s explanation has facilitated understanding among students.



Graph 4.2.8: Researcher’s explanation has facilitated understanding.

STATEMENT-9: Learning terminology through root words has helped in developing scientific attitude.

TABLE4.2.9 Analysis of responses of Students on statement-9

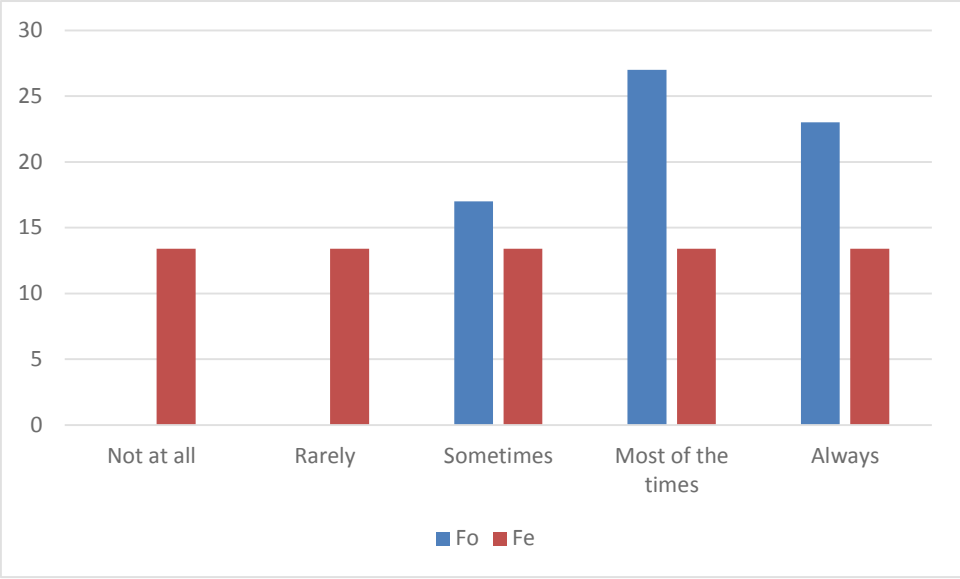
	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	-	-	17 (25.3%)	27 (40.2%)	23 (34.3%)	48.44 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

Interpretation

40.2% of the Students found that Learning terminology through root words has helped in developing scientific attitude. 34.3 % of the Students said that always they were able to develop scientific attitude when they learned Biology through root words. 25.3% of the Students said that sometimes they were able to develop scientific attitude when they learned Biology through root words. Therefore, learning Biology through root words helped them in developing Scientific attitude.

The computed χ^2 value 48.44 is greater than that of table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and Learning terminology through root words has helped in developing scientific attitude among students.



Graph 4.2.9: Learning terminology through root words has helped in developing scientific attitude.

STATEMENT-10: Learning to make use of root words has developed critical thinking.

TABLE 4.2.8 Analysis of responses of Students on ststatement-8

	Not at all	Rarely	Sometimes	Most of the Times	Always	χ^2 and level of Significance
fo	4 (5.9%)	5 (7.4%)	19 (28.3%)	21 (31.3%)	18 (26.8%)	20.08 (0.01)
fe	13.4	13.4	13.4	13.4	13.4	

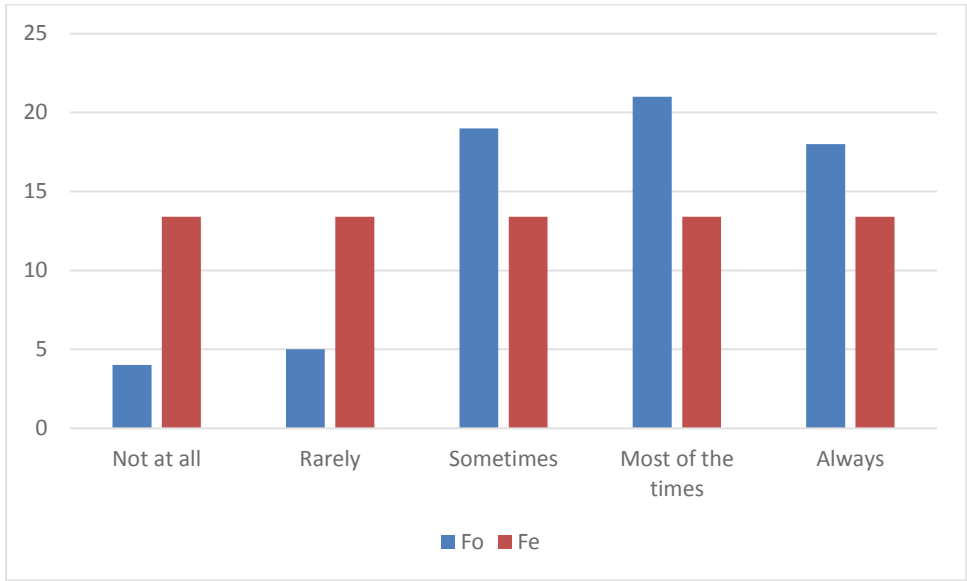
Interpretation

31.3% of the students said that most of the time they developed critical thinking in learning Biology. 26.8% of the Students said that they always developed critical thinking in learning Biology. 28.3% of the Students said that sometimes they developed critical thinking in learning Biology. 7.4% of the Students said that they

rarely developed critical thinking in learning Biology. 5.9% of the Students said that they not at all developed critical thinking in learning Biology. Therefore, learning Biology developed their critical thinking.

The computed χ^2 value 20.08 is greater than that of table χ^2 value 13.27 at 0.01 levels for 4 degree of freedom.

Therefore, the Null Hypothesis is rejected. It means that, there is significant difference between the observed frequencies and expected frequencies and making use of root words has developed critical thinking.



Graph 4.2.10: Learning to make use of root words has developed critical thinking.

4.3 Conclusion

Thus, from the above data analysis a programme has been found effective to enrich lexical content in Biology at secondary level as evident through the significant difference between the mean achievement score of Pre-test & Post-test and also through responses given by the Students on reaction scale. The next chapter comprises of Findings, Suggestions, educational Implications collected during the programme.

CHAPTER – V
FINDINGS, SUGGESTIONS, EDUCATIONAL
IMPLICATIONS
AND CONCLUSION

5.0 Introduction

The purpose of the study was to find out Effectiveness of a Programme to Enrich Lexical content in Biology at Secondary level.

Vocabulary plays an important role in understanding the subject. The habit of reading develops the vocabulary and its meaning in different context. Students having more vocabulary show better performance in studies. Even, learning new vocabulary helps in enhancing language. It also helps in provoking thoughts of an individual while expressing ideas. Vocabulary (Lexical Items) is generically defined as the knowledge of words and word meanings. More specifically, we use vocabulary to refer to the kind of words that students must know to read increasingly demanding text with comprehension (Kamil & Hiebert, 2005). Thus, the attempts had been made to Enrich Lexical content in Biology at Secondary level so that learning Biology becomes interesting.

For this, Construction and finalization (with experts comments & suggestions) of a programme and tests were in the phase – 1 where as its implementation was in phase – 2. This chapter helps to get overview of the study. The detailed report of the present study has been given in the previous chapters. In the present chapter the summary of the report has been presented along with the findings, implications, observations and recommendations for prospective researches.

5.1 Statement of the Problem

The title of the present study

EFFECTIVENESS OF PROGRAMME TO ENRICH LEXICAL CONTENT IN BIOLOGY AT THE SECONDARY LEVEL

5.2 Objectives of the Study

The study was carried out with the following objectives.

1. To study the Effectiveness of the programme to Enrich Lexical content in Biology at the Secondary Level
2. To study the Effectiveness of the programme to Enrich Lexical content in Biology in context to gender (Male and Female)

5.3 Variables of the study

The variables of the present study are as below

a) Independent variables

- i. Programme (Devices to enrich Lexical Content)

Secondary Independent Variables

- i. Gender
 - a. Male
 - b. Female

b) Dependent variables

- i. Achievement Scores (Pre- test and Post- test)
- ii. Reaction Scale

5.4 Hypotheses of the Present Study

Following were the hypotheses of the present study.

1. There will be no significant difference between mean Pre-test scores and Post-test scores of students through a programme to enrich lexical content in Biology at the secondary level.
2. There will be no significant difference between mean Pre-test scores and Post-test scores of girls through a programme to enrich lexical content in Biology at the secondary level.
3. There will be no significant difference between mean Pre-test scores and Post-test scores of boys through a programme to enrich lexical content in Biology at the secondary level.
4. There will be no significant difference between mean Post-test scores of girls and boys through a programme to enrich lexical content in Biology at the secondary level.
5. There will be no significant difference between mean Pre-test scores of boys and girls through a programme to enrich lexical content in Biology at the secondary level.
6. There will be no significant difference between the observed frequencies and expected frequencies through a programme to enrich lexical content in Biology at the secondary level.

5.5 Population of the Study

The present study was carried out with students of STD X English Medium CBSE schools studying in the year 2016-17.

5.6 Sampling Technique and Sample

In the present study the researcher used convenient sampling technique for selecting the sample. The sample for the present study was STD X Students of Bharatiya Vidya Bhavan's School, Nadiad studying in the year 2016-17. The sample size was of 67 students of STD X.

Table 5.6.1 : Sample distribution

Sr. No.	School Name	Boys	Girls
1.	Bhartiya Vidya Bhavans, Nadiad	33	34

5.7 Tools for the Study

Following were the tools used in the present study.

1. Achievement Tests (Pre-test and Post-test)
2. Reaction Scale

5.8 Research Design

Research Type : The study was quantitative type.

Research Method: The method used for the study was experimental.

Research design: The research design used was Single Group Pre-test Post-test design.

5.9. Data Analysis

The researcher analyzed the collected data using t-test, Chi square (χ^2) and Percentage Analysis and interpreted the result.

5.10. Results of Hypotheses Testing

Results obtained after testing the hypotheses are presented in table 5.10.1:

Table 5.10.1: Result obtained using t -test

Sr. No.	Hypothesis	t – value	Significant level	Rejected / Accepted
1.	There will be no significant difference between the mean achievement scores of pre test and post test to enrich lexical content in Biology at the secondary level.	6.42	0.01	Rejected
2.	There will be no significant difference between mean Pre-test scores and Post-test scores of girls to enrich lexical content in Biology at the secondary level.	7.40	0.01	Rejected
3.	There will be no significant difference between mean Pre-test scores and Post-test scores of boys to enrich lexical content in Biology at the secondary level.	4.19	0.01	Rejected
4.	There will be no significant difference between mean Post-test scores of girls and mean Pre-test scores of boys to enrich lexical content in Biology at the secondary level.	0.19	Not significant at 0.01 and 0.05 levels	Accepted
5.	There will be no significant difference between mean Post-test scores of girls and mean Pre-test scores of boys to enrich lexical content in Biology at the secondary level.	0.37	Not significant at 0.01 and 0.05 levels	Accepted

5.11. Findings of the Study

After testing the hypotheses, obtained findings are as given below

1. The programme to enrich Lexical content in Biology at the Secondary Level was found effective in teaching Biology.
2. The programme to enrich Lexical content in Biology at the secondary level was found effective in both boys and girls.
3. The programme to enrich lexical content in Biology at the secondary level was not found effective after intervention programme in Boys and girls.
4. The Programme was found to be effective to enrich lexical content in Biology at the secondary level
5. Activities given were interesting to understand Biology concepts.
6. Majority of the Students were able to correlate Biology concepts with daily life.
7. Majority of the Students learned Biology subject comfortably through the programme.
8. Learning Biology through different activities has developed the understanding of the Biology among Students.
9. Learning root words through various activities was interesting and joyful for Students.
10. Learning Biology through games is better than learning through traditional method.
11. Explanation given has facilitated students understanding.
12. Learning Biology through root words helped them in developing Scientific attitude.
13. Learning Biology through a programme has developed their critical thinking.

5.12. Educational Implications

Following are the educational implications of the present study.

- 1) A programme can be used to enrich lexical content in Biology for students of STD X students.
- 2) Games, activities, etc. can be used to enrich lexical content in Biology for students of STD X students.

- 3) Learning biology through such programme develops critical thinking, scientific attitude and facilitates Students understanding.
- 4) To enrich lexical content among students such programme is fruitful.

5.13 Suggestions for further Studies

Following are the suggestions for further studies

- 1) Effectiveness of a Programme to enrich Lexical content in Environmental Science at the Primary Level
- 2) Effectiveness of a Programme to enrich Lexical content in Biology at the Higher Secondary Level
- 3) Effectiveness of a Programme to enrich Lexical content in Biology at the College Level
- 4) Effectiveness of a Programme to enrich Lexical content in Chemistry at Various levels
- 5) Effectiveness of a Programme to enrich Lexical content in Biology at the secondary level in context to certain variables.
- 6) Effectiveness of various strategies to enrich Lexical content in Biology at the Secondary level
- 7) Effectiveness of a Peg word method to enrich Lexical content in Biology at the Secondary level
- 8) Effectiveness of a Loci method to enrich Lexical content in Biology at the Secondary level
- 9) Teachers' Perceptions about developing lexical content in Biology at various levels.

5.14. Recommendations to educationists

The following are the recommendations for the further studies

- 1) Textbooks of Biology should contain root words and their meanings.
- 2) Teacher should use various methods / strategies to enrich lexical items in different subjects.
- 3) Workshops should be organized for the teachers on use of various methods to enrich lexical content in various subjects.

- 4) Material can be produced to enrich lexical content in various subjects at different levels.

5.15. Conclusion

This research study was carried out with a view to verify **Effectiveness of a Programme to Enrich Lexical Content in Biology at the Secondary Level**. It was an experimental research.

On the basis of the analysis of the data presented in the previous chapter, this chapter presented the findings arrived at and discussed their educational implications. Thus, this chapter is a summative view of the investigation in terms of its academic outcome. The next chapter deals with the references mentioned in this study.

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APPENDICES

APPENDIX - I

Pre-test

Maximum Marks: 30

Time: 35 Min

Instructions : All the questions are compulsory. Write the answer as per the instructions given in each question.

1)	Encircle the correct meaning for the given sentences 1) The Organisms living both in land and water is called as :Reptile/Amphibian 2) Man eat food using :Anterior hand/posterior 3) We walk by :Hind limb/ Fore Limb 4) Seed having one cotyledon is called :Monocotyledon/Dicotyledon 5) The hollow part of developing embryo is called as : Viscera/ Blastocoel	[5]												
2)	Match the words given in column A with the meaning given in column B. Write in the space provided below. <table><thead><tr><th>A (Words)</th><th>B (Meanings)</th></tr></thead><tbody><tr><td>(i) Cytotoxic</td><td>(a) toxicity to the heart</td></tr><tr><td>(ii) Cardiotoxicity</td><td>(b) group of symptoms occurring together</td></tr><tr><td>(iii) Hyperglycaemia</td><td>(c) toxic to the cell</td></tr><tr><td>(iv) syndrome</td><td>(d) study of tissue</td></tr><tr><td>(v) histology</td><td>(e) excessive blood sugar levels</td></tr></tbody></table> (i) _____, (ii) _____, (iii) _____, (iv) _____, (v) _____	A (Words)	B (Meanings)	(i) Cytotoxic	(a) toxicity to the heart	(ii) Cardiotoxicity	(b) group of symptoms occurring together	(iii) Hyperglycaemia	(c) toxic to the cell	(iv) syndrome	(d) study of tissue	(v) histology	(e) excessive blood sugar levels	[5]
A (Words)	B (Meanings)													
(i) Cytotoxic	(a) toxicity to the heart													
(ii) Cardiotoxicity	(b) group of symptoms occurring together													
(iii) Hyperglycaemia	(c) toxic to the cell													
(iv) syndrome	(d) study of tissue													
(v) histology	(e) excessive blood sugar levels													
3)	Fill in the blanks using appropriate words from the list given below. Gymnosperm, Inter-Membrane, Isotonic, Gnatha, Mammary-gland, Angiosperm, Di- Phase 1) The process of breakdown of water is called as_____. 2) The gap between two cell is called as _____. 3) The term used for fish is _____. 4) The plant producing naked seed is called as_____. 5) Presence of _____ is a characteristic of Mammals.	[5]												
4)	State whether the given word and its meaning is True / False	[5]												

1)	polychromatic → having many different colors	
2)	pseudo → A temporary footlike extension of a one-celled organism, used for moving about and for taking in food	
3)	Olfactory receptor – helps to see	
4)	photosynthesis → formed together from artificial part; not genuine	
5)	Oligosaccharide- many unit of glucose	

Split the below mentioned words and define them:

[10]

1) Pseudopodia

2) Syngamy

3) Gynoecium

4) Polygamy

5) Amphibian

APPENDIX - II

Post-test

Maximum Marks: 30

Time: 35 Min

Instructions : All the questions are compulsory. Write the answer as per the instructions given in each question.

1) Encircle the correct meaning for the given sentences [5]

- 1) The fish without the jaw is called as : Agnatha/Gnatha
- 2) The fats are stored in : Adipocyte/ Cytokine
- 3) The process of division is called : Kinesis/Dyalisis
- 4) Flower having both male and female is called : Bisexual/Unisexual
- 5) The starch is digested by : Cellulose/Salivary Amylase

2) Match the words given in column A with the meaning given in column B. Write in the space provided below. [5]

A (Words)	B (Meanings)
nephrotoxic	outside the uterine cavity
anaemia	an instrument to look inside the body cavities or organs
ectopic pregnancy	harmful to the kidneys
prenatal	before birth
endoscope	lack of red blood cells

(i) _____, (ii) _____, (iii) _____, (iv) _____, (v) _____
3) Fill in the blanks using appropriate words from the list given below. [5]

Waste Removal, Hydrolysis, Hydroponics, Fussion, fission, haploid, Gemma Diploid
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- 1) Nephredia helps in _____.
 - 2) The process of division of nucleus in atom bomb is called
 - 3) as_____.
 - 4) The organism having two set of genome is called as
 - 5) _____.
- The other name of bud is _____.
- The solution in which cell remains unchanged is called as _____.

4) State whether the given word and its meaning is True / False [5]

- 1) Osteology- Study of birds
- 2) biennial → happening every two years
- 3) Ova- The male gamete
- 4) hydrate → to add water to
- 5) polyclinic → A hospital that treats many kinds of diseases

Split the below mentioned words and define them: [10]

1) Cytokinesis

2) Nephrolysis

3) Monohybrid

4) Amphibian

5) Ave

APPENDIX – III (A)

Programme

Greek and Latin Root Words for Biology

The key to learning biological terms is in learning the origins of those words which is usually Greek or Latin.

A <i>a(n)</i>- without <i>ab</i>- away from <i>abduc</i>- lead from <i>acanth</i>- prickle <i>acer</i>- without horns <i>acetabul</i>- vinegar cup <i>aceto</i>- acid <i>acin</i>- cluster of grapes <i>acri</i>- acrid, sharp <i>acro</i>- summit, top <i>actin</i>- ray <i>acust</i>- of hearing <i>ad</i>- towards <i>adipo</i>- fat <i>adventit</i>- coming to <i>aegopod</i>- goat-foot <i>aestiv</i>- summer <i>affer</i>- carrying to <i>agrest</i>- rural, wild <i>agro(st)</i>- field <i>al(i)</i>- wing <i>alb</i>- white <i>allant</i>- sausage <i>allium</i> garlic <i>alopec</i>- fox <i>altissim</i>- tall <i>alve</i>- pit, socket <i>ambly</i>- blunt <i>ambul</i>- walk <i>ammo</i>- sand <i>amnio</i>- fetal envelope <i>amoeb</i>- change <i>amphi</i>- both <i>amplex</i>- clasping <i>ampulla</i>- flask <i>amygdala</i>- almond shaped organ	B <i>baca</i>- small berry <i>baccatus</i>- berried <i>baena</i>- walking <i>balan</i>- acorn <i>barb</i>- beard <i>basi</i>- at the bottom <i>bat(is)</i> skate, ray <i>bdella</i>- sucker <i>bell</i>- pretty <i>bi</i>- two <i>bi(ola)</i>- life <i>blast</i>- germ <i>bore</i>- north <i>botry</i>- small bunch of grapes <i>bov</i>- ox <i>brachi</i>- arm <i>brachy</i>- short <i>brady</i>- slow <i>branch</i>- gill <i>brevi</i>- short <i>brizo</i>- to nod <i>bromo</i>- oats, broom, shadow <i>bronch</i>- windpipe <i>bucca</i>- mouth cavity <i>bulbos</i>- bulbous <i>bull</i>- bubble, flask <i>bullat</i>- wrinkled <i>buno</i>- hill <i>bursa</i>- pouch, purse	C <i>caduci</i>- temporary <i>caec</i>- blind <i>caerul</i>- sky blue <i>caespit</i>- tufted <i>calam</i>- reed, aspen <i>calc</i>- stone <i>calli</i>- beautiful <i>callos</i> callous <i>calor</i>- heat <i>calyx</i> cup, chalice <i>camp</i>- field <i>campanula</i> bell <i>cani</i>- dog <i>cap(it)</i>- head <i>capill</i>- hair <i>capsella</i>- small box <i>card</i>- heart <i>carin</i>- keel <i>cam</i>- flesh <i>carotid</i>- producing stupor <i>carp</i>- seed, wrist <i>cary</i>- nut <i>cata</i>- down <i>cauda</i>- tail <i>cav</i>- hollow <i>centi</i>- hundred <i>ceph(al)</i>- head <i>cera(s)(t)</i>- horn <i>cerc</i>- horns, lobes, short tail <i>cerebro</i>- brain <i>cerv</i>- neck <i>ch(e)ir</i>- hand <i>chaero</i>- to please <i>chaet</i>- bristle <i>chamae</i>- on ground <i>chel</i>- turtle <i>cheno</i>- goose
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<i>amyl-</i> starch <i>an-</i> without <i>ana-</i> up, back, again <i>anatol-</i> east <i>Anagallis-</i> delightful <i>anchus-</i> bend, bay <i>andr-</i> male <i>anemo-</i> wind <i>angi-</i> vessel <i>angul-</i> angle <i>angusti-</i> narrow <i>ankylo-</i> stiff jointed <i>annu-</i> annual <i>anomo-</i> lawless, irregular <i>anser-</i> geese <i>ante-</i> before <i>antho-</i> flower <i>anthro-</i> human <i>anti-</i> against, opposite <i>antr-</i> cave <i>apo-</i> separate, from <i>aqua-</i> water <i>aguilin-</i> eagle-beaked <i>arach-</i> spider <i>arbor-</i> tree <i>arc-</i> arch <i>arch(ae/i)-</i> ancient <i>arct(i/o)-</i> north, bear <i>are-</i> space <i>areni-</i> sandy <i>arg(en/lyr)-</i> silver <i>arthro-</i> joint <i>artic-</i> jointed <i>artio-</i> even-numbered <i>arundin-</i> reed-like <i>asc-</i> sac <i>asper-</i> rough <i>aspid-</i> shield <i>ast(e)r-</i> star <i>astrag-</i> dice (originally a knuckle bone) <i>ater, atra-</i> black <i>Atlas=</i> a Titan(mythical giant) who supported the world on his shoulders		<i>chiasm-</i> crossing <i>chil-</i> lip <i>chlamy-</i> outer garment <i>chlor-</i> green <i>choan-</i> funnel <i>chondr-</i> cartilage <i>chord-</i> cord <i>chorion</i> membrane <i>chrom-</i> colour <i>chrys-</i> golden <i>chyl-</i> fluid <i>chym-</i> juice <i>cili-</i> eyelash <i>ciner-</i> ashen, grey <i>cipit-</i> head <i>circum-</i> around <i>cirr-</i> tentacle (originally curl) <i>cl(e)ist-</i> closed <i>clad-</i> branch <i>clast-</i> broken <i>clav-</i> key <i>cleid-</i> key <i>cleithr-</i> bar, key <i>clin-</i> bed, recline <i>cloaca</i> sewer <i>coccus</i> berry, grain <i>cochl-</i> shell <i>coel-</i> hollow <i>col(on)</i> large intestine <i>coll-</i> neck <i>collat-</i> borne together <i>columella</i> little column <i>com-</i> with <i>commis-</i> sent out <i>communis-</i> colonial <i>commutat-</i> changed <i>compact-</i> compact <i>compress-</i> flattened <i>con-</i> with <i>conch-</i> shell <i>condyl-</i> knuckle <i>cono-</i> cone <i>contra-</i> opposite <i>convolvo-</i> to entwine <i>copro-</i> dung
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<i>atr(ium)</i> - vestibule <i>Atropos</i> = one of the Fates who cut the thread of life <i>aur</i> - ear, gold <i>austral</i> - southern <i>auto</i> - self <i>aux</i> - grow <i>avi</i> - bird <i>axi</i> - axis <i>azyg</i> - unpaired		<i>cora(xlg)</i> - raven <i>corb</i> - basket <i>cord</i> - heart <i>corium</i> - leather <i>corn</i> - horn <i>coron</i> - crown <i>corp</i> - body <i>cort</i> - bark <i>cost</i> - rib <i>cotyl</i> - cup <i>crani</i> - skull <i>crass</i> - thick <i>crep</i> - shoe <i>cribi</i> - sieve <i>cric</i> - ring <i>crispus</i> curled <i>crist</i> - crest <i>crosso</i> - fringe, tassel <i>cru(rals)</i> - shank <i>cruci</i> - cross-like <i>crypt</i> - hidden <i>cten</i> - comb <i>cune</i> -wedge <i>culp</i> - lance, point <i>cuti</i> - skin <i>cyan</i> - blue <i>cycl</i> - circular <i>cyno</i> - dog <i>cyst</i> - capsule <i>cyt</i> - cell
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D	E	F
<i>dactyl</i> - finger <i>dasy</i> - shaggy <i>deci</i> - ten <i>decid</i> - falling off <i>decuss</i> - cross banding <i>deka</i> - ten <i>delph</i> - womb <i>delphis</i> - dolphin <i>demi</i> - half <i>dendr</i> - tree <i>dent</i> - tooth <i>derm</i> - skin <i>dero</i> - persisting <i>desmo</i> - band	<i>echino</i> - spiny <i>echis</i> - viper <i>eco</i> - house <i>ecto</i> - outside <i>effer</i> - carrying away <i>effusus</i> - loosely spreading <i>ejacul</i> - throw out <i>elasmo</i> - plate, flat <i>elat</i> - tall <i>-ell</i> - diminutive <i>embio</i> - living <i>embol</i> - thrown in <i>endo</i> - inside <i>engy</i> - narrow	<i>fab</i> - bean <i>falc</i> - sickle-shaped <i>fallax</i> - false <i>fasc(ic)</i> - bundle <i>fatuus</i> - foolish, useless <i>feli</i> - cat <i>fer</i> - carry <i>ficar</i> - fig-like <i>fil</i> - thread <i>fistul</i> - hollow, tube <i>flacc</i> - flabby <i>flav</i> - yellow <i>flexu</i> - wavy <i>flocculus</i> - lock of wool

<i>deut-</i> second <i>dextro-</i> right <i>di(a)-</i> two <i>dia-</i> through <i>didym-</i> twin <i>digit-</i> finger <i>dino-</i> terrible <i>diplo-</i> double <i>dipso-</i> thirst <i>dissect-</i> deeply cut <i>dodeca-</i> twelve <i>don't-</i> tooth <i>dors-</i> back <i>drom-</i> quick running <i>dubi-</i> doubtful <i>dulci-</i> sweet <i>duo-</i> two <i>dur-</i> hard	<i>ensi-</i> sword <i>entolenter-</i> inside <i>eo-</i> dawn, east <i>epi-</i> upon <i>equi-</i> horse, equal <i>erect-</i> upright <i>erythr-</i> red <i>esculent-</i> edible <i>ethm-</i> sieve <i>eu-</i> well, very <i>eury-</i> wide <i>ex-</i> out of <i>exiguus-</i> slender <i>exo-</i> outside <i>extens-</i> draw out <i>extra-</i> beyond <i>extrins-</i> coming from	<i>fluitans-</i> floating <i>foen-</i> hay <i>foetid-</i> foul smelling <i>foli-</i> leaf <i>fontan-</i> fountain <i>foramen-</i> opening <i>fornix-</i> vault <i>fovea-</i> shallow round depression <i>fruticans-</i> shrubby <i>fund-</i> to pour <i>furc(ul)-</i> fork
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G	H	I
<i>gal-</i> milk <i>gale-</i> weasel <i>gall-</i> of France <i>gangli-</i> knot <i>gano-</i> shining <i>gast(e)r-</i> stomach, pouch <i>gemin-</i> twins <i>gemm-</i> bud <i>genu-</i> knee, joint <i>geranium-</i> crane <i>gerro-</i> shield <i>gladi-</i> sword <i>glen-</i> socket <i>glia-</i> glue <i>glom(er)-</i> half of yam <i>glo(ss/tt)-</i> tongue <i>glut-</i> sticky <i>gl(uly)c-</i> sweet <i>glypt-</i> carved, engraved <i>gnaph-</i> wool <i>gnath-</i> jaw <i>goni-</i> angle <i>gono-</i> seed <i>gracil-</i> slender <i>gram-</i> of grass <i>gymn-</i> naked	<i>haem-</i> blood <i>hal-</i> salty <i>hallu(x/ci)-</i> big toe <i>hamat-</i> hook <i>haplo-</i> single, simple <i>hasta(t)-</i> spear-tip shape <i>hect-</i> hundred <i>heira-</i> hawk <i>helios-</i> sun <i>helminth-</i> worm <i>helo-</i> wart <i>hemi-</i> half <i>hepa(r/t)-</i> liver <i>hepta-</i> seven <i>hetero-</i> different <i>hex-</i> six <i>hibem-</i> winter <i>hippo-</i> horse <i>hirsut-</i> hairy <i>hispid-</i> bristly <i>histri-</i> actor <i>holo-</i> complete, whole <i>homo-</i> man, same <i>homal-</i> flat <i>hormon-</i> that which excites <i>hortens-</i> of gardens	<i>ichthy-</i> fish <i>-ida-</i> like <i>-idae-</i> ending of zoological family names <i>ileum-</i> twisted <i>impar-</i> unpaired <i>in-</i> in, not <i>-in-</i> diminutive <i>-inae-</i> ending of zoological sub-family names <i>incarnat-</i> flesh coloured <i>incis-</i> cutting in <i>incus-</i> anvil <i>inermis-</i> unarmed <i>inflexis-</i> rigid <i>infra-</i> under <i>inter-</i> between <i>intra-</i> within <i>iod-</i> violet <i>-iola-</i> diminutive <i>iris-</i> rainbow <i>iso-</i> equal <i>iter-</i> passage <i>jug-</i> yoked together <i>jungoljunc-</i> to bind

<i>gyn-</i> woman <i>gyr-</i> turning	<i>humus-</i> ground <i>hyal-</i> glassy <i>hydr-</i> water <i>hyemal-</i> winter <i>hyo-</i> U-shaped <i>hyper-</i> above <i>hypo-</i> beneath	k <i>ket-</i> ketone <i>kilo-</i> thousand
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L	M	N
<i>labi-</i> lips <i>labyrinth-</i> tortuous passage <i>lacer-</i> torn <i>lacrim-</i> tears <i>lact-</i> milk <i>lacuna-</i> space <i>laevo-</i> left <i>lagna-</i> flask <i>lamella-</i> leaf, layer <i>lan(at)-</i> wool <i>lanceol(at)-</i> lance-shaped <i>lati-</i> broad <i>lecith-</i> egg yolk <i>lemm-</i> skin, husk <i>lens-</i> lentil, bean <i>leo(n)-</i> lion <i>lepid-</i> scale <i>lepto-</i> slender <i>leuc-</i> white <i>levator-</i> lifter <i>lign-</i> wood <i>ligul-</i> strap-shaped <i>lin-</i> line <i>ling-</i> tongue <i>lip-</i> fat <i>lith-</i> stone <i>log(y)-</i> discourse <i>loph-</i> crest <i>lumen-</i> cavity <i>luna-</i> moon <i>lupus</i> wolf <i>lute-</i> yellow <i>lymph-</i> clear water <i>lysis-</i> loosen	<i>macr-</i> large <i>macula-</i> spot <i>magni-</i> large <i>maj-</i> greater <i>mala-</i> cheek <i>malleus-</i> hammer, mallet <i>mamma-</i> breast <i>mandib-</i> lower jaw <i>manu-</i> hand <i>maritim-</i> of the sea <i>marsupium-</i> pouch <i>masseter-</i> chewer <i>mast-</i> nipple <i>mat(e)ri-</i> mother <i>maxi-</i> large <i>maxill-</i> jaw <i>maxim-</i> greatest <i>meatus-</i> passage <i>medi-</i> medium <i>medull-</i> marrow <i>mega-</i> large <i>mel(l)i-</i> honey <i>melan-</i> black <i>menin(x,g)-</i> membrane <i>meno-</i> moon <i>mer-</i> part <i>meso-</i> middle <i>meta-</i> after <i>micro-</i> small <i>milli-</i> thousand <i>min-</i> smaller <i>minim-</i> smallest <i>mirabile-</i> wonderful <i>miss-</i> sent <i>mito-</i> thread <i>mixi-</i> mingle <i>moll-</i> soft	<i>na(rls)-</i> nose <i>necro-</i> dead <i>necto-</i> swimming <i>nema-</i> hair <i>nemoral-</i> in woods <i>neo-</i> new <i>nephr-</i> kidney <i>neur-</i> nerve <i>nictitat-</i> winking <i>nigr-</i> black <i>non-</i> not <i>nona-</i> nine <i>noth-</i> spurious <i>notho-</i> southern <i>noto-</i> back, south <i>nu(clx)-</i> nut <i>nuch-</i> back of neck <i>nucle-</i> little nut <i>nud-</i> naked <i>nulli-</i> none <i>nutans-</i> nodding

	<i>monil-</i> string of beads <i>mono-</i> one <i>montan-</i> of mountains <i>morph-</i> form <i>motor-</i> mover <i>multi-</i> many <i>mural-</i> walls <i>muri-</i> mouse <i>myo-</i> muscle, mouse <i>myri-</i> countless <i>myx-</i> mucous <i>myz-</i> sucker	
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O	P	Q, R
<i>obtect-</i> concealed <i>obturat-</i> closed <i>obtusi-</i> blunt <i>occiden-</i> Western <i>occip-</i> back of head <i>oct-</i> eight <i>odont-</i> tooth <i>odor-</i> fragrant <i>oecious-</i> house of <i>oed-</i> swollen <i>oen-</i> wine <i>oesoph-</i> gullet <i>officinal-</i> used in medicine <i>-oid-</i> like <i>olecran-</i> skull of elbow <i>oleo-</i> oily <i>olfact-</i> smelling <i>oligo-</i> few <i>oliva-</i> olive <i>omaso-</i> paunch <i>oment-</i> fat skin <i>omm-</i> eye <i>omo-</i> shoulder <i>omphalo-</i> navel <i>onto-</i> existing <i>oo-</i> egg <i>op(t)-</i> eye <i>operculum-</i> little cover <i>ophi-</i> snake <i>ophthalmo-</i> eye <i>opistho-</i> behind <i>opoter-</i> either	<i>pachy-</i> thick <i>palae-</i> old <i>palli(um)-</i> mantle <i>pallid-</i> pale <i>palustri-</i> in marshes <i>pan-</i> ali <i>par(a)-</i> near <i>parie-</i> wall <i>parvi-</i> little <i>patella-</i> small dish <i>patens-</i> spreading <i>pect(or)-</i> chest <i>pectin-</i> comb-like <i>ped-</i> foot, child <i>pellucid-</i> shining through <i>pene-</i> almost <i>pent-</i> five <i>per(i)-</i> through, beyond <i>peregrin-</i> foreign <i>peri-</i> around <i>persic-</i> peach <i>petr-</i> rock <i>phaeo-</i> dark <i>phag-</i> eat <i>phalan(g/x)-</i> close formation of troops <i>phalar-</i> shining <i>phanero-</i> visible <i>pher-</i> carry <i>phil-</i> love <i>phloe-</i> tree bark	<i>quadr-</i> four <i>quarter-</i> four <i>quin(t/que)-</i> five <i>rach-</i> spine <i>radi-</i> root <i>ram-</i> branching <i>ran-</i> frog <i>rapa-</i> turnip <i>raph-</i> seam <i>rect-</i> straight <i>reflex-</i> bent back <i>ren-</i> kidney <i>repens-</i> crawling <i>reptans-</i> crawling <i>retic-</i> network <i>retina-</i> little net <i>retro-</i> behind, backward <i>rhabd-</i> rod <i>rhach-</i> spine <i>rhage-</i> tear, rent <i>rhin-</i> nose, snout <i>rhiz-</i> root <i>rhodo-</i> red <i>rhynch-</i> snout <i>-rrh-</i> flow <i>rode-</i> gnaw <i>rogos-</i> wrinkled <i>rostr-</i> beak, prow <i>rota-</i> tum, wheel <i>rub(e)r-</i> red <i>rumen-</i> throat

<i>or-</i> mouth <i>orbi-</i> circle <i>orch-</i> testicle <i>oriental-</i> Eastern <i>ornith-</i> bird <i>ortho-</i> straight <i>os(ti)-</i> mouth <i>os(s/t)-</i> bone <i>ostrac</i> shell <i>ot-</i> ear <i>ovi-</i> sheep <i>ovo-</i> egg <i>oxys, oxus-</i> sharp, pointed	<i>phor-</i> carry <i>pho(s/to)-</i> light <i>phragm-</i> fence <i>phren-</i> diaphragm, mind <i>phyl-</i> tribe <i>phyll-</i> leaf <i>physa-</i> bladder <i>physio-</i> nature <i>phyto-</i> plant <i>pil-</i> hair <i>pinea-</i> pine cone <i>pinnat-</i> feather-shaped <i>pisum-</i> pea <i>pisc-</i> fish <i>plac-</i> plate, tablet <i>plagio-</i> oblique <i>plan-</i> flat <i>platy-</i> flat, broad <i>plec(o/t)-</i> twist, pluck <i>plesio-</i> near <i>pleth-</i> full <i>pleur-</i> side <i>plex-</i> interwoven <i>plica-</i> fold <i>plum-</i> feather <i>pneu(mo/st)-</i> air, lung <i>pod-</i> foot <i>pogo-</i> beard <i>polio-</i> grey <i>polit-</i> polished <i>poll(ex)-</i> thumb <i>poly-</i> many <i>pons-</i> bridge <i>porc-</i> pig <i>porphyr-</i> purple <i>porta-</i> gate <i>post-</i> after <i>potam-</i> river <i>potero-</i> drinking cup <i>praeco-</i> early <i>pratens-</i> in meadows <i>pre-</i> before <i>rode-</i> gnaw <i>rogos-</i> wrinkled <i>rostr-</i> beak, prow <i>rota-</i> tum, wheel	
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S	T	U-Z
<i>sacchar-</i> sugar <i>saccul-</i> little sac <i>sacr-</i> sacred <i>sagitta-</i> arrow <i>sal-</i> salt <i>sanguini-</i> bloody <i>sapon-</i> soapy <i>sarc-</i> flesh <i>sativus-</i> cultivated <i>saur-</i> lizard <i>scala-</i> ladder <i>scalene-</i> uneven <i>scaph-</i> anything hollow, bowl, ship <i>schizo-</i> split <i>cler-</i> hard <i>scop-</i> gaze, small owl, broom, shadow <i>scut-</i> shield <i>scyph-</i> cup <i>seba-</i> tallow, wax <i>sect-</i> cut <i>segetum-</i> in cornfields <i>selen-</i> moon <i>sella-</i> saddle, seat <i>semi-</i> half <i>sept-</i> seven, wall <i>ser(olu)-</i> any body fluid <i>serot-</i> late <i>serrat-</i> saw-toothed <i>set-</i> hair <i>sex-</i> six <i>simi-</i> monkey <i>sinus-</i> hollow, bay <i>sipho-</i> tube <i>sol-</i> sun <i>soma-</i> body <i>somni-</i> sleep <i>specios-</i> showy <i>sperm-</i> seed <i>sphen-</i> wedge <i>sphinct-</i> closing	<i>tachy-</i> fast <i>tact-</i> touch <i>taenia-</i> ribbon <i>talus-</i> ankle <i>tapetum-</i> carpet <i>tard-</i> late <i>tarsus-</i> ankle <i>tect-</i> covered <i>tegmen-</i> covering <i>tel (e/o)-</i> far, end <i>teleo-</i> complete <i>temno-</i> cut <i>tenacul-</i> holding <i>tentor-</i> spread like a tent <i>tenuis-</i> slender <i>ter(ti)-</i> three <i>teres-</i> round <i>tetr-</i> four <i>textilis-</i> of textiles <i>thalam-</i> chamber, bed <i>thalass-</i> sea <i>theca-</i> case <i>thel-</i> nipple, female <i>therm-</i> heat <i>thero-</i> breast, mammal <i>thyreo-</i> large shield <i>tinctori-</i> of dyes <i>torn-</i> cut <i>tomentos-</i> densely woolly <i>torpe-</i> numb <i>toxo-</i> arrow, dart <i>trab-</i> beam <i>trachy-</i> rough <i>trago-</i> goat <i>trans-</i> across <i>trapez-</i> four sided, table <i>trema-</i> hole <i>tremulans-</i> trembling <i>tri-</i> three <i>trich-</i> hair <i>trivialis-</i> trivial <i>troch-</i> wheel <i>trop-</i> turning <i>troph-</i> feed	<i>uliginosus-</i> in marshes <i>-ul-</i> diminutive <i>ulo-</i> woolly <i>ultra-</i> above <i>umbilic-</i> navel <i>un-</i> one <i>unc-</i> hook <i>ungui-</i> nail, claw <i>ungul-</i> hoof, claw <i>urens-</i> bum <i>uro-</i> tail <i>urs-</i> of bears <i>utricul-</i> little skin bag <i>uv(ela)-</i> grapes <i>vagina-</i> sheath <i>vagus-</i> wandering <i>vas-</i> vessel <i>velum-</i> veil <i>ven-</i> vein <i>ventr-</i> belly <i>verd-</i> green <i>veris-</i> true <i>verm-</i> worm <i>vern-</i> spring <i>versi-</i> various <i>vesic-</i> blister <i>vesper-</i> evening, western <i>vill-</i> shaggy hair, velvet <i>virens-</i> green <i>visc-</i> organs of body cavity <i>vita-</i> life <i>vitell-</i> yolk <i>vitri-</i> glass <i>vora-</i> devour <i>vulgaris-</i> common <i>vulp-</i> fox <i>xanth-</i> yellow <i>xen-</i> stranger <i>xer-</i> dry <i>xiphi-</i> sword <i>xyl-</i> wood

<i>spinos-</i> spiny <i>spondyl-</i> vertebra <i>squalid-</i> squalid <i>squam-</i> scale <i>squarros-</i> spreading at tips <i>stae(rlt)-</i> fat <i>sta(silt)-</i> standing <i>steg-</i> covering <i>stell-</i> star <i>steno-</i> narrow <i>stereo-</i> solid <i>steril-</i> sterile <i>stern-</i> breastbone <i>stom-</i> mouth <i>strat-</i> layer <i>strept-</i> twisted <i>strictus-</i> upright, stiff <i>strigos-</i> having stiff bristles <i>stroph-</i> turning <i>styl-</i> column <i>sub-</i> below <i>sucr-</i> sugar <i>sulc-</i> furrow <i>super-</i> beyond <i>supin-</i> lying back <i>supra-</i> above <i>sutur-</i> seam <i>sym-</i> with <i>syn-</i> with <i>syrin(glx)-</i> pipe <i>sys-</i> with	<i>tussi-</i> cough	<i>zo-</i> animal <i>zon-</i> girdle <i>zyg-</i> yoke
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APPENDIX – III (B)

Paragraph 1:

Leech may be aquatic (marine and fresh water) or terrestrial; free-living, and sometimes parasitic. They exhibit organ-system level of body organisation and bilateral symmetry. They are triploblastic, metamerically segmented and coelomate animals. Talking of animals, they have four limbs, two fore limb and two hind limb.

- | | |
|---------------|--|
| 1) OBJECTIVES | (1) To make student themselves find out the difficult word from the paragraph and try to guess the meaning. |
| | (2) To help students learn the terminology and their meaning. |
| 2) PROCEDURE | (1) The researcher will give paragraph to each student and ask them to underline the difficult words. |
| | (2) The researcher will explain the meaning of those words and also teach them to break the terms in few components to find the meaning. |
| 3) OUTCOME | Students will learn different terminology with their meaning. |

Paragraph 2:

The fungi include heterotrophic organisms. They show a great diversity in morphology and habitat. The common mushroom you eat and toadstools are also fungi. Some unicellular fungi, e.g., yeast are used to make bread and beer. Yeasts which are unicellular, fungi are filamentous. Reproduction in fungi can take place by vegetative means – fragmentation, Binary fission and budding. Asexual reproduction is by spores and sexual reproduction is by oospores, ascospores and basidiospores.

The sexual cycle involves the following three steps:

- (i) Fusion of protoplasts between two motile or non-motile gametes called plasmogamy.
- (ii) Fusion of two nuclei called karyogamy.
- (iii) Meiosis in zygote resulting in haploid spores.

However, in other fungi (ascomycetes and basidiomycetes), an intervening dikaryotic stage occurs; such a condition is called a dikaryon and the phase is called dikaryophase of fungus.

- | | |
|---------------|--|
| 1) OBJECTIVES | (1) To make student themselves find out the difficult word from the paragraph and try to guess the meaning. |
| | (2) To help students learn the terminology and their meaning. |
| 2) PROCEDURE | (1) The researcher will give paragraph to each student and ask them to underline the difficult words. |
| | (2) The researcher will explain the meaning of those words and also teach them to break the terms in few components to find the meaning. |
| 3) OUTCOME | Students will learn different terminology with their meaning. |

APPENDIX –III (C)

Read out the words carefully and write its meaning in the space provided below.

Sr.No.	Word	Meaning
1)	Adipo	
2)	Amyl	
3)	Gemme	
4)	Coel	
5)	Ichthy	
6)	Ornitho	
7)	Olfact	
8)	Syn	
9)	Gnath	
10)	Inter	

APPENDIX – III (D)

Article

- | | | |
|--------------|-----|---|
| 1) OBJECTIVE | (1) | To enable student to read the article and learn more terminology and its meaning |
| 2) PROCEDURE | (1) | The researcher will give students with article and will ask it them to read. |
| | (2) | After some time the researcher will ask the students to share what they have understood and especially scientific terms with its meaning and explanation. |
| 3) OUTCOME | | Students will learn different terminology with their meaning. |

Article 1:

Darwin's Dogs wants your dog's DNA

Going for walks, playing fetch and now participating in genetic research are just a few things people and their dogs can do together.

Darwin's Dogs, a citizen science project headquartered at the University of Massachusetts Medical School in Worcester, is looking for good — and bad — dogs to donate DNA. The project aims to uncover genes that govern behavior, including those involved in mental illness in both people and pets.

Looking to dogs for clues about mental illness isn't as strange as it may seem. Certain breeds are plagued by some of the same diseases and mental health issues that afflict people. Researchers have learned about the genetics of narcolepsy and obsessive compulsive disorder, as well as cancer, blindness and many other ailments from studying purebred dogs. Studies of purebreds are mainly useful when the problem is caused by mutations in a single gene. But most behaviors are the product of interactions between many genes and the environment. A search for those genes can't be done with a small number of genetically similar dogs. So, Darwin's Dogs hopes to gather data on a large number of canines, including many breeds and genetically diverse mutts.

Finding behavior-related genes, such as ones that lead dogs to chew up shoes or engage in marathon fetch sessions, may give clues to genes that affect human behavior. "It seemed to me that if we could understand how [changes in DNA] make a dog so excited about chasing a ball, we could learn something about how our brains work and what goes wrong in psychiatric disease," says project leader Elinor Karlsson.

Karlsson and colleagues launched darwinsdogs.org, inviting people to answer questions about their dogs' behavior and share their pets' DNA. More than 7,000 dog owners have already signed up, and the researchers are still recruiting new volunteers.

The process is simple and can be done alone with your dog, or even as a family activity. First, take an online quiz about your canine companion. The quiz is divided into multiple sections. Some sections gather basic information about your dog's appearance, exercise and eating habits; others ask about simple behaviors, such as whether your dog crosses its front paws when lying down or tilts its head. (Some questions are philosophical puzzles like whether your dog knows it is a dog.) Each question has a comment box in case you want to explain an answer. Plan to spend at least half an hour completing the questionnaire.

Once the questions are answered and the dog is registered, researchers send you a DNA sampling kit that comes with written instructions and an easy-to-follow picture guide. The kit contains a large sterile cotton swab for collecting DNA from your dog's mouth. (It's an easy procedure for the human involved, and Sally, the 14-year-old Irish setter "volunteer" *Science News* sampled, was rather stoic.) Also included is a tape measure for recording your dog's height, length, nose and collar size. When you're done, just seal the sample, measurement sheet and consent form inside the return mailer and drop it in a mailbox.

Dog owners don't need to pay a fee to participate, but they do need patience, Karlsson says. It takes time to analyze DNA, and the researchers can't say exactly how long it will be before owners (and *Science News*) learn their dogs' results. These results will include the dog's raw genetic data as well as information about the dog's possible ancestry. Knowing ancestry or particular mutations a dog carries may help veterinarians personalize a dog's care.

Dog trainers are being enlisted to give owners feedback on their dogs' personalities and to suggest activities the dogs may enjoy. Karlsson hopes to create a way for impatient owners who are willing to donate money to the project to get their reports back faster.

Article 2:

Eating shuts down nerve cells that counter obesity

Fractions of a second after food hits the mouth, a specialized group of energizing nerve cells in mice shuts down. After the eating stops, the nerve cells spring back into action, scientists report August 18 in *Current Biology*. This quick response to eating offers researchers new clues about how the brain drives appetite and may also provide insight into narcolepsy.

These nerve cells have intrigued scientists for years. They produce a molecule called orexin (also known as hypocretin), thought to have a role in appetite. But their bigger claim to fame came when scientists found that these cells were largely missing from the brains of people with narcolepsy.

People with narcolepsy are more likely to be overweight than other people, and this new study may help explain why, says neuroscientist Jerome Siegel of UCLA. These cells may have more subtle roles in regulating food intake in people without narcolepsy, he adds.

Results from earlier studies hinted that orexin-producing nerve cells are appetite stimulators. But the new results suggest the opposite. These cells actually work to keep extra weight off. "Orexin cells are a natural obesity defense mechanism," says study coauthor Denis Burdakov of the Francis Crick Institute in London. "If they are lost, animals and humans gain weight."

Mice were allowed to eat normally while researchers eavesdropped on the behavior of their orexin nerve cells. Within milliseconds of eating, orexin nerve cells shut down and stopped sending signals. This cellular quieting was consistent across foods. Peanut butter, mouse chow, a strawberry milkshake and a calorie-free drink all prompted the same response. "Foods with different flavors and textures had a similar effect, implying that it is to do with the act of eating or drinking, rather than with what is being eaten," Burdakov says. When the eating ended, the cells once again resumed their activity.

When Burdakov and colleagues used a genetic technique to kill orexin nerve cells, mice ate more food than normal, behavior that led to weight gain, the team found. But a reduced-calorie diet slimmed these mice down.

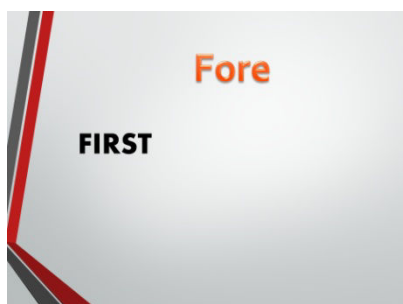
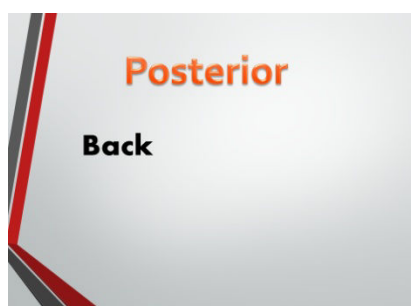
The results suggest that giving orexin to people who lack it may reduce obesity. But that might not be a good idea. An overactive orexin system has been tied to stress and anxiety, Burdakov says. Orexin's link to stress raises a different possibility—that anxiety can be reduced by curbing orexin nerve cell activity. "And our study suggests that the act of eating can do just that," Burdakov says. "This provides a candidate explanation for why people turn to eating at times of anxiety."

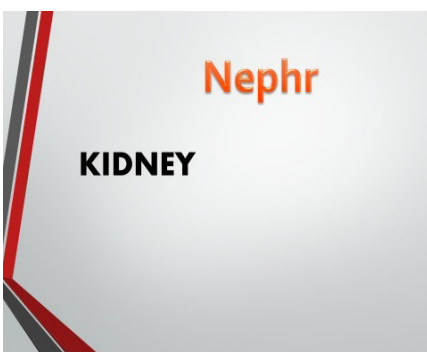
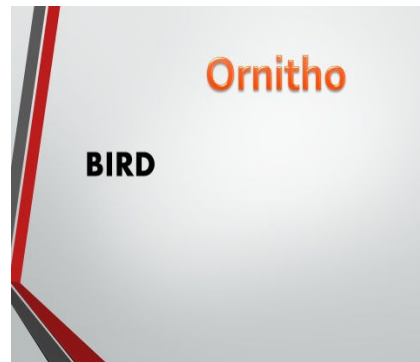
APPENDIX – III (E)

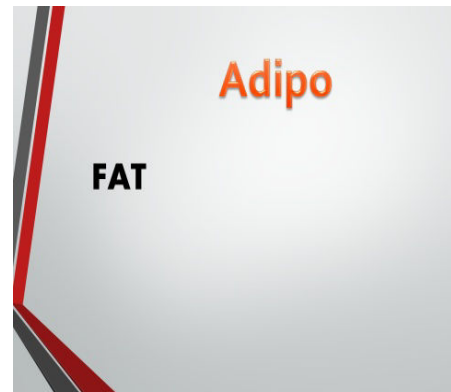
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|---------------|--|
| 1) OBJECTIVES | (1) To enable student to learn terminology using powerpoint presentation.. |
| | (2) To help students learn the terminology and their meaning by visualizing. |
| 2) PROCEDURE | (1) The researcher will ask student to assemble in projector room for powerpoint presentation. |
| | (2) The researcher will make powerpoint presentation. The researcher will teach students how to break the words to learn meaning of difficult terminology.
After the presentation is over the researcher will ask few questions to confirm the understanding of students. |
| 3) OUTCOME | Students will learn different terminology with their meaning. |

After the presentation is over the researcher will ask few questions to confirm the understanding of students. The questions are mention under:

1. List the words with “**An**” and write their meaning.
2. List out two words with “**bi**” and write their meaning.
3. List out two words with “**bio**” and write their meaning.
4. List out two words with “**poly**” and write their meaning.







APPENDIX – III (F)

Learning Difficult Words through Game

- 1) OBJECTIVE
 - (1) To enable student to find the meaning of difficult words by matching the chits.
 - (2) To help students learn the terminology and their meaning through game.
- 2) PROCEDURE
 - (1) The researcher will make chits of different colours, from which few chits will contain terminology and remaining chits will contain its meaning.
 - (2) The researcher will shuffle the chits.
 - (3) The researcher will make groups and distribute chits to different groups.
 - (4) The members of each group will be asked to find out correct chit containing meaning for the given word
- 3) OUTCOME Students will learn different terminology with their meaning.

The list of words and its meaning which will be used in game are mentioned below:

Sr.No.	Words	Meaning
1.	Binneal	happening every two years
2.	Amylase	Enzyme which digest starch
3.	Oligosaccharide	Few molecules of sugar
4.	Polymorphism	Many differences
5.	Polymer	Many unit (of anything)
6.	Ornithology	Study of birds
7.	Chondrichthy	Fish
8.	Gnatha	Jaw bearing
9.	Gemmule	Bud
10.	Mammogram	Report of mammary gland

Learning Difficult Words through Game

- 1) OBJECTIVE
 - (1) To enable student to find the meaning of difficult words by playing dumb- sharads
 - (2) To help students learn the terminology and their meaning by playing dumb-sharads
- 2) PROCEDURE
 - (1) The researcher will divide students in two group.
 - (2) The researcher will ask any one group member to come forward.
 - (3) The researcher will give one word and its meaning to

- (4) students and will ask them to act.
The team member will be asked to guess the word along
- (5) with the meaning.
This will be repeated with the other groups also.
- 3) **OUTCOME**
Students will learn different terminology with their meaning.

The list of words and its meaning which will be used in game are mentioned below:

Sr.No.	Words	Meaning
1.	Amphibian	Which lives both of land and water
2.	Forebrain	Front brain
3.	Anterior side	Front side
4.	Posterior part	Last side
5.	Limb	Hands and legs
6.	Hydro	Water
7.	Bi	Two
8.	Diplo	Double
9.	Gnath	Jaw
10.	Inter	Between