THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION AND CULTURE

Field Support Programme For Second Year

Diploma In Secondary Education

SELF STUDY MODULE

BIOLOGY

NOVEMBER, 2007

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENT ii
INTRODUCTION iii
MAIN COMPETENCES: iii
HOW TO USE THE MODULE iv
TOPIC 1: THE O-LEVEL BIOLOGY CURRICULUM MATERIALS 1
TOPIC 2: BIOCHEMISTRY 3
TOPIC 3: CLASSIFICATION 5
TOPIC 4: RESPIRATION 7
TOPIC 5: HEALTH AND IMMUNITY 9
TOPIC 6: GENETICS 11
TOPIC 7: ECOLOGY 13
TOPIC 8: ASSESSMENT IN BIOLOGY 15

ACKNOWLEDGEMENT

The Ministry of Education and Vocational Training (MoEVT) wishes to thank the following experts who participated in designing and developing this self-study module.

Writers:

1. Theonestina A. Lema - Tutor Morogoro Teachers College
2. Amina Tou - Tutor Morogoro Teachers College.

Coordinators:

1. Samwel J. Makundi - Teacher Education Department
2. Naomi V. Swai - Teacher Education Department.

Secretary

Anna Hamis - Chief Education Office

……

Chief Education Officer

INTRODUCTION

Dear student teacher, welcome to the Biology Module which has been developed to assist you to learn and work effectively when you are in field during your second year of study. The module has attempted to merge the theory and practical aspects of the pedagogy and academic syllabi. The activities provided will enhance development of scientific skills and the spirit of co-operation among learners, at the same time helping you to prepare yourself for your final examinations.

This module is organized into various parts: The Introduction, overall competences, followed by the topic and the main concepts to be covered in each topic. Other parts include competences that are expected to be developed in each topic, the activities indicating the tasks to be performed for each topic, followed by self-assessment questions.

If well covered, it is expected that you will become a competent and confident Biology teacher who can teach effectively. It is also expected that you will be able to make and Teaching and Learning materials for effective teaching. In order to be able to acquire the intended knowledge, you will be required to consult various sources like Library search, surfing the internet, visiting various Biology – related fields and the environment in general. By so doing, your self-study and classroom pracices will become successful, interesting and enjoyable.

MAIN COMPETENCES:

Within your two years of your diploma course, you are expected to develop some competences in Biology, based on both academic and pedagogical aspects. The following are the main competences:

(i) Solving daily problems using Biology knowledge, principles and skills.
(ii) Performing various basic biological experiments.
(iii) Demonstrating positive attitudes towards biology related cross-cutting issues.
(iv) Conducting independent study

(v) Applying learner – centered approaches, strategies and techniques in the teaching and learning of Biology.

(vi) Analyzing and interpret correctly, curriculum materials for Form I – IV,

(vii) Applying appropriate laboratory skills in maintaining a biology laboratory

(viii) Preparing teaching and learning aids using locally available materials.

(ix) Preparing effectively scheme of work, lesson plan and subject logbook

(x) Using valid and reliable assessment instruments for effective performance in Biology.

HOW TO USE THE MODULE

This module is self-instructional. The activities provided for each topic have been designed to develop the intended competences for a particular topic. In order to be able to use this module effectively, you have to perform well the provided activities. You will be required to review what you have learnt during your college based training on both pedagogy and academic part. Moreover, you are highly encouraged to consult various sources of relevant information, hold some discussions with your colleagues, at the same time integrate your field experience with what you learnt at the college.

In order to perform well you will be required to read, understand and adhere to the given instructions for the provided activities and self assessment questions. All the tasks should be kept in your portfolio or diary which will be submitted to your tutor(s)/mentor(s)/College for assessment and grading. You will also be required to write a final teaching practice field report for grading and evaluation purposes.

TOPIC 1: THE O-LEVEL BIOLOGY CURRICULUM MATERIALS

1.1 Brief explanation

Teaching and learning of Biology involve the use of relevant curriculum materials. The activities provided focuses on textual and non-textual Biology curriculum materials. You will also be required to review on the factors to consider when analyzing Biology curriculum materials.

Competences: Upon completion of this topic, you will have ability to:

(i) analyze and interpret correctly Textual Biology curriculum materials for Form 1 – 4.

(ii) assess the recommended non-textual curriculum materials for teaching/learning Biology.

Activity 1.1

By using O-level Biology Syllabus, explain the factors you will consider when analyzing it and comment on its quality.

Activity 1. 2

Collect at least six various Biology text books and describe various things you will consider when selecting a book for your student.

Activity 1.3

Explain how Biological diagrams, models and specimens can be effectively utilized when teaching Biology concepts.

Self-assessment –

After you have gone through this topic, can you now try to answer the following questions?

1. What do you think is the necessity of having Biology syllabus for 'O' level?
2. Enumerate all Biology textual and non-textual Curriculum materials found at your school.
3. What do you think is a relevance of analyzing Biology Curriculum materials?

TOPIC TWO:
BIOCHEMISTRY

Brief Explanation

This topic focuses on the properties and importance of carbohydrates, lipids and proteins. Properties of enzymes and their classification are also highlighted. The activities provided will require you to review on the principles of teaching Biology and Biology laboratory skills.

Competences: Upon completion of this topic, you will develop the following competences:

(i) Apply various principles of teaching and learning Biology in teaching Biochemistry.

(ii) Apply appropriate laboratory skills in performing biochemical practicals.

Activity 2.1

Imagine you have planned to conduct a food test practical session to your Form IV students. Unfortunately, you have realized that there is a deficit of some chemical reagents including dil. HCL and Benedict solution. Go in your school laboratory, under the assistance of a laboratory technician; prepare these two above mentioned chemical reagents.

Activity 2.2

a) Design a practical on food test to your form IV students. Guide them in conducting and recording their findings.

b) How can you create learning environment that enhance curiosity and creativity among your students when performing the above practical?

Activity 2.3

Carry out a biochemical test on the effect of different factors on enzyme controlled reaction. Write a practical report.

Self assessment:

After you have gone through this topic, can you now answer the following questions?

1. Identify the principles of teaching and learning Biology which you have applied in teaching Biochemistry. Do you think you have been able to apply those principles as well as laboratory skills in your daily teaching and learning activities? Give your views.
2. What are the reasons of developing a set of Biology laboratory rules and precautions when working in the Biology laboratory?
3. Consult various sources, gather information and write a brief summary on the following:-
   (i) Structure, properties and importance of carbohydrates, lipids and proteins.
   (ii) Properties and classification of enzymes and their modes of action.

TOPICTHREE:
CLASSIFICATION

Brief Explanation

This topic helps you to review the principles of classification. It deals with the major system of classification, basis of classifying organisms under each system and rules of binomial nomenclature. It further highlights s on the major groups of living organisms.

Competences:

After completing this topic, you will develop an ability to:

(i) perform various biological practicals on classification.

(ii) conduct independent study on different living organisms.

(iii) collect, preserve and use biological specimens in teaching and learning classification.

(iv) prepare teaching – learning aids using locally available materials.

Activity 3.1

Conduct a field visit with your students around the school compound. Guide them to collect various living organisms, put them in a Biology laboratory and classify them up to class level.

a) Write down the adaptive features of the classified organisms

b) Discuss the economic importance of each class

c) Preserve the specimens for future use.

Activity 3.2

Using the knowledge of classification keys, construct a numbered key for the identification of the following organisms:- bee, wasp, ant, housefly, butterfly, cockroach, mosquito, spider and millipede.

Activity 3.3

Together with your students, collect fern plants from your school botanical garden or from any other places. Guide your students to perform the following tasks:

a) Examine external features of the leaves using a hand lens.

b) Draw and label a diagram of a fern leaf to show its external features.

c) Explain the advantages of ferns in daily life.

Self-assessment

1. Having gone through this topic, do you think you can now teach it effectively than before? What are the other activities can you perform with your students in order to teach the topic more effectively?
2. Recall what you have learnt on classification during your college based training, try to answer the following questions.
   (i) Explain what you understand by the following terms:-
      (a) Taxonomy
      (b) Classification
      (c) Nomenclature
      (d) Systematics.
   (ii) What is the Biological significance of classifying living organisms.
   (iii) Discuss the pros and cons of Artificial and Natural Systems of classification.
3. Describe various ways you can improvise teaching and learning materials in a Biology laboratory based on Classification?

TOPIC FOUR:
RESPIRATION

Brief Explanation

This topic gives you an overview of respiration and respiratory pathways. It also highlight on the differences between aerobic and anaerobic respiration as well as their economic importance. The fate of pyruvic acid and computation of ATP yield when a substrate is oxidized are also looked upon.

Competences:

Having gone through this topic, you will develop ability to:

(i) guide students to perform experiments/practicals on aerobic and anaerobic respiration.
(ii) apply appropriate laboratory skills in maintaining a Biology laboratory.
(iii) supervise students' research/projects in respiration.
(iv) apply respiration knowledge in real life situations.

Activity 4. 1

Conduct a demonstration experiment to your students (Form two) to show that oxygen is necessary for aerobic respiration.

Activity 4. 2

Design and carry out an experiment with your students which will help them to realize that heat energy is liberated during aerobic respiration.

Activity 4.3

Conduct an experiment with your students to demonstrate the application of anaerobic respiration in bakery.

Activity 4. 4

Guide a group of Form four students to conduct a project work on the economic importance of anaerobic respiration in alcoholic brewing.

Self assessment:

After going through this topic, ask yourself the following questions: - Can I:

(i) guide my students in conducting some experiments on respiration successfully while maintaining the safety of the laboratory?

(ii) explain the economic importance of anaerobic respiration in real life?

(iii) describe the process of Kreb's cycle?

(iv) describe the respiratory pathways using Carbohydrate, Lipid and Protein substrates and explain the fate of pyruvi acid?

(v) guide and supervise my students' project works effectively?

TOPIC FIVE:
HEALTH AND IMMUNITY

Brief explanation

This topic deals with body immunity, Human Immuno Deficiency Virus (HIV), Acquired Immune Deficiency Syndrome (AIDS), Sexually Transmitted Infections (STIs) and Sexually Transmitted Diseases (STDs). It further highlights on Reproductive Health, Drug, Drug Abuse and Responsible/irresponsible behaviour.

Competences:

After having gone through this topic, you will have ability to:-

(i) Solve daily life problems using the Knowledge, principles and skills of Health and Immunity.

(ii) Demonstrate positive attitudes towards health – related cross-cutting issues.

(iii) Conduct an independent study on health-related problems.

Activity 5. 1

Make a brief summary on the following:-

1. The meaning of body immunity
2. The factors contributing to healthy and unhealthy body conditions.
3. The importance of body immunity.

Activity 5.2

From your knowledge on this topic, write short notes on the following:

(i) Causes, ways of transmission, symptoms effects and preventive measures of HIV/AIDs, STIs/STDs (ii) Reproductive Health

(iii) Family planning.

Activity 5.3

Observe student's behaviours at your school. Identify responsible and irresponsible behaviours shown by your students. Comment on the observed behaviour.

Activity 5. 4

Make a survey in the village/town you live in, interview some people on drug abuse and the status of HIV/AIDS in that area. Write a brief report on the obtained information, suggest ways of reducing the mentioned problems in that community. Comment on the impact of drug abuse and HIV/AIDS in that community.

Self assessment:

After completing this topic, ask yourself the following questions:-

Can I:

1. explain the importance of body immunity?
2. discuss the impact of HIV/AIDs in education sector and in Tanzania in general?
3. describe modern and natural methods of Birth control and their respective effects?
4. describe the causes and effects of drug addiction/drug abuse and suggest preventive/control measures.

TOPIC SIX:
GENETICS

Brief explanation

This topic reminds you what you have studied in Genetic during your O-level, A-level and college studies. It covers Genetic materials, Mendelian Principles of Inheritance and Genetic disorders. The concepts of mutations and application of Genetics are also looked upon. The activities provided will assist you to plan lessons on Genetic and find out proper teaching strategies for implementing the planned lessons.

Competences:

After going through this topic, you will have ability to:

(i) solve daily problems using the knowledge of genetics.

(ii) apply learner- centered approaches, strategies and techniques in teaching and learning of genetics.

(iii) explain the application of Genetics in various fields.

Activity 6.1

Prepare a one term Biology Scheme of work to a Form IV class. Genetics should be one of the topics.

Activity 6.2

From activity 6.1 above, choose one sub-topic from Genetics, plan and implement a double period lesson. Your lesson plan should reveal active participation of learners in the teaching and learning process.

Activity 6.3

Suppose you have already taught all the topics in activity 6.1. Prepare a subject logbook and record the required information. Compare it with that of your department.

Activity 6.4

Write a brief summary on the following concepts:-

(1) DNA and RNA

(2) Protein synthesis

(3) Causes and effects of mutations.

(4) Mendelian monohybrid and dihybrid crosses and ratios.

(5) Differences between Mendelian inheritance and non-Mendelian inheritance.

(6) Effects of Genetic disorders and ways of controlling and managing them.

Self – assessment:

Now, having gone through this topic, answer the following questions:-

(i) Try to recall the first time you conducted micro-teaching at the college. Compare with the way you are teaching now. Do you think you have improved your teaching? How? Which areas do you think you need further improvements for future better performance?

(i) Explain the following in respect of human beings.

(a) Allele

(b) Chromosome number

(c) Genotype

(d) Homozygous

(e) Recessive Character.

(ii) Explain briefly how can Mendelian Inheritance and non-Mendelian inheritance be applied to solve genetical problems.

(iii) Identify the application of Genetics in various fields.

(iv) Explain the importance of Genetic engineering in biotechnology?

TOPIC SEVEN:
ECOLOGY

Brief explanation

This topic intends to remind you of the concepts on energy flow and nutrient cycling, food chain and food web. It also enables you to revise on pollution and its impact on living organisms.

Competences:

After you have gone through this topic, you will have ability to:-

(i) demonstrate positive attitudes towards ecology – related cross-cutting issues in order to address environmental issues.

(ii) conduct independent study and research on Ecological issues.

Activity 7.1

Write brief notes on the following:-

1. Food chain and food web
2. Trophic level
3. Energy flow from the producers to the consumers
4. Nitrogen and carbon cycles.

Activity 7. 2

Conduct a field visit with your Form IV students to learn about abiotic and biotic features of the environment and their interactions.

Activity 7. 3

Make a field visit with your students to identify types of pollutants, their sources and effects. Lead a discussion to include suggestions on the control measures when back in class.

Self assessment: After you have completed this topic, try to ask yourself the following questions:

1. Am I able to explain the interaction of living organisms with the environment?
2. Can I address properly some issues of pollution and their impact on living organisms?

TOPIC EIGHT:
ASSESSMENT IN BIOLOGY

Brief Explanation

This topic deals with assessment in Biology. The given activities will assist you to go through the knowledge you have learnt from Research, Evaluation and Measurement (REM) subject during your first year of study.

Competences:

After completing this topic you will be able to:-

(i) Construct, moderate and administer Biology tests/ examinations

(ii) Mark and keep records of students' biology tests/examinations results.

(iii) Assess Biology practical skills.

Activity 8.1

Study various past Biology tests/exams, observe if they address different levels of the learning domains. Now, review the Biology topics you have taught for a specific class, prepare a Table of specification and construct a test.

Activity 8.2

Upon completion of test construction in activity 8.1 give that test to your fellow Biology teacher or the head of department and request them to moderate it. Why do you think it is important to moderate your test?

Activity 8. 3

- Prepare a marking scheme for activity 8.1 above, and then mark the test. Record the test results in ascending order then calculate the following:-

  (i) Mean (ii) Mode (iii) Median (iv) Variance (v) Standard deviation (vi) T-score (vii) Z-score

Activity 8.4

Prepare an experiment (practical work) from any topic in O-level syllabus, and guide your students in conducting such practical. Identify practical skills that have been shown by your students?

Self assessment:

Using the knowledge you have gained from this topic, ask yourself the following questions:- Can I:

1. construct, moderate, standardize, mark and keep my students' progressive records?.
2. assess my Students' Practical Skills whenever conducting various Biological experiments?.