

**TEACHING METHODS AND PRACTICE (TMP)
OF SCIENCE AND ELEMENTARY
TECHNOLOGY FOR TTC**

OPTIONS: SME & ECLPE

STUDENT BOOK

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FOREWORD

Dear Student teacher,

Rwanda Basic Education Board is honoured to present the Teaching Methods and Practice of SET for TTCs textbook. It was designed based on the revised curriculum to support its implementation. This textbook will equip you with knowledge, skills and attitudes required to effectively implement the Competence-Based Curriculum for Science and Elementary Technology in primary schools.

The Teaching Method and Practice textbook will help you to gain required competences to meet teacher profession standards that are teacher as educator, communicator and connector, guide, organizer and facilitator, innovator, researcher and reflective practitioner.

The textbook is designed based on SET syllabus for Primary schools and in a way that facilitates self-study. Each unit starts with a key unit competence, which represents abilities you are expected to have by the end of the unit. This competence will be progressively built throughout the unit. The key unit competence is followed by an introductory activity. You are requested to attempt this activity before any other contact with the content under the unit. The unit is then broken down into different sub-topics to help you to go gradually. Each sub-topic starts with an activity in which you are requested to engage. The content that follows each sub-topic is a summary that gives you clear definitions of concepts and explanations to complement what you have acquired through learning activities. At the end of each unit, there are assessments tasks/ activities that give you an opportunity to demonstrate the level of achievement of the key unit competence.

For effective use of this textbook, your role is to:

- Participate and take responsibility for your own learning: you are encouraged to engage in given activities to develop cooperation, communication, critical thinking, innovation and problem-solving skills.
- Share with your classmates relevant information through presentations, discussions, group works, videos, visits, lesson observations, field/classroom visits, group discussions, presentations, brainstorming, role plays, case studies, interpretation of illustrations, research, etc.
- Conduct further research to enrich information provided under each topic or unit.

- Draw conclusions based on the findings from the learning activities.
- Prepare and deliver micro-teaching lessons.

Enjoy learning “The SET Teaching Methods and Practice” using your book!

Dr. MBARUSHIMANA Nelson

Director General, REB

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I wish to express my appreciation to all the people who played a major role in the development of this learner's textbook of the Teaching Methods and Practice of SET for TTCs. It would not have been successful without active participation of different education stakeholders.

I owe gratitude to tutors from TTCs, staff from IEE and all other individuals whose efforts in one way or the other contributed to the success of writing this textbook.

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Finally, my word of gratitude goes to the Rwanda Basic Education Board staff particularly those from Curriculum, Teaching and Learning Resource Department who were involved in the whole process of In-house textbook writing.

Joan MURUNGI

Head of Curriculum, Teaching and Learning Resources Department

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PART 1 :

TMP FOR SET-SCIENCE

COMPONENT

UNIT 1 : INTRODUCTION TO TEACHING SCIENCE AND ELEMENTARY TECHNOLOGY

Key unit competence:

Explain the essence of teaching SET including ICT component in primary and how the ICT tools are used in teaching and learning process.

Introductory Activity:

Read the following scenario and answer related questions

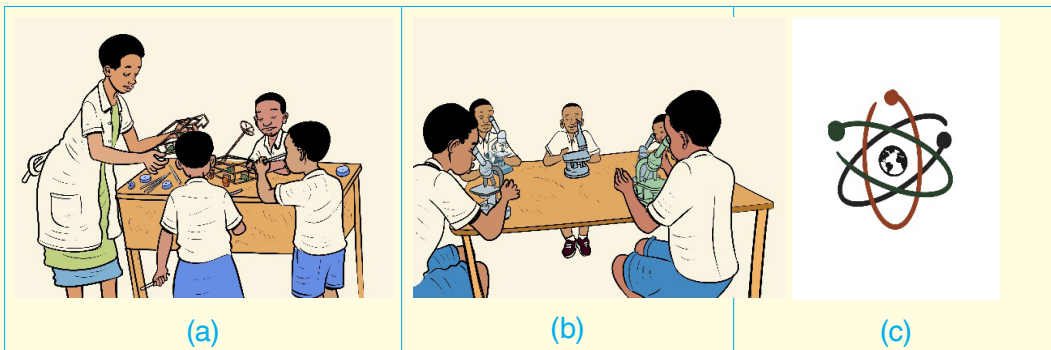
A student of preprimary school sharing dinner with her parents asked them the following questions:

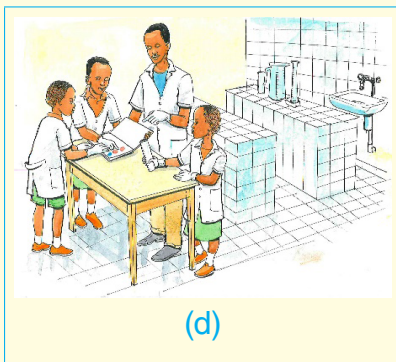
- Why do you cook different types of food and why do we eat many times per day?
 - Why some fruits you bring on table are red, green or yellow?
 - When there is power cut at our school they put on a generator while here you put on the solar panel. Why and how?
 - Again, when the power is off, I see you writing numbers in the cash power from your phone thereafter all lamps light. How this happen?
- Suppose you are the parent of that child, try to answer her questions.
 - Do you think every parent in Rwanda will accurately answer all questions asked by that small child? If not, why and suggest corrective actions.

1.1. Rationale of teaching and learning SET in primary

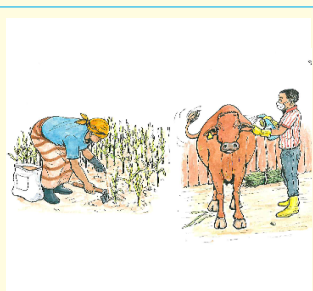
Activity 1.1

Look at the following pictures and answer the asked questions

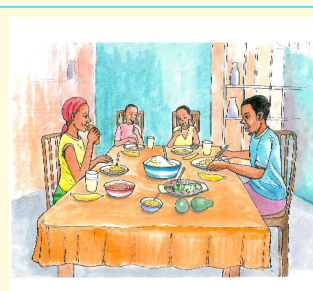




(d)



(e)



(f)

1. What have you observed on each of the pictures above?
2. What is the importance of teaching science at primary school?
3. Explain why ICT is necessary in teaching science at primary school?

Summary Notes

In today's world, every situation requires using scientific information to make informed choices and decisions. Science helps to understand the natural world, approach challenges in life as modern life necessitates scientific mind and a scientific culture for every citizen.

Teaching and learning SET at primary provides a very good foundation for the study of science subjects in the post-primary levels. Most importantly, it cultivates a positive attitude towards science and provides pupils with opportunities to experience the excitement of working as a scientist.

Furthermore, it allows learners to have a greater awareness of the role of science and technology in everyday life and enables the learner to develop scientific competencies which will have great impact on the society in general. It allows to raise the level of scientific literacy of citizens and equip them with the relevant basic scientific knowledge needed for their own living and making valuable contributions to the general development of the society

The most important application of science is valued by society because the application of scientific knowledge helps to satisfy many basic human needs and improve living standards.

Essence of learning TMP for SET

Teaching Methods and Practice in the options of Science and Mathematics Education (SME) and Early Childhood and Lower Primary Education (ECLPE) provides instructional approaches in the teaching and learning of Science in preprimary and primary levels. It focuses on learner-centered approaches with a variety of teaching methods that help student teachers to effectively teach scientific concepts, motivate and engage all learners in teaching and learning activities.

Necessity of ICT in teaching and learning science at primary

ICT is essential in teaching and learning science at primary because:

- ICT increases the quality of student learning through the access to the subject content.
- ICT promotes a supportive, interactive teaching and learning environment by creating broader learning communication and therefore provides learning tools for students especially those with special needs.
- ICT encourages deeper understanding about data collection, saves time on measuring and recording analysis.
- ICT empowers learners with ICT awareness and skills which are essential for success in contemporary knowledge economy.
- ICT develops scientific process skills, fosters the acquisition of concepts, and develops particular attitudes.

Application Activity 1.1

1. What are the applications of science and ICT in daily life?
2. Search other importance of using ICT in teaching and learning science at primary

1.2. Components of SET syllabus

Activity 1. 2

1. Read the preprimary and SET primary syllabi and identify its components
2. Write units found in SET syllabus of each grade.
3. Identify the components of syllabus unit structure and establish the relevance of every component.

Summary Notes

The SET syllabus comprises many components which guide the understanding of users for its effective implementation.

The lower or upper primary SET syllabus has the following main components:

1. Preliminary pages

- Foreword
- Acknowledgement
- Introduction
- Pedagogical Approach
- Assessment Approach
- Resources

Each component of the preliminary pages plays an important role at every step of the teaching and learning process.

- Introduction of the syllabus provides all information related to: Background to curriculum review, Rationale of teaching and learning SET, Competences (generic and broad subject competences).
- Pedagogical approach part provides all information related to: the role of the learner, the role of the teacher and special needs education and inclusive approach while the teaching and learning of SET. In this part, various teaching strategies and approaches such as direct instruction, discovery learning, investigation, guided discovery or other methods are incorporated. Also, in this pedagogical part, a list of generic and broad subject competences are presented so that a SET teacher can consider them while preparing and delivering lessons.
- Assessment approach part provides information needed to formative assessment and summative assessments, record keeping, Item writing in summative assessment and reporting to parents.
- Resources are the part of the syllabus which provides a non-exhaustive list of materials needed for implementation of SET syllabus.

2. SET syllabus units for lower and upper primary

Syllabus units are composed by the following: Presentation of the structure of the syllabus units, units for each grade in lower primary (primary one , two, three) ; units for each grade of upper primary (Primary four , five , six), Key

competences at the end of primary one, two, three, four, five and six.

At every grade, the syllabus is structured in topic areas, sub-topic areas where applicable and then further broken down into units and unit content. This breakdown promotes the uniformity, effectiveness and efficiency of teaching and learning SET.

The Units have the following elements:

- a. Each Unit is aligned with the number of periods
- b. Each Unit has a key unit competence whose achievement is pursued by all teaching and learning activities undertaken by both the teacher and the learners.
- c. Each Key Unit Competency is broken into three types of Learning Objectives as follows:
 - Learning Objectives relating to Knowledge and Understanding also known as Lower Order Thinking Skills).
 - Learning Objectives related to acquisition of skills also known as Higher Order Thinking skills.
 - Learning Objectives related to acquisition of Attitudes and Values also known as Higher Order Thinking Skills.
- d. Each Unit has content that indicates the scope of coverage of what is to be taught and learnt in line with the stated Learning Objectives.
- e. Each Unit suggests a non-exhaustive list of learning activities that are expected to engage learners in an interactive learning process as much as possible (learner-centered and participatory approach).

The table below is the structure of each syllabus unit

Topic Area:				
Subject & Grade		Unit:		No. of periods:
Key Unit competence:				
Learning objectives			Content	Teaching Learning Activities
Knowledge and understanding	Skills	Attitudes and values		
<i>Assessment criteria:</i>				
<i>Link to other subjects:</i>				
<i>Resources:</i>				

3. References and appendices

Units for SET syllabus for each grade

Primary One (9 units)	
1. Materials and Tools used at home and at school	6. Plants
2. Toys, various materials and teaching and learning aids	7. Waste and Hygiene
3. Basic ICT tools	8. The Human Body
4. Water	9. Natural and artificial materials
5. Animals	
Primary Two (8 units)	
1. Tools and materials used at home and at school	5. Soil
2. Toys, various materials and teaching and learning aids	6. Plants
3. Computer my Friend	7. Light and heat
4. Air and wind	8. Human Sensory organs
Primary Three (10 units)	
1. Toys, basic materials and teaching aids	6. Animals
2. Use of telephone	7. Muscles and Bones
3. Computer my Friend	8. Types of Energy
4. Drinking Water	9. Electricity
5. Soil	10. Magnet
Primary Four (14 units)	
1. Agricultural tools	8. Soil
2. Objects production	9. Animals
3. Computer my friend	10. Animals management
4. Writing skills	11. Plants
5. Graphics and multimedia	12. Human sensory organs
6. Programming for children	13. Human skeleton
7. Air, wind and sound	14. Muscles
Primary Five (16 units)	
1. Carpentry tools	9. Soil,
2. Masonry tool	10. Animals

3. Objects production	11. Plants and environment
4. Computer my friend	12. Digestive system
5. Writing skills	13. Reproductive system
6. Computer research	14. Light,
7. Programming for children	15. Electricity,
8. Water	16. Materials
Primary Six (16 units)	
1. Mechanics and blacksmith tools	9. Plant reproduction
2. Simple machines	10. Sustainable waste management
3. Objects production	11. Circulatory system
4. Writing skills	12. Respiratory system
5. Computer research	13. Reproductive system
6. Programming for children	14. Energy management
7. Air pollution	15. Magnetism
8. Animals	16. States of matter

Application Activity 1. 2

1. Identify the similarities across grades syllabi of SET.
2. Find out the vertical and horizontal progression in the SET syllabi

End unit assessment

1. There are many misconceptions about sciences in the society. As future teacher of SET, what do you predict as a solution to overcome those misconceptions?
2. What are benefits of integrating ICT in teaching and learning SET at primary school?
3. Explain the essence of teaching Science and Elementary Technology in primary and provide five examples showing scientific competences useful in everyday life.

UNIT 2 : TEACHING AND LEARNING RESOURCES FOR SET

Key unit competence:

Differentiate possible learning and teaching resources required for learning Science and Elementary Technology in primary.

Introductory Activity:

Read the following scenario and answer related questions

A teacher of 15 years of experience in teaching SET has a very good content summary for students. One day the school Head teacher visited his class and was surprised by his poor lesson facilitation. After observing the lesson, the head teacher asked why he didn't use teaching and learning resources in his lesson. The teacher tells him that it's not necessary to continue bringing resources at every lesson because he has enough experience in teaching SET. The head teacher took a time to remind him the importance of planning and use of teaching and learning resources. The teacher agreed to change and start using teaching and learning materials. Learner's performance has increased to the level of 98%.

- a) As a future teacher of SET, do you think was the teacher right? Explain your opinion.
- b) What are teaching and learning resources the teacher was supposed to have in that lesson?
- c) Name the groups of those teaching and learning resources for SET lessons.

2.1. Importance of using teaching and learning resources in SET lessons

Activity 2. 1

1. Explain why a teacher who uses teaching and learning resources in SET lessons is different from the one who does not use them.
2. Establish the benefits for learners when the teacher uses teaching and learning resources in SET lesson.

Summary Notes

Teaching and learning resources (TLR) for SET are used to enhance the learning of students in classrooms. A teacher uses them to make teaching-learning effective. Teaching and learning resources also help learners achieve the learning outcomes after classroom teaching and learning. Teaching and learning materials are referred as teaching and learning resources, instructional materials or educational media. They are sources of information that make teaching and learning easier, practical, enjoyable and more meaningful.

Every learner needs learning resources and the learning style for every child influence the choice of teaching and learning materials to be used in SET lessons.

The following are different learners we can have in classroom depending on the learning styles:

- **Visual-spatial Learners:** A visual learner learns best SET by using their eyes to see information. They learn by seeing words in printed form or by using graphics and pictures, observing real objects, and other visual aids.
- **Auditory learners:** An auditory learner is someone who learns best SET by listening and talking. They learn by listening to someone who presents information orally (audio) and by being allowed to discuss and ask questions.
- **Tactile learners:** Tactile learners learn best SET through their sense of touch, such as using their hands and fingers. They learn best by writing, drawing, and using hands-on manipulative.
- **Kinesthetic learners:** Kinesthetic learners learn best SET through movement of their large or gross motor muscles. They take in information best while moving and doing, being involved in projects, role playing, learning while standing up and engaging in real life activities.

Therefore, it is up to every teacher to use different types of teaching aids for satisfying the learning need for every learner in SET lesson.

Reasons for using teaching and learning resources (TLR) in SET lessons

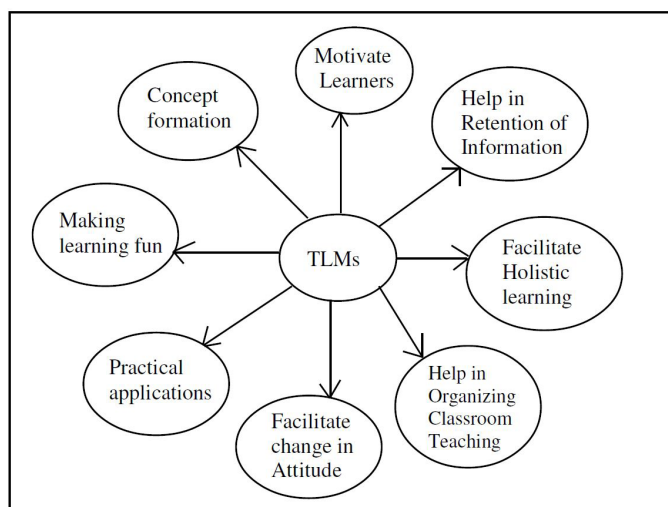
Some of reasons for using teaching and learning resources in SET lessons are various as described below:

i) TLRs motivate learners: Teaching and learning resources help in capturing the attention of learner in classroom. Once motivated to look at TLRs, the children are curious to learn new things. Teaching and learning resources provide a variety of stimuli, which helps in making classroom teaching most effective.

ii) TLRs help in longer retention of information: The more the number of sensory channels involved in interacting with teaching and learning materials, the longer will be the retention of information. Therefore, the learning will be effective and will last long.

iii) TLRs facilitate holistic learning: You have read about Blooms taxonomy of objectives. Learning objectives to be achieved through classroom teaching are in all domains- cognitive, affective and psychomotor. Therefore, to achieve varied objectives, varied learning experiences need to be provided, which can be done through the use of teaching and learning materials.

iv) TLRs help in organizing classroom teaching: As a teacher you need to organize learning experiences, making them as realistic as possible. You can use visual or verbal teaching and learning resources to present accurate data in sequentially organized manner. This helps teacher to verbal and visual communication in classroom. Thus, you may use teaching and learning materials to overcome shortcomings in verbal or visual communication.



Application Activity 2.1

1. Provide any four criteria for selecting teaching and learning resources in SET lessons
2. Why to use teaching and learning resources in SET lessons?

2.2. Books used in teaching and learning SET

Activity 2.2

1. List different types of books used in teaching and learning SET at primary school
2. Explain the relevance of each of the SET books for primary
3. Establish the precautions when using SET books

Summary Notes

The textbook plays an important role in teaching and learning. It represents a useful resource for both teacher as a course designer and facilitator and learner as beneficiary of teaching and learning process.

The effective implementation of SET syllabus need appropriate use of text books.

In addition to SET Syllabi, books used in teaching and learning SET at primary school are:

- a) Student text book for SET:** One of the most common and important resources in the classroom is the student textbook; student and teacher will find this resource particularly valuable as they provide most of the contents to be learnt by student. Text books will provide supplementary materials and exercises to student. Student's SET text book has a great influence in learning science because learners will have the opportunity of doing proposed activities. SET textbook helps student form correct understanding of basic concepts and principles of science.
- b) Teacher's guide for SET:** Teacher's guide for SET supports teachers in their practices in order to effectively implement the SET curriculum. Teacher's guide is linked to the use of student textbook. SET teacher's guide supports teachers in the following essential components:
 - Explicitly communicate key unit competences
 - Propose activities to be performed by teachers and students in teaching and learning process
 - Reinforce pedagogical content knowledge, skills, attitudes and values
 - Help understand and implement steps of every lesson

You are encouraged to read both student's text books and teacher's guide. Remember also to read other reference books about science and methods of teaching various SET topics to enrich the content found in the SET syllabus and related books.

According to Graves 2000: 175 and Basturkmen 2010: 149, the following list contains the most **advantages** of using textbooks:

- It provides a syllabus for the course because the authors of the syllabus have made decisions about what will be learned and in what order.
- It provides security for the students because they have a kind of a road map of the course: they know what to expect and they know what is expected from them.
- It provides a set of visuals, activities, readings, etc., and so saves the teacher time in finding or developing such materials.
- It provides teachers with a basis for assessing students' learning. Some textbooks include tests or evaluation tools.
- It may include supporting materials (teacher's guide, CD, worksheets, and video.)
- It provides consistency within a program across a given level, if all teachers use the same textbook.

On the other side, there are **limitations** of using textbooks. The following list contains the most frequently stated disadvantages of using only ready-made textbooks (Graves, 2000):

- The content or examples may not be relevant or appropriate to the group and they may not reflect the learners' needs since textbooks are often written for global markets and often do not reflect the interests and needs of learners. They may contain inauthentic language, since texts, methods of teaching, dialogs and other aspects of content tend to be specially written to incorporate teaching points and are often not developing all Mathematics competences as suggested in the syllabus.
- The content may not be at the right level of learners. There may not be the right mix of activities (too much of it or too little of it), there may be too much focus on one topic and not enough focus on others, or it may not include everything teachers want to include.
- The sequence of units may not be in accordance with the real work-related needs of the learners' experiences.
- The textbook may not take the learners' background knowledge into account.

To overcome such limitations, Graves (2000) suggests that, in order to minimize difficulties when selecting textbooks, teachers should keep in mind the following:

- Use the textbook as a resource for students, but not the only resource.
- Use a textbook as a guide, not a mandate, for instruction.

- Supplement the textbook with lots of outside readings.
- Supplement information in the textbook with teacher resource books.

Application Activity 2.2

After reading SET student's books and teacher's guide, establish the parallelism and differences among them stressing on elements of their structure.

2.3. Visual teaching and learning materials

Activity 2.3

1. As a SET teacher, identify visual teaching and learning materials proposed in units in the SET syllabi and propose others where possible.
2. Explain the categories of visual materials in teaching SET?

Summary Notes

The visual teaching and learning materials involve the sense of vision. It stimulates the visual impulses. This can be in three categories with various types as given below:

- **Printed or visual print materials:** The text is the main instructional or teaching learning aid. Visual print materials include textbook, supplementary book, reference books, dictionaries, magazine, newspaper, case studies, reports etc.
- **Non-projected visual materials:** Those are in form of images or pictures explaining the concepts or representation of real objects or phenomenon. Those include charts, posters, maps, diagrams, graphs, photographs, cartoons, models, specimen, puppet etc.
- **Projected visual materials:** Here the images are projected or displayed on a screen and thus are nearer reality than visual non-projected ones. Those include slide, filmstrips, projector etc.

It is in this type of teaching and learning materials that we may easily have locally made materials.

It is possible to make many visual teaching and learning resources using locally available materials. The waste materials like used wrapping papers, cardboards can be used to prepare teaching and learning materials. It is better to involve students in creating teaching and learning materials.

Application Activity 2.3

1. You are appointed as a teacher at a school which does not have enough budget for providing costly teaching and learning resources. Advise the school leader how to find solution to that problem.
2. Make some visual TLMs in TRC that you can use while teaching SET at primary school.

2.4. Audio teaching and learning materials

Activity 2.4

1. What are the benefits to teachers and learners from facilitating SET lessons using audio teaching and learning materials?
2. Give three examples to be used as audio teaching and learning materials in SET subject

Summary Notes

The auditory aids produce sound and act through the ear. They primarily stimulate the hearing sense of learner. They include human voice, telephonic conversation, audio discs/tapes, radio broadcast, cassettes, records, CDs, etc.

Audio media can make several unique contributions to the teaching-learning process: self-study for non readers, stories to stimulate the imagination, and music for physical activity, to name a few. To use audio media effectively requires an understanding of the hearing-listening processes and thoughtful selection of materials based on your objectives.

You can prepare your own audio materials, and so for your students. These recordings can take the form of oral reports, accompaniments to learning center activities, communication skills practice, and the like. By following some basic guidelines you can improve the quality of such recordings.

Advantages and disadvantages of using audio media in teaching and learning

Advantages

- Classroom audio overcomes ambient noise levels and distributes the teacher's voice at the same amplified level throughout the classroom. Every child hears the teachers at the same level no matter where the child is seated.
- Reduce a child's sensitivity to distractions .When a teacher's voice is amplified 5 to 15 decibels above ambient noise, articulation and speech intelligibility are enhanced.
- Teachers using classroom audio report less need for repeating of instructions, and fewer reminders are needed.

Disadvantages

- Students will not learn how to read as effectively (as they listen instead of practice to read stories, poem, etc.)
- Difficult to teachers to control device(s) use in class (affects classroom management and especially time management).
- Teachers have to grow eyes in the back of their heads and when mobile devices are used in class, the need for continual monitoring and regulation increases.
- Inability to know how to extract information from text successfully.

Application Activity 2.4

As a SET teacher, identify topics which need audio teaching and learning materials in units of the SET syllabi and propose others where possible.

2.5. Audio-Visual teaching and learning materials

Activity 2.5

1. What are the benefits to teachers and learners from facilitating SET lessons using audio-visual teaching and learning materials?
2. Give three examples to be used as audio visual teaching and learning materials in SET subject

Summary Notes

The audio-visual TLMs appeal to the sense of sight and hearing and are effective when teaching large numbers of learners. They are the projected aids, which use both auditory and visual senses to enhance learning. The greatest advantage of these is they are the closest representation of reality. They include motion picture film, television, video discs/cassettes, slide, tape presentations, multimedia, computer, etc.

Audio-visual teaching and learning materials give teachers the chance to stimulate each student's learning process with a combination of pictures, sounds and attention grabbing media. We are surrounded by audio visual equipments and students are intense to understand technology and keep up to date with applied science. Having this opportunity in the classroom helps to facilitate learning.

As a teacher, you may prepare your class to watch the TV science programme. You should ask your students to answer questions related to SET topics being telecast on TV. This will raise their curiosity level and they will be more alert and focused while watching the TV science programme. This will help in retention of the points learned and helps in consolidating the learning.

Some of the important benefits of the proper use of audio-visual aids are given below:

- **Best motivators:** Audio-visual aids are the best motivators. The students work with more interest and zeal. They are more attentive
- **Helpful in attracting attention:** Attention is the true factor in any process of teaching and learning. Audio-Visual aids help the teacher in providing proper environment for capturing as well as sustaining the attention and interest of the students in the classroom work
- **Helpful in fixing up new learning:** What is gained in terms of learning, needs to be fixed up in the minds of students. Audio –Visual aids help in achieving this objective by providing several activities, experiences and stimuli to the learners
- **Reduction of verbalism:** They help to giving clear concepts and thus help to bring accuracy in learning.
- **Clear images:** Clear images are formed when we see, hear, touch, taste and smell as our experiences are direct, concrete and more or less permanent. Learning through the senses becomes the most natural and consequently the easiest.

- **Variety:** Audio-Visual aids given variety and provide different tools in the hands of the teacher
- **Freedom:** When audio-visual aids are employed, there is great scope for children to move about, talk, laugh and comment upon. Under such an atmosphere the students work because they want to work and not because the teacher wants them to work
- **Opportunities to handle and manipulate:** Many visual aids offer opportunities to students and manipulate things
- **Retention:** Audio-Visual aids contribute to increase retention as they stimulate response of the whole organism to the situation in which learning takes place
- **Saving of energy and time:** A good deal of energy and time of both the teachers and students can be saved on account of the use of audio-visual aids as most of the concepts and phenomena may be easily clarified, understood and assimilated through their use.

Improvisation for teaching and learning materials for SET

All primary schools do not have adequate materials or facilities for effective teaching and learning of SET as described in previous paragraphs. This problem of a total or partial absence or inadequacy of the SET teaching resources may be due to inadequate finances for purchasing of appropriate equipments, poor culture of some teachers making teaching and learning materials using local materials and poor management and maintenance of existing resources available at school. According to Adejoh (2001), the **improvisation** is one possible solution to this problem of inadequate availability of teaching and learning materials.

Improvisation is the act of construction of instructional materials from locally available materials that can adequately replace or function in place of the original material which otherwise may be very expensive or in short supply or unavailable (Eriba, 2011) .Improvisation therefore can be a state of mind and it is a skill that lies at the heart of good science teaching.

Improvisation involves of identifying, developing and using suitable materials in the absence of the real one for effective teaching and learning process. It could mean making of instructional material or teaching aid by SET teachers where the original materials are not available or where there are available but not functional.

In TTCs, the Teacher Resource Centers (TRCs) should serve as a good area for student teachers to make materials or improvise SET teaching aids.

Benefits of improvisation of resource materials in the teaching and learning of science

The benefits of improvised materials have on science teaching and learning are the following:

- Improvised materials provide a cognitive bridge between abstraction and reality to learners.
- Improvisation saves cost and in addition the teacher and the learners make positive effort towards effective instruction.
- Improvisation undertaken by teacher enables him/ her to think and research for cheaper, better and faster methods for making the teaching and learning process easier to learners. This makes the teacher innovative and a lifelong learner.

Note: In teaching SET at primary, the main teaching and learning materials are provided in a science kit which is not sufficient on itself. The teacher must find other many materials in environment, visit different places with learners and fabricate other resources using locally available materials.

Management of instructional resources

The effective management of teaching and learning resources concerns its **care and maintenance**. The following are general ways of taking care of and maintaining instructional materials:

- Updating the catalogue of available resources and store them in a special place from where other teachers can borrow the resources for use and then return them. The storage can be done in a room, a box, or cupboard.
- Storing materials in a flat position to avoid folding and creasing (e.g. charts on manila papers or rice sacks)
- Mounting materials/aids correctly and firmly/ secured
- Storing materials in a clean, dry place.
- Avoiding folding the materials to prevent wear and tear at the fold
- Keeping electronic equipment in bags to protect them from dust.
- Edges binding using sell tape, polythene paper or commercial edge binders.
- Using synthetic spray, polythene paper or varnish to protect the surface of picture or maps.

Application Activity 2.5

1. As a SET teacher, identify topics which need audio visual teaching and learning materials in units of the SET syllabi and propose others where possible.
2. Discuss how Laptop, projector, TV can be used in teaching SET lessons?
3. In your school laboratory or demonstration school, open the science kit for primary and list all items in it by completing the following table:

No	Name of materials / Item	Name of experiment	Other locally available materials or resources to be made to complement them

4. Identify the materials in the science kit that will challenge you in using them at primary and do a research on how to use them (ask your neighbors, your science teachers or visit internet in smart room).

End unit assessment

1. Differentiate the importance of every category of teaching and learning resources in SET lessons.
2. Using tangible examples, what and why improvisation in science teaching and learning?
3. Refer to categories of TLMs, enumerate the examples of materials that you can use while facilitating every unit in SET syllabi.

UNIT 3 : THEORY BASED LESSONS

Key unit competence:

Identify and plan theory based lessons by developing generic competences and integrating cross-cutting issues through learning activities.

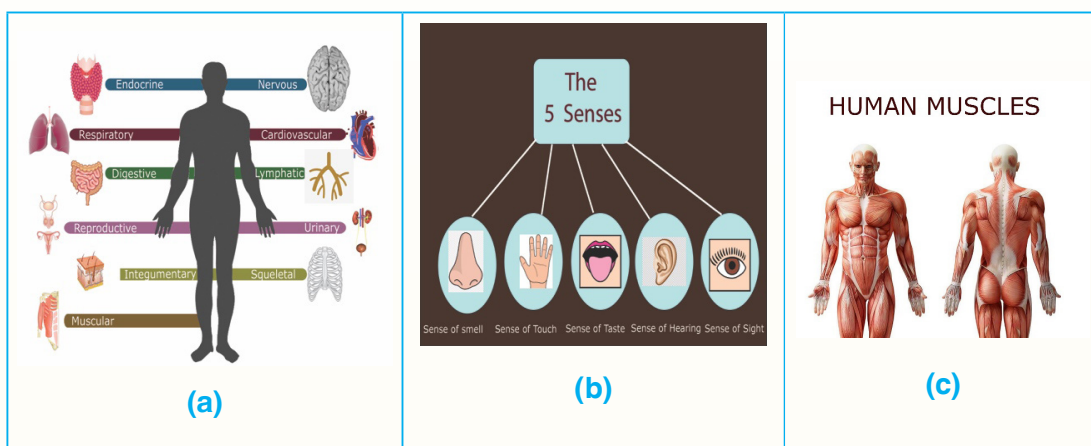
Introductory Activity:

Read the following text and answer related questions

A teacher planned to teach sense organs but was challenged on how to find real materials for teaching a tongue. During the peer learning session of all science teachers he raised that issue. The fellow teacher told him that such lesson is theoretical and proposed him some materials he may use to make his lesson active. The teacher followed advice from the colleague and taught the lesson effectively.

1. Why do their colleagues tell him that the lesson is theoretical?
2. What materials do you think the colleague teachers have proposed him?

3.1. Theory based lessons for primary



Activity 3.1

1. Look at the above pictures and brainstorm how you can teach related lesson
2. Is there any way of conducting a practice while teaching the lesson related to the above picture at primary school? Why?

Summary Notes

A theory based lesson is a learning from a text, images, charts, and videos. A theory based lesson refers to concepts you cannot demonstrate and are learned only theoretically. In SET, these concepts include Systems, Sensory organs, muscles, Animals etc.

Application Activity 3.1

1. Read through SET syllabus, identify topics that can be taught as theory based lessons
2. What are the criteria based on to identify theory based lessons from SET books
3. Select throughout the SET syllabi the theory based topics which you feel will challenge you in teaching them at primary and make research on them to enrich your mastery.

3.2. Techniques and strategies for facilitating theory based lessons



(a)



(b)

Activity 3.2

1. Analyze the above pictures and write a short note on them
2. Find out different teaching methods and techniques you can use in facilitating a theory based lesson

Summary Notes

The most technique in teaching a theory based lesson is the observation which is the active acquisition of information from a primary source. In living beings, observation employs the senses.

In science, observation can also involve the recording of data via the use of scientific instruments. The term may also refer to any data collected during the scientific activity. Observations can be qualitative, that is, only the absence or presence of a property is noted, or quantitative if a numerical value is attached to the observed phenomenon by counting or measuring. There are two types of observation:

- **Free- observation:** Allows observers to see how individuals act in natural settings, rather than in the more artificial setting of a lab or experiment
- **Guided observation:** Teachers provide an environment and materials to invite and promote students engagement in the visual and performing science. Develop student understanding of the concept or skill through activities or exercises.

Observation involves always the **analysis** of observations or findings and the **synthesis** of the observations.

Analysis consists of the following:

1. Analysis means breaking up into simpler elements.
2. It proceeds from the unknown to the known fact
3. It is a method of discovery.
4. It is a process of thinking (exploration).
5. The students can recall and reconstruct easily any step if forgotten.
6. It develops originality.
7. It is informal.

Synthetic Method consists of the following:

1. Synthesis means building up separate elements and their combination
2. It proceeds from the known to the unknown facts.
3. It is a method of presentation of discovered facts.
4. It is a product of thought.
5. It is short and concise.
6. It puts together or synthesizes known facts.
7. It develops memory.

During a theory based lesson, the teacher will proceed as follow:

- Availing object to be observed
- Requesting learners to observe the object and take notes (Free observation)
- Asking questions on observed object (Guided observation)
- Requesting learners to discuss on their observations (analysis)
- Requesting learners to summarize and report their observations (synthesis)
- The tutor fine-tunes the statements presented by learners.

Application Activity 3.2

Consider the theory based topics identified from SET syllabi during the application activity 3.1 and suggest appropriate teaching methods and techniques to be used while facilitating each and every one.

3.3. Generic competences and integration of cross-cutting issues in a theory based lesson

Activity 3.3

1. Justify why is it necessary to develop generic competences and integrate cross-cutting issues in SET theory lesson.

Summary Notes

Generic competences: Are the competences which are transferable and applicable to a range of subjects and situations including employment.

The generic competences to be developed in SET lessons are Critical thinking, Creativity and innovation, Research and problem solving, Communication, Co-operation, Interpersonal relations and life skills, Lifelong learning.

Cross-cutting issues: Is the content that does not belong to any one subject or learning area exclusively but which is best taught and learned in a number of SET topics.

The Cross-cutting issues to be integrated in SET lessons are: Genocide Studies, Environment and sustainability, Gender, Comprehensive Sexuality Education, Peace and Values Education, Financial Education, Standardization Culture and Inclusive Education.

Note: All generic competences and crosscutting issues enumerated above cannot fit in every topic at once. It requires to select those which match with a specific topic.

Application Activity 3.3

1. In theory based lessons identified in application activity 3.1, find out the generic competences that will be developed by learners in each and every lesson identified.
2. What cross-cutting issues to be integrated in those theory based topics?

3.4. Appropriate resources for theory based lessons

Activity 3.4

1. Give examples of teaching and learning materials that can be used in SET
2. Suggest teaching and learning materials that can be used while facilitating every theory based lesson identified in activity 3.1.

Summary Notes

In a theory based lesson, teaching materials are objects, drawings equipment that can be used to help explain concepts during teaching and learning process.

Teaching materials to be used in SET may be insects when teaching animals, flowering plant parts (leaves, flowers, roots, stems) when teaching plants, objects models, drawings, posters, equipment rice sacks, flash cards, picture cards, kit science etc.

To make teaching and learning resources useful, they should be always used and maintained to ensure that they are in good condition. It is important that a teacher of SET knows the resources that are available in their school and where they are kept.

Application Activity 3.4

In Teaching Resources Center (TRC), make teaching resources to be used while teaching every theory based lesson identified in activity 3.1

3.5. Assessment for a theory based lesson

Activity 3.5

1. How can you assess a SET theory based lesson?
2. Does a theory based lessons assessed on paper or in a laboratory? Explain why.

Assessment is the process of evaluating the teaching and learning processes through collecting and interpreting evidence of individual student progress in learning and to make a judgment about the achievements measured against defined standards. Assessment is an integral part of the teaching learning process. In the competence-based curriculum, assessment must also be competence-based whereby a student teacher is given a complex situation related to his/her everyday life and asked to try to overcome the situation by applying what was learned.

As a teacher, allow students the following:

- Go beyond facts or simple recall and encourage students to think
- Require students to decide what knowledge to apply and when can be used in a variety of ways
- Give students a chance to explain their thinking and ways of figuring things out
- Ask students to communicate in different ways, for example, through words or drawings

Suggested assessment tools and techniques in science

In assessing a theory based lesson, the common assessment tools and techniques used include experiments, information gathering, presentation on science concepts, investigation for stated problems, science quiz, assignment, projects, preparation of various compounds, and explanation of different phenomenon using scientific principles.

Application Activity 3.5

For every theory based lesson identified in application activity 3.1, set questions to assess the learner's knowledge, skills, values and attitudes.

3.6. Lesson planning for a theory based lesson

Activity 3.6

1. What are elements and their significance to consider during SET lesson planning?
2. Draw the importance of lesson planning.
3. Read critically the provided sample **theory based** lesson plan by analysing the formulation of every element of lesson plan template.

Summary Notes

Good in Radha Mohan (2010) defines a lesson plan as an outline of the important points of a lesson arranged in order in which they are to be presented to students by the teacher.

Points to consider in advance when planning a theory based lesson

- What are learners going to learn? i.e what are the **objectives** of the lesson?
- What are **competencies** learners will acquire? Teachers write down one sentence for each of the following categories, describing the intended outcomes: (1) Knowledge/ understanding, (2) Skills and (3) Attitudes & Values
- Who are **learners with Special Education Needs** in the targeted classroom? Here the teacher needs to think on the objectives achievable by all learners (including SEN)

- What **organizational issues need** to be considered? E.g. is the class inside/outside/in a laboratory? What equipment is available or necessary? Is the size or means for grouping learners appropriate, e.g. male and female, ability, friendship groups, etc?
- What are **teaching methods and activities** could be included in order to achieve these objectives, maximize learner participation/motivation, and meet the needs of both a mixed ability class and the different learning styles of learners?
- What are **previous relevant knowledge** will the lesson build upon to make clear the learning linkages? This may be formal (taught previously) or informal (life experience).
- What are **teaching and learning resources** will motivate the learners and facilitate their understanding of the topic?
- How long is the lesson and how can this **time** be used most efficiently?
- How will the teachers **assess** whether learning has taken place and the lesson objectives have been achieved?

Importance of SET lesson planning

Lesson planning allows the following:

- The teacher covers his/her SET content in a systematic order.
- The teacher researches before the lesson, find and present the correct information to his students
- The teacher thinks on methods to use in a given SET topics, class, number of student and teaching and learning materials available.
- The teacher updates his/her next move while teaching SET topics
- The teacher reviews his/her previous lesson and seeks some remedial measures in case the objective fixed is not achieved.

The following is a lesson plan format to be use in competence based lesson planning:

While formulating the instructional objectives, the teacher takes into account the five components of an instructional objective

The teacher should take into account learners with special need to ensure that the play is adapted to all learners

LESSON PLAN FORMAT

School Name: Teacher's name:

Term	Date	Subject	Class	Unit N ^o	Lesson N ^o	Duration	Class size
.....	.../.../20..... of
Type of Special Educational Needs to be catered for in this lesson and number of learners in each category							
Unit title							
Key Unit Competence							
Title of the lesson							
Instructional Objective							
Plan for this Class (location: in / outside)							
Learning Materials (for all learners)							
References							

Teacher indicates the learning materials needed for the lesson specifying those for learners with SEN

Timing for each step	Description of teaching and learning activity		Generic competences and Cross cutting issues to be addressed + a short explanation
	Teacher activities	Learner activities	
Introduction ... min			
Development of the lesson ... min			
Conclusion ... min			
Teacher self-evaluation			

This part is a summary of the teaching and learning process.

Towards the end of the lesson, the teacher asks effective questions on how learners perceive the lesson, how it's connected to their life experience and how they will use the acquired competences.

The teacher sets learning activities which help learners develop generic competences and cross-cutting issues to be addressed in the lesson.

The teacher provides short written explanations justifying how above mentioned generic competences and cross cutting issues are catered for.

Sample lesson plan for a theory based lesson

School Name: xxx xxx

Teacher's name: yyy yyy

Term	Date	Subject	Class	Unit No	Lesson No	Duration	Class size
3rd	dd/mm/yyyy	SET	P4	9	2 of 12	40min	36
Type of Special Educational Needs to be catered for in this lesson and number of learners in each category				Two (2) learners with partial hearing impairment			
Unit title	Animals						
Key Unit Competence:	To be able to classify the animals according to their backbone, locomotion, feeding, reproduction and respiration mode.						
Title of the lesson	Classifying animals according to locomotion ways						
Instructional Objective	Given a box of 20 flash cards with names of known animals and 6 flash cards with category of animal locomotion ways, learners are able to match correctly animals and their locomotion way in 10 minutes.						
Plan for this Class (location: in / outside)	Inside the classroom						
Learning Materials (for all learners)	Flash cards with pictures of different animals: cow, snake, rabbit, fish, dove (inuma), frog, flash card with animal locomotion ways and flash card with names of animals.						
References	REB, 2015: Science and Elementary Technology. Syllabus for upper primary. Kigali						

Timing for each step	Description of teaching and learning activity		Generic competences and cross cutting issues
	Teacher activities	Learner activities	
Introduction 5min	<p>Ask some questions related to previous lesson (characteristics of mammals)</p> <p>1) What are the main characteristics of mammals</p> <p>2) Give 2 examples of mammals</p>	<p>Expected answers:</p> <p>1) Mammals are characterized by:</p> <ul style="list-style-type: none"> - Hair to maintain constant the body temperature; - Females produce milk to nourish their babies - Mammals have a four-chambered heart - The diaphragm aids mammals in breathing ... <p>2) Examples of mammals: cow, goat, gorilla, rabbit, dog, pig, cat, etc.</p>	Communication: Developed through thinking about the asked questions and orally answering as well.
Development of the lesson 20 minutes a) Discovering activity	<ul style="list-style-type: none"> - Assist learners to form 6 gender balanced groups - Display the required teaching material and give instructions of the simulation game: there is a box with 5 flash cards with pictures of animals - Ensure that the instructions are well understood and implemented 	<ul style="list-style-type: none"> - Make 6 groups and select one team member based on abilities to simulate animal locomotion ways. - Group work: in 6 groups, learners carry out the following: <ul style="list-style-type: none"> 1) The selected team member from each group picks one flash card with picture of an animal from the box. 	<p>Communication:</p> <p>Through active listening to game related instructions and group discussions.</p> <p>Creativity and innovation:</p> <p>For learners who have to simulate animal locomotion ways.</p>

	<ul style="list-style-type: none"> - Ensure that the two learners with partial hearing impairment are seated at the front near the chalkboard where they can see and hear the teacher/classmates. - Provide required support and guidance during after the game. - Ask questions related to the game: <ol style="list-style-type: none"> 1) What was interesting in the game? Explain 2) During the game, how did you feel when you were moving/simulating animal locomotion way? 3) What was the most difficult to achieve? 	<p>3) The group discuss and gives at least 3 examples of animals in the same category.</p> <p>Expected answers on the game:</p> <ul style="list-style-type: none"> -Simulating animal locomotion ways is funny - It was too difficult to perform the simulation game for a snake, fish in classroom situation. 	<p>Cooperation and interpersonal relationship: Through group work</p> <p>-Inclusive education: While accommodating learners with hearing difficulties</p>
<p>b) Exploitation</p>	<p>Invite group representatives to present their findings and provide related guidance</p>	<p>Group presentations:</p> <ul style="list-style-type: none"> -A group representative to present their findings: describe the way of locomotion for the assigned category and give at least 2 examples of animals in that category. 	<p>Communication: Through presentation and active listening to findings; asking questions.</p>

		- Members of other groups give other examples or ask questions.	
c) Synthesis and conclusion	Guide learners to summarize animal locomotion ways.	<p>Provide examples for animal locomotion way:</p> <ul style="list-style-type: none"> - Swimming: Examples: fish, hippopotamus, crocodile - Walking: Examples: cow, dog, pig... - Flying: Examples: Birds, insects like bee, fly, mosquito ...) - Crawling: Examples: snake, lizards, crocodiles - Jumping: Examples: rabbits, frog, cat - Climbing: Examples: Gecko, spiders, monkey <p>Note: One animal can use more than one locomotion way.</p>	<p>Environment and sustainability:</p> <p>Appreciate the variety in the natural environment</p>
Conclusion 15 minutes	<ul style="list-style-type: none"> - Display needed materials: 6 flash cards with name of animal locomotion way; a box with flash card with names of animals. - Gives instructions for assessment activity, ensure that they are understood and provide needed support during the game. 	<p>Matching game using flash cards</p> <ul style="list-style-type: none"> - 6 learners holds flash card with name of animal locomotion ways - One by one, learners pick from a box a flash card with name of an animal, run quickly and line up behind appropriate locomotion way. 	<p>Critical thinking:</p> <p>While making correct matching</p>

	<ul style="list-style-type: none"> - Guide learners to assess the matching and make corrections. - Ask a closing question: in your everyday life, why is it important to know animal locomotion ways? - Encourage learners to find out more examples through research. (Homework) 	<ul style="list-style-type: none"> - When the box is empty, learners in their group assess if the matching is correct and make required corrections. <p>Because animals can move to find food, we should know their locomotion ways for security measures.</p> <p>Homework: Make research on animal locomotion ways to find out more examples in each category.</p>	<p>Lifelong learning:</p> <p>Through research when learners are doing the homework on animal locomotion and ways to find out more examples</p>
Teacher self-evaluation	Strengths: The lesson was delivered in a funny way and the objective is highly achieved within the allocated time.		

Application Activity 3.6:

Select a theory based topic and make its lesson plan using CBC lesson plan template. Submit your lesson plan to the tutor on email.

End unit assessment

1. What do you understand by a theory based lesson?
2. What are criteria to consider when selecting teaching and learning materials?
3. What are relationship between free-observation and guided observation?
4. Refer to SET syllabus with primary SET books and plan a theory based lesson

UNIT 4 : PRACTICAL BASED LESSONS

Key unit competence:

Identify and plan practical based lessons by developing generic competences and integrating cross-cutting issues through learning activities.

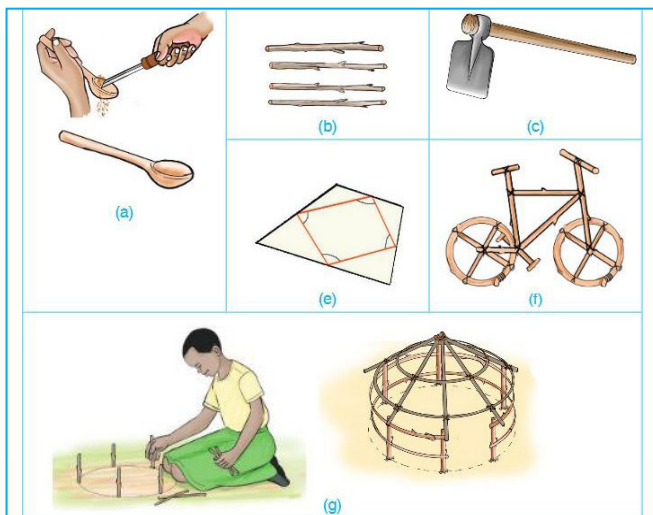
Introductory Activity:

Read the following scenario and answer related questions

In a village there was a boy who likes to build houses in clay and make bicycles in bamboo. At home his father requested him to stop such practices because he makes clothes dirty and he may cut himself. The following day, the boy came close to his father politely and requested him to allow him continue making such objects. He told his father that he will keep cleaning the place where he made the toys and putting all rubbishes in the dustbin. His father accepted and the boy was happy.

1. Make comments on the attitude of the boy and parent.
2. Do you think making toys by the boy was important? Explain using tangible examples.
3. List other toy materials usually made by children and draw the future benefit from making each of those materials.

4.1. Practical based lessons for primary



Activity 4.1

1. Observe objects on the above pictures. Describe each of them and how they are produced.
2. What is the relevance of teaching primary students how to fabricate different objects?

Summary Notes

Practical based lessons are lessons in which students observe or manipulate real objects or materials. Practical lessons teach laboratory skills, enhance the learning of scientific knowledge, give insight into scientific method and develop expertise in using it. The practical based lessons in SET syllabus are those related to objects production.

Practical SET lessons improve the classroom practices through the provision of open educational resources to support teachers in developing student- centred, participatory approaches.

Practical lessons for SET design opportunities for learners to tangibly struggle with and apply their understanding of scientific concepts. It allows them to do the work in contexts that are more familiar to them (e.g., building a self-propelled vehicle, designing a functioning garden ecosystem, building projects, designing a process).

Application Activity 4.1

1. Read all SET syllabi and identify topics that can be taught as practical based lessons
2. Select throughout the SET syllabi the practical based topics which you feel will challenge you in teaching them at primary and make research on them to enrich your mastery.

4.2. Methods and techniques for facilitating practical based lessons

Activity 4.2

Find out different teaching methods and techniques you can use in teaching and learning a practical based lesson

Summary Notes

In SET practical based lesson, the teacher will use the following techniques:

- 1. Observation:** Is a perceptual process which refer to look at, listen to, touch, taste, or smell something, attending to details of the resulting perceptual experience. In many cases students and teachers must arrange and manipulate things or materials to produce informative perceptible results.
- 2. Demonstration:** Is a teaching method used to communicate an idea with the aid of visuals such as flip charts, posters, power point, etc. A demonstration is the process of teaching someone how to make or do something in a step-by-step process.

Demonstration involves showing how something is done. It is a more effective way of teaching than describing. In demonstration, the emphasis is on learning by observation followed by doing drills and practice exercises are required. It enables learners to eventually perform the activity on their own as individuals or as groups.

Criteria for a good demonstration

A successful demonstration will have the following patterns:

- The demonstration should be visible to all and set up should be at a good height. Students should be seated either in gallery type classrooms or be allowed to come near.
- The apparatus used for demonstration should be larger in size
- The pace of demonstration should be accurate, neither too fast nor too slow. This helps students to follow the demonstration carefully.
- For recording the data the students should be given sufficient time
- The teacher should make interesting her demonstration by asking suitable reflective type questions.
- Emphasis should be given to the major points in the demonstration, so that students are aware of the objectives of the demonstration.

- 3. Fabrication:** Is manufacturing process in which an item is made (fabricated) from raw or semi-finished materials instead of being assembled from ready-made components or parts. During SET lessons, students must be provided with resources and time to produce different objects using local materials.

Application Activity 4.2

Identify specific teaching methods and techniques possible to be used while teaching every practical based lesson identified in SET syllabi in application activity 4.1.

4.3. Generic competences and integration of cross-cutting issues in practical based lesson

Activity 4.3

1. Is it possible to develop generic competences during a practical based lesson? If possible, how and which ones?
2. How a teacher will integrate crosscutting issues in a practical based lesson.

Summary Notes

During a practical based lesson, it is also necessary to consider the generic competences and cross cutting issues as well. This is a good opportunity to help learners develop generic competences and integrate crosscutting issues as this kind of lessons may be facilitated in different setting from the classroom.

Application Activity 4.3

1. In practical based lessons identified in application activity 4.1, find out the generic competences that will be developed by learners in each and every lesson identified.
2. What cross-cutting issues to be integrated in those practical based topics?

4.4. Appropriate resources for practical based lessons

Activity 4.4

Select teaching and learning materials that can be used when you teach every practical based lesson identified in the SET syllabi in previous activity 4.1.

Summary Notes

In every unit in the syllabus, there are proposed teaching and learning resources to be used while facilitating the content of unit. Some of those resources are found in school environment, others are purchased like science kits, and others are locally made in teacher resource center (TRC).

Some materials you can use when you facilitate SET practical based lessons are in different areas like:

Carpentry tools: Work bench, wood saw, T-square, claw hammer, mallet, plane, wood chisel, axe, screw driver, brace, clamp, ruler, bow saw, spirit level, auger bits.

Masonry tools : Water level/spirit level, trowel, plumb line, float, meter ruler, tape measure, jointer, brick frame, wheel barrow, T-square, shovel, hoe, brick hammer, mortar mixer.

There is also variety of materials like clay, fibers, wood, thread, needle, hammer, short nail, palm leaf, papers, glue, etc

Materials for making toys such as wires, old slippers, rubber bands, used vehicle/bicycle tubes, bottle tops, scissors, pliers, etc.

Photographs or charts showing simple toys, utility objects, straws and sticks, machete, suitable piece of wood, cartoons,

Sewing materials such as threads, weaving hooks or needle, pieces of clothes, pair of scissors, razor – blade or lancelet.

Application Activity 4.4

Select a practical based lesson and make in TRC the teaching resources to be used while facilitating it.

4.5. Assessment for a practical based lesson

Activity 4.5

1. How can you assess a SET practical based lesson?

Summary Notes

Practical based lesson assessment reflects on learning outcomes according to the competences you want to develop. When you assess a practical lesson you reflect on the following:

- Appropriate methods to particular object production
- Knowledge and skills in practical context
- Understanding and application of reasoning,
- Logical structure and order of arguments and
- Presentation skills for his/her practical lesson.

Application Activity 4.5

Select a practical based lesson and set questions to assess the learner's knowledge, skills, values and attitudes

4.6. Lesson planning for a practical based lesson

Activity 4.6

1. What are elements and their significance to consider while planning a SET practical based lesson?
2. Read the provided sample practical based lesson plan on next page and analyse the formulation of every element of lesson plan template.

Summary Notes

Effective lesson plan will comprise key components including Clear Objectives, Necessary Materials, and Background Knowledge, development of competences, Student Practice, synthesis and Demonstration of Learning (Assessment). All components of a practical based lesson are completed in the following sample lesson.

Sample lesson plan for a practical based lesson

School Name: xxxxxx

Teacher's name: yyyyy

Term	Date	Subject	Class	Unit N°	Lesson N°	Duration	Class size
1 st	dd/mm/yyyy	SET	P6	1	1 of 16	80min	36
Type of Special Educational Needs to be catered for in this lesson and number of learners in each category				<ul style="list-style-type: none"> - Learners with low vision (2) - Learner with hearing problems (1) 			
Unit title	Mechanics and blacksmith tools						
Key Unit Competence:	To be able to use and maintain mechanics and blacksmith tools safely						
Title of the lesson	Common mechanics tools and their uses						
Instructional Objective	Through a garage visit to observe mechanics at work and by practicing using mechanics tools such as spanners, pliers, screw drivers, mechanics hammer among others and further, by watching the video through the video link provided, learners should accurately discover the role of various mechanics tools and the role mechanics play in the society and properly use the tools.						
Plan for this Class (location: in / outside)	<ul style="list-style-type: none"> - Individual research works on what a mechanic is. - Academic trip to a garage to witness use of mechanics tools - Watching a video in class 						
Learning Materials (for all learners)	<ul style="list-style-type: none"> - Common mechanics tools such as spanner, pliers, screw driver, hack saw, mechanics hammer etc - Charts showing mechanics tools and their uses - Videos on mechanics tools and their uses or video link: http://www.youtube.com/watch?v=NF9dQt74O3g - VCDs or DVDs and player and TV screen - Computer connected to the internet - Projector (for projecting the video) 						
References	<ul style="list-style-type: none"> - REB, 2015: Pupil's book for Science and Elementary Technology and ICT for Primary 6. - REB, 2015: SET syllabus for upper primary. Kigali. 						

Timing for each step	Description of teaching and learning activity		Generic competences and cross cutting issues
	Teacher activities	Learner activities	
	Students observe mechanics at work and watch the video and discover the various mechanic tools and their uses as the teacher guides them.		
Introduction 10 minutes	<p>Ask learners to study the picture on page 1 of their books and to state what is going on.</p> <p>Ask learners to suggest a solution to the problem situation in the picture.</p>	<p>Study the picture and states what is happening:</p> <p>The picture shows a publish service vehicle with a flat tyre. The driver is trying to replace the tyre but he cannot do it. The passengers inside the vehicle are complaining of getting late. The driver is stranded as he is not a mechanic. He is using a wrong tool (hammer) to remove the wheel.</p> <p>Give a solution to the problem situation as the driver should be trained on the basics of mechanics and mechanics tools and their uses.</p>	<p>Critical thinking and problem solving skills</p> <p>This competence will be developed as learners study the picture and give solutions to the problem situation.</p> <p>Cooperation and interpersonal management life skills</p> <p>This competence will be developed as learners freely participate in the discussions regarding the problem situation.</p> <p>Peace and values education</p> <p>As learners discuss why the driver has to accommodate passenger views.</p> <p>Standardization culture</p> <p>The problem situation may have come about as a result of fake tyre. Stress the need to always by original products.</p>

<p>Development of the lesson 50 minutes</p> <p>Observation</p>	<p>Guides learners to carry out research on who a mechanic is and the tools he/she uses and asks them to write a report.</p> <p>Takes learners to a nearby garage to observe mechanics at work. They should note down how each tool is being used and draw it in their notebooks.</p>	<p>Carry out research and writes a report.</p> <p>Sample report</p> <p>A mechanic is a person who repairs, assembles, maintains or fixes spoilt vehicles. He/she uses tools such as pliers, hammer, spanner, screw driver, hack saw and screw jack.</p> <p>Mechanics work in a garage where they name a special room for storing their tools. They are important in our society because they help to repair spoilt and worn out vehicles and make us able to use them safely again.</p> <p>Visits a nearby garage, observes mechanics at work and note down the tools the mechanics are using and their uses.</p>	<p>Cooperation and interpersonal management life skills</p> <p>As learners engage one another during group discussions.</p> <p>Communication</p> <p>As learners do presentation in English and as they share during group discussions.</p>
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<p>Demonstration</p>	<p>Show learners a video of mechanics at work.</p> <p>Ask learners to discuss, write a report and present what they saw during the garage visit or in the video.</p>	<p>Practice using the various mechanics tools.</p> <p>Watch the video, listen and comment about the video.</p> <p>Form groups according to teacher instructions</p> <p>Discuss and write a report and do a presentation to the rest of the class.</p>	<p>Lifelong learning</p> <p>By practicing using mechanics tools, learners gain pre-requisite skills that will come in handy in their lives if they were to become mechanics.</p> <p>Environment, climate change and sustainability</p> <p>The oils and other chemicals that come from machines when not disposed of well, cause pollution. Caution learners against disposing of these wastes anyhow.</p> <p>Gender education</p> <p>Emphasize to learners the fact that both men as well as women can earn a living by becoming either a mechanic.</p> <p>Inclusive education</p> <p>Allow all learners to participate equally irrespective of their gender, physical disability or mental challenges.</p>
<p>Fabrication</p>	<p>Assist learners to form groups depending on the class size and ability of learners.</p>	<p>Form groups and try to practice how mechanic works for different tools</p>	<p>Critical thinking</p> <p>Learners develop this competence during manipulation of mechanic tools.</p>

<p>Conclusion 20 minutes</p>	<p>Ask a volunteer to come and summarize what they have learnt in this lesson.</p> <p>Assist learners in summarizing the lesson by asking some questions about the roles and uses mechanics tools</p> <p>Complete the summary done by students by highlighting the main points on who a mechanic is and the tools he uses. (Refer to student book pages 2-7 for the facts).</p>	<p>Listen to the fellow learner and give their contribution where necessary</p> <p>Answer the asked questions while summarizing the lesson</p> <p>Answer to the questions in student book on page 2-7 and continue to do research on them.</p>	<p>Communication As the volunteer learner does presentation in English to the rest of the class.</p> <p>Gender education Both boys and girls should be given equal opportunity to present to the rest of the class.</p>
<p>Teacher self-evaluation</p>	<p>Some learners had problems using the mechanics tools. Further garage visits will be arranged for them to improve their skills of using the tools.</p>		

Application Activity 4.6:

Select a practical based lesson in SET syllabus and make its lesson plan using CBC template

End unit assessment

1. What do you understand by a practical based lesson?
2. What are criteria to consider when selecting teaching and learning materials for practical based lessons?
3. Predict the challenges in facilitating practical based lessons and propose solutions

UNIT 5 : OBSERVATION BASED LESSONS

Key unit competence:

Identify and plan observation based lessons by developing generic competences and integrating cross-cutting issues through learning activities.

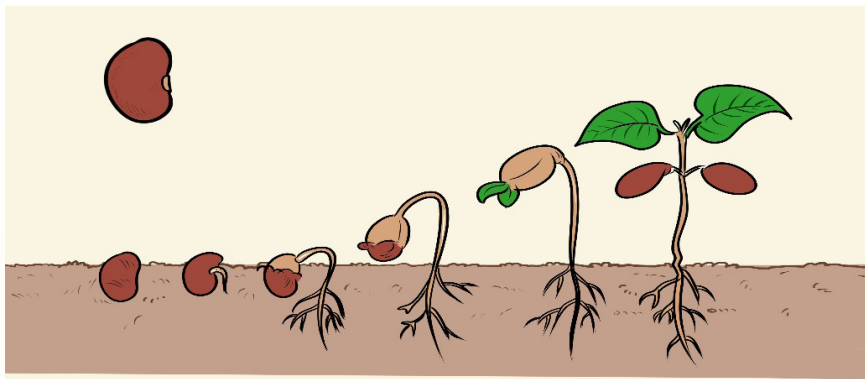
Introductory Activity:

Read the following text and answer related questions

A farmer cultivates beans in her garden. At different intervals of time she knows the planted grains germinated, they need beans support and when to harvest.

1. What tells the farmer that her planted beans grow well?
2. What are conditions needed by the plant to grow?
3. Does cultivation of beans need specialized farmers? Explain

5.1. Observation based lessons



Activity 5.1

1. Analyze the above pictures and write a short note on how you can teach the steps of germination.
2. Research on internet about an observation based lesson for SET.
3. Based on your research findings, establish the relevance of using observation method.

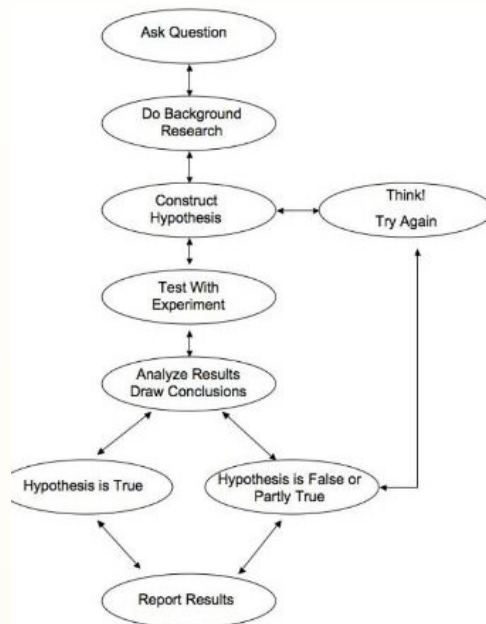
Summary Notes

Teaching science requires scientific methods like observation of natural phenomena to formulate and test hypotheses.

In teaching an observation based lesson the teacher will guide student through the following steps:

1. Ask a question about a natural phenomenon
2. Make observations of the phenomenon
3. Formulate a hypothesis that tentatively answers the question
4. Predict logical, observable consequences of the hypothesis that have not yet been investigated
5. Test the hypothesis' predictions by an experiment, observational study, field study, or simulation
6. Draw a conclusion from data gathered in the experiment, or revise the hypothesis or form a new one and repeat the process
7. Write a descriptive method of observation and the results or conclusions reached
8. Have peers with experience researching the same phenomenon evaluate the results

The above steps are summarized in the following diagram:



Methods to develop observation skills

There are different observation methods which help learners to benefit more through his/her learning. Those include:

- **Field trip** (for observing and collecting): It enables learners to investigate and observe SET in action. It helps them to understand scientific concepts more deeply as they can investigate them in a real context. Field work helps to understand the world around them.

Examples:

1. Field work to investigate the steps of soil preparation
 2. Field work to investigate the effect of water on the environment
- **Experimentation and demonstration:** This is where the learners get the opportunity to explore and manipulate different teaching and learning materials and it permits them to be able to discover new things on their own.

In SET subject, there are concepts which are taught as observational based lessons like stages of germination, air, water, etc.

Application Activity 5.1

1. Read through SET syllabi and identify topics that can be taught in an observation based approach
2. Select throughout the SET syllabi the observation based topics which you feel will challenge you in teaching them at primary and make research on them to enrich your mastery.

5.2. Techniques and strategies for facilitating observation based lessons

Activity 5.2

1. How should you teach an observation based lesson?

Summary Notes

Observation is the action or process of observing something or someone in order to gain information. Our observation skills inform us about objects, events, attitudes and phenomena using one or more senses.

Additionally, being able to observe and gather information about the world is important because it's the basis of communicating well.

In facilitating SET observation based lesson, the teacher will go through the following steps:

- Collect materials for observation
- Present the objectives of observation
- Prepare and avail to students the guiding questions
- Let student observe
- Student share about their observations
- Summarize together the results observed
- Report the observations
- Discuss about the observations
- Make conclusion

Application Activity 5.2

Identify specific teaching techniques possible to be used while teaching every observation based lesson identified in SET syllabi.

5.3. Generic competences and integration of cross-cutting issues in an observation based lesson

Activity 5.3

1. Is it possible to develop generic competences during an observation based lesson? If possible, how and which ones?
2. How a teacher will integrate crosscutting issues in an observation based lesson.

Summary Notes

During an observation based lesson, it is also necessary to consider the generic competences and cross cutting issues as well.

This is a good opportunity to help learners develop generic competences and integrate particular crosscutting issues as this kind of lessons may be facilitated in different setting from the classroom.

Application Activity 5.3

Identify specific generic competence to be developed and cross-cutting issues possible to be integrated in every observation based lesson identified in SET syllabi.

5.4. Appropriate resources for an observation based lessons

Activity 5.4

1. Suggest appropriate teaching and learning materials that can be used while teaching every observation based lesson identified in SET syllabi in previous activity 5.1.

Summary Notes

When teaching observation based lessons like steps/stages of germination and soil preparation you need the following materials: Bean seed, water, Ziploc bag, Paper towels, soil, containers, potting mix, radish, pea and seeds (in matching seed packets with planting information listed), Small pots, etc.. Cameras for taking photos, notebooks for recording observation are used.

When you teach air and wind units you need the following materials: Balloons, beam balance, a kit to demonstrate that air has weight, candle, etc.

Application Activity 5.4

In TRC, make the teaching resources to be used while teaching every observation based lesson identified in SET syllabi in previous activity 5.1.

5.5. Assessment for an observation based lesson

Activity 5.5

1. How can you assess a SET observation based lesson?

Summary Notes

Through observation, teacher determines the level of understanding a student has and can track his or her progress throughout the learning process. For assessing an observation based lesson teacher requests student to elaborate the report of their observation and assesses from the beginning until the end the project.

The assessment is necessary in this kind of lesson because it enhances student's competence as it stimulates him/her to find other technological methods to use in his/her study. The teacher continues to ask more questions about how they carried observation process. In the report student shows the records from the beginning until the end showing also the materials used. The methods for assessing an observation based lesson may include observation checklists and rubrics, performance tasks, unit test, created tests etc. In every assessment, it is always necessary to refer to bloom's taxonomy levels in order to check if learners mastered the competences at all levels.

Application Activity 5.5

Referring to Bloom's taxonomy, set questions and activities to assess the learner's knowledge, skills, values and attitudes for every observation based lesson identified in SET syllabi in previous activity 5.1.

5.6. Lesson planning for an observation based lesson

Activity 5.6

1. What are elements to be focused on while preparing an observation based lesson?
2. Read the provided sample observation based lesson plan and analyse its components.

Sample lesson plan for observation based lesson

School Name: xx xx

Teacher's name: yy yy

Term	Date	Subject	Class	Unit N°	Lesson N°	Duration	Class size
3 rd	dd/mm/yyyy	SET	P4	8	11of 14	40 min	37
Type of Special Educational Needs to be catered for in this lesson and number of learners in each category				No one			
Unit title	Plants						
Key Unit Competence:	To be able to demonstrate stages of germination and establish the relationship between parts of plants and their function						
Title of the lesson	Conditions necessary for seed germination						
Instructional Objective	Using containers and cowpea seeds, learners should be able to explain the conditions necessary for seed germination and report correctly all processes of seed germination at the end of the project.						
Plan for this Class (location: in / outside)	Out side						
Learning Materials (for all learners)	Containers, cotton wool, some viable and non-viable cowpea seeds and a cupboard.						
References	<ul style="list-style-type: none"> - REB, 2016: Science and Elementary Technology, Pupil's book, Primary 4, P 215. - REB, 2015: SET Syllabus for upper primary. Kigali 						

Timing for each step	Description of teaching and learning activity		Generic competences and cross cutting issues
	<p>Using seeds of maize and beans, transparent plastic pots, water and refrigerator learners practice the project and follow all steps for the planting seeds.</p> <p>Note that some steps of germination can not be observed during the lesson. Learners will be given a homework to plant seeds at their homes and observe all steps. They will have to make a report of their observations.</p>		
	Teacher activities	Learner activities	
Introduction 5 minutes	<p>Ask questions about plants:</p> <ol style="list-style-type: none"> 1. Are plants living things or non-living things? 2. Do plants grow from roots or from seeds? 	<p>Answer asked questions</p> <p>Proposed answers:</p> <ol style="list-style-type: none"> 1. Plants are living things 2. Plants grow from seeds, most plants bear seeds. Seeds germinate and grow into new plants. 	<p>Communication</p> <p>During questions and answers, learners express their ideas in English language.</p> <p>Environment and sustainability</p> <p>Learners in answering the questions talk about the importance of plant in living things and also how to protect plants.</p>
Development of the lesson 30 minutes	<p>Present to learners the activity to be done and how they will proceed by following the steps during the project:</p>	<p>Brainstorm on the activity and ask some questions about the project.</p>	<p>Critical thinking</p> <p>Through sharing ideas on seed germination processes, learners develop the critical thinking.</p>

Experimentation and demonstration

STEP 1: Ask learners to collect four containers, cotton wool, some viable and non-viable cowpea seeds.

STEP 2: Facilitate learners to mark the four containers A, B, C and D as follows:

A with a dry cotton wool.

B, C and D with a moist cotton wool each.

STEP 3: Ask learners to place 3-4 viable (healthy) cowpea seeds at the top of the cotton wool in containers A, B and D and non-viable (unhealthy) seeds in container C.

STEP 4: Facilitate learners to place containers A, B and C in sufficient light and air.

STEP 5: Ask learners to place container D in the cupboard.

STEP 6: Facilitate learners observe containers daily for 3-4 days.

STEP 7: Ask learners to discuss their findings in the class.

Ask questions about what they reported during the observation process:

Practice the whole activities and follow each steps.

Record all data from the observation of the project.

Answer the asked questions.

Proposed answers:

- After carrying out the activity, the learners conclude that oxygen, water and suitable temperature are necessary conditions for viable seeds to germinate.

	- During your observation of all processes of seeds after planting them what conditions needed by the seeds to grow up?		
Conclusion 5 minutes	<p>Summarize together with learners the lesson from all processes of observation project for seed germination.</p> <p>Ask questions about seed germination:</p> <ol style="list-style-type: none"> 1. Explain the conditions for seed germination 2. Write in brief all processes of seed germination 3. What seed germination will help you in your life? 	<p>Summarize the lesson during presentation for all processes of seed germination.</p> <p>Answer the asked questions by the teacher in exercises notebook.</p>	
Teacher self-evaluation	The lesson rendered pupils enthusiastic as they observed the natural phenomenon. The use of real project were interesting.		

Application Activity 5.6:

Using CBC template, make a lesson plan for every observation based lesson identified in SET syllabi in previous activity 5.1

End unit assessment

1. What do you understand by an observation based lesson?
2. Select an observation based lesson in SET syllabus, make the needed teaching and learning resources in TRC and make a lesson plan which develops generic competences and integrate cross-cutting issues.

UNIT 6 : EXPERIMENTAL BASED LESSONS

Key unit competence:

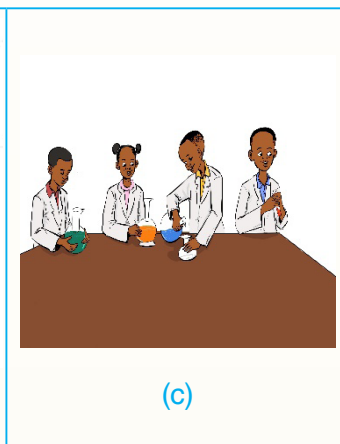
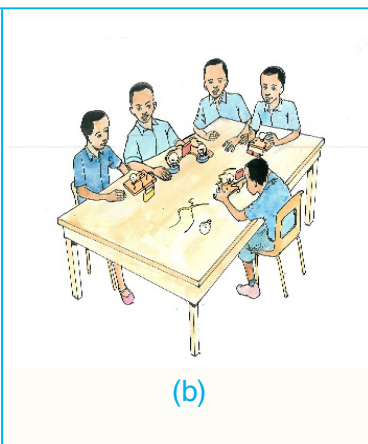
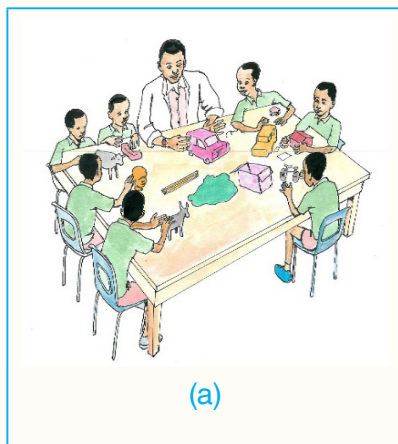
Identify and plan experimental based lessons by developing generic competences and integrating cross-cutting issues through learning activities.

Introductory Activity: Read the following text and answer related questions

A senior four student likes to revise lessons in evening at home. One day during a rainy season there was a problem of electricity and his parents asked him to help solve that problem as he learnt electricity in primary and ordinary level. The student did not manage to change that situation of electricity cut. Suddenly, an electricity technician passes by their home and tells them that the cut in their house is due to a simple problem. The fuses have broken the installation system as the quantity of the current was disturbed during the rain. He steps-up the fuses and the problems was resolved. The student get surprised and said “we have learnt the fuses many times”.

1. Do you think the student knows really fuses? Why?
2. What went wrong while learning the electricity related units?
3. What teaching and learning methods should dominate lessons similar to that of electricity?

6.1. Experimental based lessons for primary



Activity 6.1

1. Analyze the above pictures and find the similarities on them.
2. Is it possible to conduct experiments in all primary schools? Why and how?
3. Predict the steps to go through in an experimental based lesson.

Summary Notes

An experimental based lesson refers to a scientific procedure undertaken to make a discovery, test a hypothesis, or demonstrate known facts. The concepts in SET syllabi which require experiments include light, electricity, states of matter, water cycle, and discovery of the density, simple machine and magnetism.

The following are steps involved in an experiment:

1. Come up with a question to explore.
2. Make a hypothesis or prediction about the results of the experiment.
3. Determine the methods involved in conducting the experiment.
4. Acquire necessary helpers and materials.
5. Test the materials and the experimental design, as needed, before conducting the experiment.
6. Recruit subjects and reserve a venue, if needed.
7. Conduct the experiment.
8. Record findings.
9. Analyze the results/data.
10. Present or report findings.

Note: The first six steps are mainly for the teacher during preparation and the last four steps are mainly for students under guidance of the teacher.

Effective teaching strategies you can use to inspire experiment in your classroom

To inspire students for their engagement in experiment lessons, the teacher may use the following strategies:

1. Visualization

Bring concepts to life with visual and practical learning experiences, helping your students to understand how their schooling applies with **classroom experiments** and **local field trips**.

2. Cooperative learning

Encourage students of mixed abilities to work together by promoting small group or whole class activities. Students will develop their self-confidence, as well as enhance their communication and critical thinking skills which are vital throughout life.

3. Inquiry-based instruction

Ask questions which inspire your students to think for themselves and become more independent learners. Encouraging students to ask questions and investigate their own ideas helps improve their problem-solving skills as well as gain a deeper understanding of concepts.

4. Differentiation

Differentiate your teaching by allocating tasks based on students' abilities, to ensure no one gets left behind. Assign classroom activities according to students' unique learning needs.

5. Technology in the classroom

Incorporating technology into your teaching is a great way to actively engage your students. Learning can become more interactive when technology is used as students can physically engage during lessons as well as instantly research their ideas and develop autonomy.

Application Activity 6.1

1. Read SET syllabi and identify topics that can be taught as experimental based lessons
2. List teaching and learning materials to be used in teaching every experimental based topic identified in the SET syllabi.
3. Select throughout the SET syllabi the experimental based topics which you feel will challenge you in teaching them at primary. Make research on them to enrich your mastery and go in laboratory or use science kit and perform related experiments.

6.2. Techniques and strategies for facilitating experimental based lessons

Activity 6.2

Predict the appropriate techniques to be used while facilitating experimental based lessons

Summary Notes

The experimental based lesson requires prior preparation before its facilitation. The following are techniques and steps during an experimental based lesson:

a. Teacher preparation

Before conducting an experiment, the teacher will do the following:

- Decide how to best incorporate experiments into class content
- Prepare in advance materials needed in the experiment
- Prepare protocol for the experiment
- Perform in advance the experiment to ensure that everything works as expected
- Designate an appropriate amount of time for the experiment - some experiments might be adapted to take more than one class period while others may be adapted to take only a few minutes.
- Match the experiment to the class level, course atmosphere and the personalities and learning styles of your students.

b. Student preparation

Helping the students prepare for the experiment is key to them having a successful learning experience. You might ask your students to do the following before starting the experiment:

- Read instructions that explain the experiment and the student's role
- Complete a pre-class reading and write about their role in the experiment
- Make predictions about the outcome of the experiment

c. Conducting the experiment and collecting data

Working through the logistics of carrying out the experiment can be key to students having a successful experience. It is often helpful to have a teaching assistant present during an experiment to help answer questions and keep things moving. You will want to consider:

- Developing a streamlined process for answering questions and collecting data
- Adapting experiments for very large classes, perhaps using computers

d. Analyzing the data and extending the experience

Once you collect the data, communicating the results to students and linking it to what they are learning in class is very important. Just doing the experiment isn't enough - you need to guide students through the process of interpreting and learning from what happened.

The classroom experiment experience isn't just about that moment in class. It can often be successfully used as a shared experience that anchors material that is covered later in the course. It also can be a catalyst to help students start thinking beyond the course material.

e. Assessing student learning achievement

Standard tests, quizzes and homework assignments can be used to measure what students are learning in class. You might consider adding additional assessment measures, for example ask students

- Test questions about the experiment itself
- Open ended questions that allow students to reflect on their experience and give you an idea of what they did and did not get from the experiment.

Application Activity 6.2

List the teaching techniques specific to facilitating every experimental based topic identified in the SET syllabi in previous activity 6.1.

6.3. Generic competences and integration of cross-cutting issues in an experimental based lesson

Activity 6.3

1. Is it possible to develop generic competences during an experimental based lesson? If possible, how and which ones?
2. How a teacher will integrate crosscutting issues in an experimental based lesson.

Summary Notes

During an experimental based lesson, it is also necessary to consider the generic competences and cross cutting issues as well. This is a good opportunity to help learners develop generic competences and integrate particular crosscutting issues as this kind of lessons may be facilitated in different setting from the classroom.

Application Activity 6.3

Identify specific generic competences to be developed and cross-cutting issues possible to be integrated in every experimental based topic identified in SET syllabi in previous activity 6.1.

6.4. Assessment for an experimental based lesson

Activity 6.4

1. How can you assess a SET experimental based lesson?
2. Select from any SET syllabus an experimental based lesson and set tasks for its assessment

Summary Notes

Assessment of an experiment in SET lesson measures the process skills of students during experimental activities. It is just measuring the skills of observing, classifying, inferring, predicting, measuring, and communicating.

To assess a SET experimental lesson you can ask the following questions:

- How could you have improved the way you did your experiment?
- What improvements would you make to your method if you did it again?
- Did the data you collect give you enough information? Why?
- What could you do to improve the reliability of your data?

Application Activity 6.4

Set questions and activities to assess the learner's knowledge, skills, values and attitudes for every experimental based lesson identified in SET syllabi in previous activity 6.1.

6.5. Lesson planning for an experimental based lesson

Activity 6.5

1. What are elements to be focused on while preparing an experimental based lesson?
2. Using the lesson plan below, read and analyze the way the SET experiments lesson plan components are completed. You will have to make a lesson plan in application activity.



Sample lesson plan for an experimental based lesson

School Name: xx xx

Teacher's name: yy yy

Term	Date	Subject	Class	Unit N°	Lesson N°	Duration	Class size
2nd	dd/mm/yyyy	SET	P5	8	8 of 16	40 min	38
Type of special educational needs to be catered for in this lesson and number of learners in each category				Learners with low vision (1)			
Unit title		Water					
Key Unit Competence:		To be able to purify water for drinking and explain dangers of polluted water					
Title of the lesson		Water purification methods: Boiling and filtration					
Instructional Objective		Using charts, water from river or dam, small containers student should be able to correctly practice the methods of purification in 10 minutes.					
Plan for this Class (location: in / outside)		In classroom and outside					
Learning Materials (for all learners)		Charts, plan/pot with a lid, sieve/white piece of cloth, source of heat, water, small containers					
References		<ul style="list-style-type: none">- REB, 2017: Science and Elementary Technology, Pupil's book, Primary 6, P102.- REB, 2015: SET Syllabus for upper primary. Kigali					

Timing for each step	Description of teaching and learning activity		Generic competences and cross cutting issues
	Teacher activities	Learner activities	
	Student observe the materials like large plastic, coarse sand, beaker, charcoal, paper filter and start manipulate them.		
Introduction 5 minutes	<p>Ask learners questions about the previous lesson of pollutants of water, dangers and their prevention</p> <ol style="list-style-type: none"> 1. Identify any two dangers of water pollution 2. Identify three ways of preventing water pollution 	<p>Answer to the questions asked Proposed answers:</p> <p>Q1.</p> <ul style="list-style-type: none"> - Water pollution causes diseases to human beings (Diarrheal disease) - Water pollution causes diseases to animals (water born diseases for animals) - Water pollution causes diseases to plants - Water pollution causes diseases to soil. <p>Q2.</p> <ul style="list-style-type: none"> - Practicing proper hygiene (use of toilets, latrines and urinals). - Avoiding bathing, watering animals and washing clothes in water sources. - Practicing farming methods that reduce soil erosion like contour and terrace farming. 	<p>Communication</p> <p>During answering questions students will use English language.</p> <p>Peace and values education</p> <p>As learners answer questions, the fellow will respect others opinions</p>

<p>Development of the lesson 25 minutes</p> <p>Preparation</p>	<p>Facilitate learners in group formation and distribute materials will use</p> <p>Ask learners to discuss on the images from the charts</p>  <p>A</p>  <p>B</p>	<p>Form groups and manipulate materials given by the teacher</p> <p>Answer for what they observe on the chart.</p>	<p>Cooperation and interpersonal management life skills</p> <p>As learners engage in group discussions and manipulation.</p> <p>Critical thinking</p> <p>During manipulation of materials, learners will think deeply about how it could work.</p>
<p>Conducting the experiment and collecting data</p>	<p>Ask questions on what they observed on the pictures above (A, B).</p> <p>Invite pupils to perform the experiment of purifying water</p> <p>Give instructions for doing experiment</p>	<p>Proposed answers:</p> <p>On figure</p> <p>A: Boiling water</p> <p>B: Dirty water is poured through a filter sieve</p> <p>Do experiment of purifying water</p> <p>Follow the instructions given by the teacher</p>	<p>Critical thinking</p> <p>This competence is developed during analysis of the pictures</p>

Analyzing the data and extending the experience

Instructions:

- Hold a sieve over a clean pan or pot
- Pour water from a jerry can over the sieve or piece of cloth into a clean pan or pot to filter it. Cover the pan or pot with a lid.
- Light a fire to get heat. Place the pan with filtered water over the heat.
- When the water has boiled, remove it from the source of heat. Let the water cool.
- Filter the water and put it in a proper container.

Share ideas into respective group work

Practice the experiments and collect all data on the papers.

Ask learners different methods of water purification
Ask questions on what they were practicing.

According to your practices and your observation on pictures, establish the methods of water purification

Proposed answers about their practices

Methods of water purification learnt:
Boiling water
Filtration of water

<p>Conclusion</p> <p>Assessing student achievement of learning goals</p> <p>10 minutes</p>	<p>Summarize together with learners the experiment done.</p> <p>Ask questions on the experiments:</p> <ol style="list-style-type: none"> 1. Do chemical treated water and boiled water taste the same? 2. Which water would you prefer to drink? Give the reasons for choice of your answer. 3. Do people in your village purify their drinking water using chemicals or do they boil it? 4. Why do you think they use the method you have talked about in (3) above? 	<p>Summarize the lesson and share what it will help them in life.</p> <p>Answer the questions asked in their exercises notebook.</p>	
<p>Teacher self-evaluation</p>	<p>The lesson was well taught, students have tried 95% of the correct answers.</p>		

Application Activity 6.5

1. Select an experimental based lesson in SET syllabus and prepare its lesson plan using CBC template
2. Perform the suggested experiments in your experimental based lesson plan.

End unit assessment

3. What do you understand by an experimental based lesson?
4. What are steps of an experimental based lesson?
5. As a teacher, how will you deal with the scarcity of teaching and learning materials in schools for conducting all experiments proposed by the syllabi?
6. Select an experimental based lesson in SET syllabus, make the needed teaching and learning resources in TRC and make a lesson plan which develops generic competences and integrate cross-cutting issues.

PART 2:
TMP FOR SET-ICT COMPONENT

UNIT 7 : ABIWORD

Key unit competence:

Create documents using Abiword program.

Introductory Activity

Using your XO laptop, write using abiWord a letter to your friend telling him/her how you have passed the O'level exam.

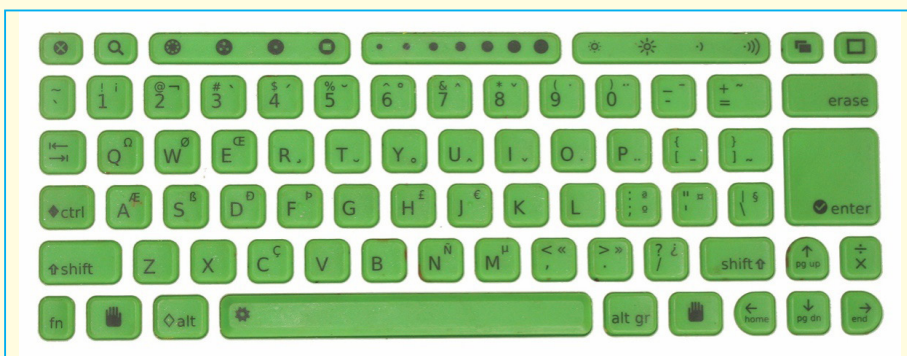
Summary Notes

Abiword or Word Processing is a computer software which helps computer users to write text using an XO laptop. For using this programs and other programs, the user will have to use the keyboard for entering text and the touchpad for moving the cursor.

7.1. XO keyboard and touchpad

Activity 7.1

Observe the picture below and discuss the different keyboard keys and their roles.



Summary Notes

7.1.1 Keyboard



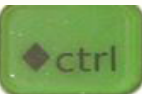
A computer keyboard is one of the main input devices which helps computer users to enter text in a computer. It has different keys/buttons and each one of them has a different role to play. Some of those keys are shown in the figure below:

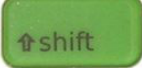





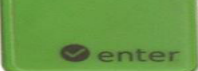








Image 7. 1. Keyboard keys

The different keys on the keyboard have different roles to play: some are for entering text while others have special roles. The table below lists special keys and their functions.

a) Table summarizing the special key names and their functions

#	Key name	Key function in computing
1	 Escape key	The escape key is labeled with an x symbol on a black circle. The escape key is most commonly used in combination with the control key to quit activities (ctrl + esc).
2	 Tab key	The tab key is labeled with arrows pointing right and left and creates an indentation in a paragraph. Also, use it in combination with the control, shift and alt keys to display open Activities. For example, alt + tab displays running Activities one after another.
3	 Control key	The control key is used in combination with other keys to issue commands. For example, ctrl + c copies to the clipboard; ctrl + v pastes from the clipboard.

4	 <p>Shift key</p>	The shift key is used in combination with other keys as a modifier, most commonly to shift between lowercase and uppercase in Latin-based alphabets.
5	 <p>Fn key</p>	The function key is used in combination with other keys as a modifier. For example, fn + erase is delete; fn + up arrow is page up.
6	 <p>Alt key</p>	The alt key is used in combination with other keys to issue commands. For example, alt + enter toggles full-screen mode; alt + spacebar toggles the tray visibility. This example works in the Browse Activity but not in the Record Activity.
7	 <p>Space bar</p>	The spacebar key types a space. In the future, when used in conjunction with the function key (fn), it will display the source code for the currently running Activity.
8	 <p>Alt Gr key</p>	The alt graphics key is used in combination with other keys as a modifier, most commonly to select an alternative letter or generate an accented character.
9	 <p>Arrow keys</p>	The arrow keys are used for navigation; combined with the function key (fn), they are used for page up, page down, home, and end.
10	 <p>Enter key</p>	The enter key in addition to its standard use is used in combination with modifier keys. For example, alt + enter toggles full-screen mode.
11	 <p>Erase key</p>	The erase key deletes the character behind the cursor (backspace). fn + erase deletes the character in front of (or on) the cursor.
12	 <p>Frame key</p>	The Frame key toggles the presence of the Frame on the screen. The Frame is the black border around the screen that holds the Activity taskbar, clipboard, wireless connections, battery level, and so on.

13	 Volume controls	The volume keys lower and raise the audio level.
14	 Brightness controls	The brightness keys lower and raise the brightness of the screen backlight. To turn the backlight off completely may take 7 to 8 button presses.
15	 View keys	The four view keys, from left to right, take you to the Neighborhood view, the Group view, the Home view, and the Activity view.
16	 Search key	The search key takes you directly to the Journal and places the text cursor in the search box

b) Keyboard shortcuts

On an XO laptop keyboard, you can combine more than one key instead of moving the pointer for some actions. The table below again shows a combination of keys to get described result:

#	Key combination	Description
1	ctrl + c (shift + ctrl + c in Terminal)	Copy the selection
2	ctrl + v (shift + ctrl + v in Terminal)	Paste the selection
3	ctrl + x (shift + ctrl + x in Terminal)	Cut the selection
4	ctrl + u while using the Browse Activity	Launch the Write Activity and view the source code for the current web page
5	alt + esc	Quit an Activity
6	alt + tab	Cycle forward through running Activities
7	shift + alt + tab	Cycle backward through running Activities
8	alt + enter	Toggle full-screen mode
9	alt + spacebar	Toggle tray visibility. This command may not work in all applications.
10	alt + 1	Save a snapshot of the current screen into the Journal
11	ctrl + alt + erase	Restart Sugar, the graphical interface for the XO
12	fn + 1	Neighborhood View
13	fn + 2	Group View

14	fn + 3	Home View
15	fn + 4	Activity View
16	shift + alt + r	Rotate the display
17	esc + Frame icon key + Right Arrow + fn (the four corners keys on the keyboard)	Reset the touchpad if the pointer behaves strangely when you use the touchpad
18	fn + spacebar	View source code system wide. This command may not work in all applications.
19	fn + up arrow	Page Up
20	fn + down arrow	Page Down
21	fn + left arrow	Home
22	fn + right arrow	End
23	ctrl + brightness down	Backlight off – black &white mode
24	ctrl + brightness up	Full brightness - color mode
25	ctrl + volume down	Mute
26	ctrl + volume up	Full volume

7.1.2 Touchpad

A touchpad also called a glide pad, glide point, pressure sensitive tablet, or trackpad, is an input device on laptops. It allows the user to move a cursor with their finger. It can be used as an external mouse.

A touchpad is operated by using your finger and dragging it across the flat surface of the touchpad. As you move your finger on the surface, the mouse cursor moves in that same direction. Like most computer mice, the touchpad also has two buttons below the touch surface that allows you to left-click or right-click



Image 7. 2. An XO laptop touchpad

7.1.3. Xo laptop display

This is an output unit which outputs to the user the result of the computer's internal operations. The main parts of an Xo laptop display are: Microphone light, built-in microphone, left built-in speaker, Game pad, Screen rotate button, camera light, Built-in camera, Right built-in speaker, Game buttons, Power button+lights.

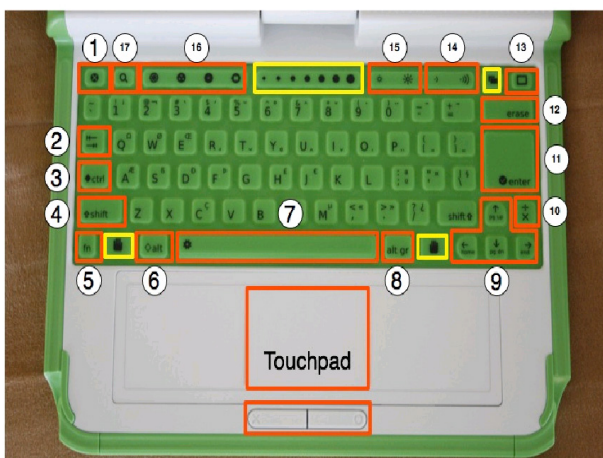


Image 7. 3. Xo display parts

Application Activity 7.1

Observe the picture below and identify the different keyboard keys and their roles.

The Keyboard and Touchpad



7.2 Sugar and Gnome interface

Activity 7.2

Kalisa is a student in p4 he is working on typing turtle activity. He remembers that his teacher gave him a homework of describing his favorite food using Abiword in Gnome interface. How will he shift from Sugar interface to Gnome interface?

Summary Notes

7.2.1. Sugar interface

The Sugar Interface is one of the two interfaces of an XO laptop which is a learning platform that reinvents how computers are used for education. The sugar interface has different options which are presented as icons or activities such as Turtle art, Browser, Scratch, etc

Children can write documents, share books and pictures or make music together with ease. In sugar interface, everything is saved automatically in **Journal**. To access the data, a user will need to open the **Journal Activity**.

7.2.1.1. Home View

The Home View has several modes. Each mode has a different arrangement of Activities:

- Your favorite Activities in a ring (Ring mode)
- Your installed Activities in a list (List view)
- Your favorite Activities arranged freeform (Freeform mode)

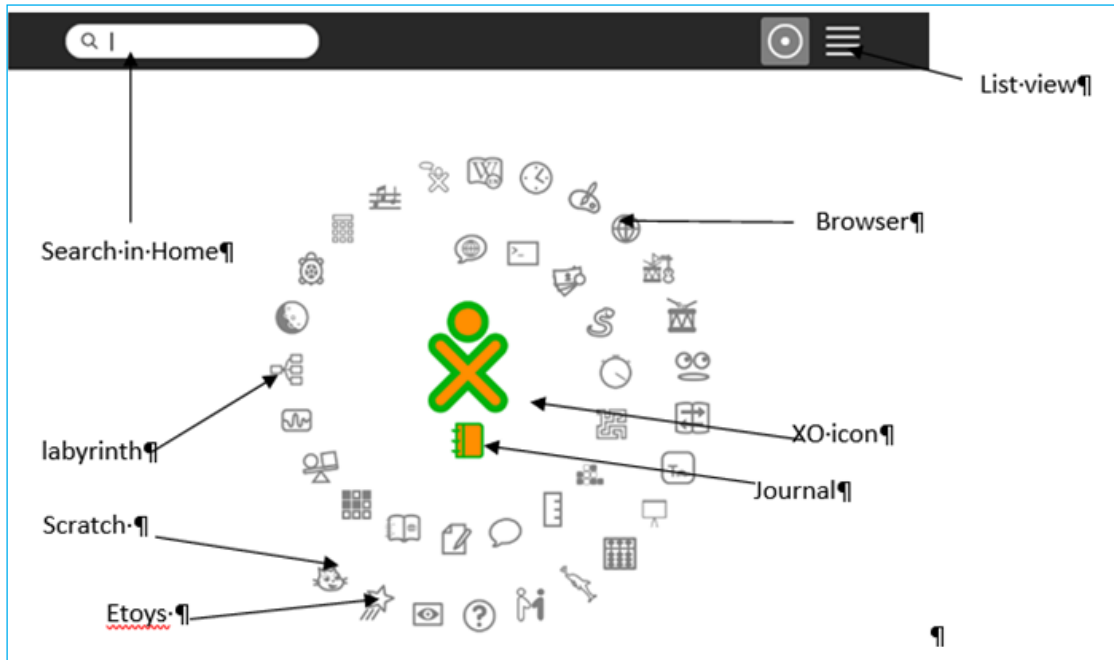


Image 7. 4. The Sugar interface main window

a) The journal activity

To open the Journal Activity in which all the Sugar work is saved click the Journal icon on the Frame as shown below:

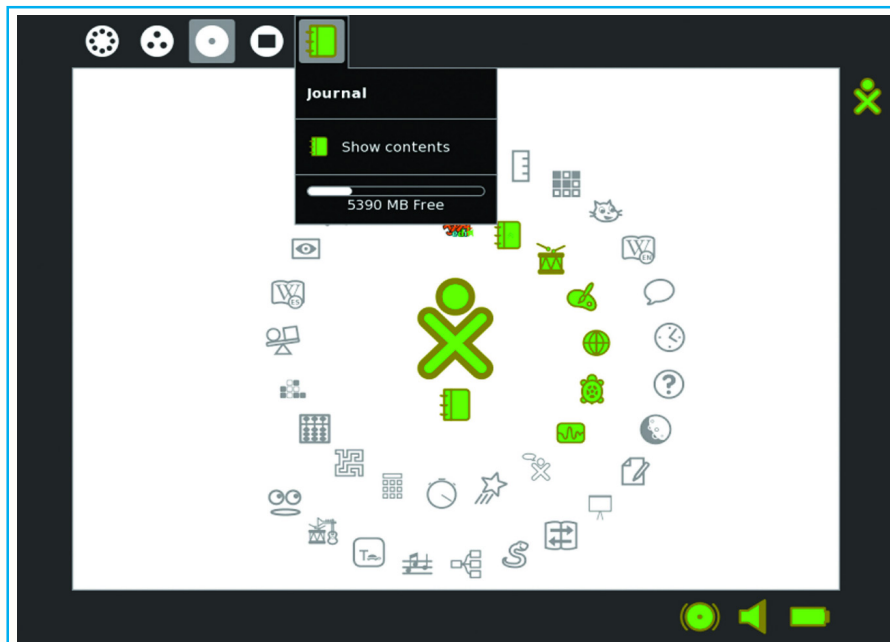


Image 7. 5. Sugar interface with all the options

After being clicked on, you will have the Journal opened. The Journal window looks like this:

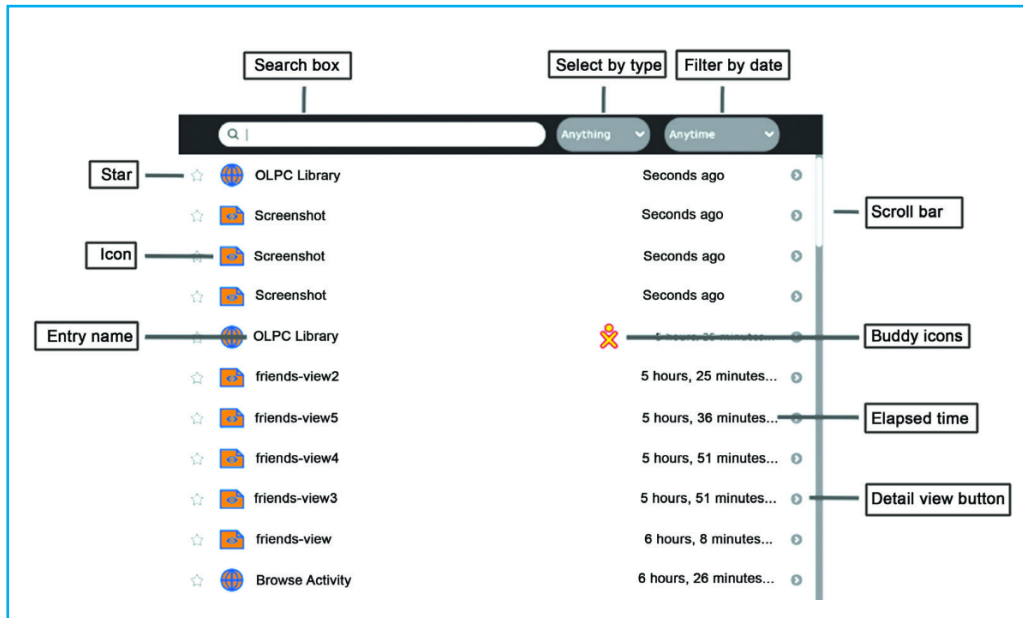


Image 7. 6. The Journal window

Note: It is a good practice to delete some unwanted content of the Journal so as to liberate space and make the XO laptop not so slow.

7.2.2. Gnome interface

Gnome is a desktop environment and graphical user interface that runs on top of a computer operating system. It provides the graphical user interface and the desktop environment. This interface is simple, usable and make things “just work”.

To enter in Gnome user interface go to:

Click on **my settings**,

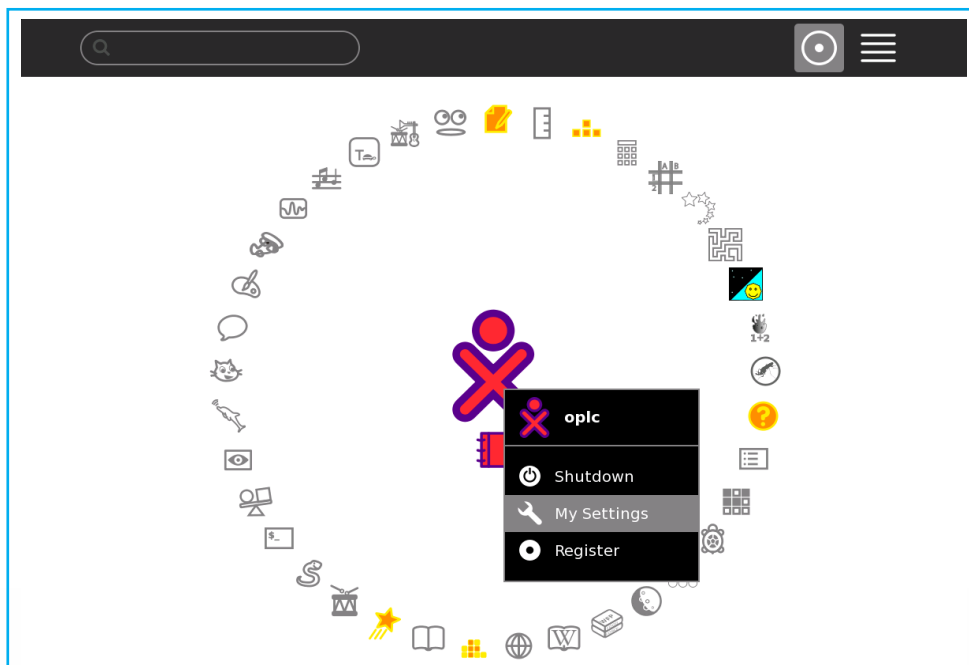


Image 7. 7. The My Settings option on Sugar interface

Click on **Switch Desktop**:

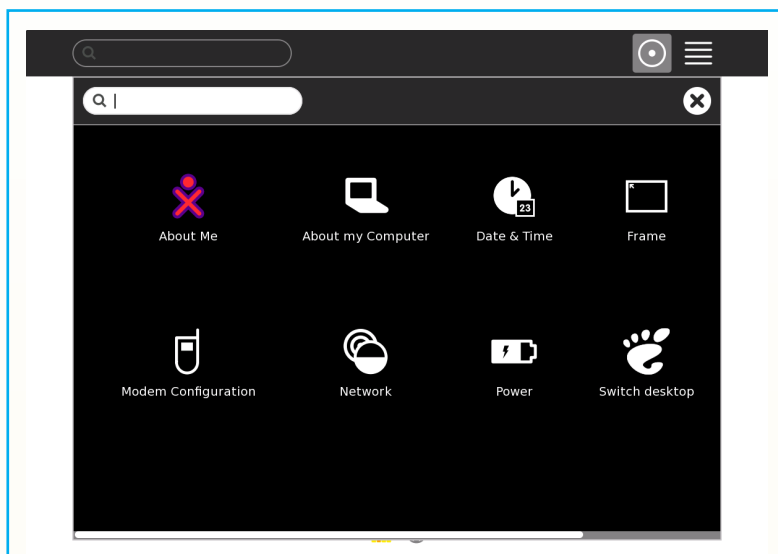


Image 7. 8. My Settings main panel

Click on **switch to GNOME**

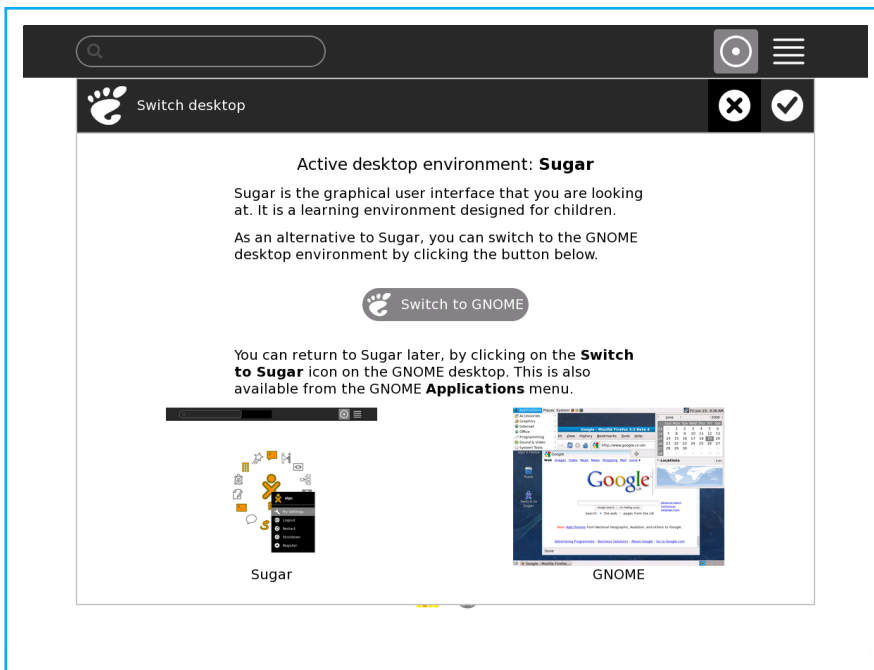


Image 7. 9. Switch Desktop window

Then click on **Restart now**

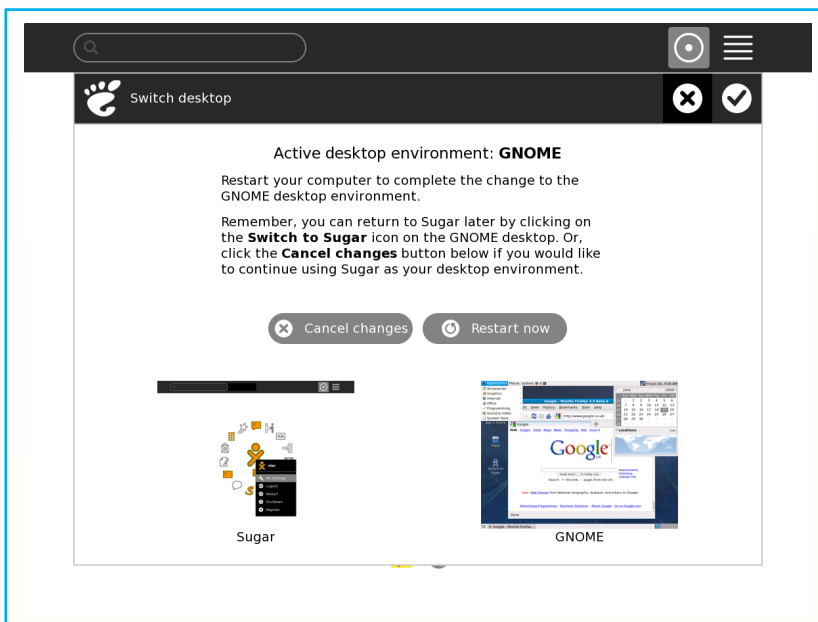


Image 7. 10. Switch Desktop window- Restart option

The Gnome interface looks like the window below:

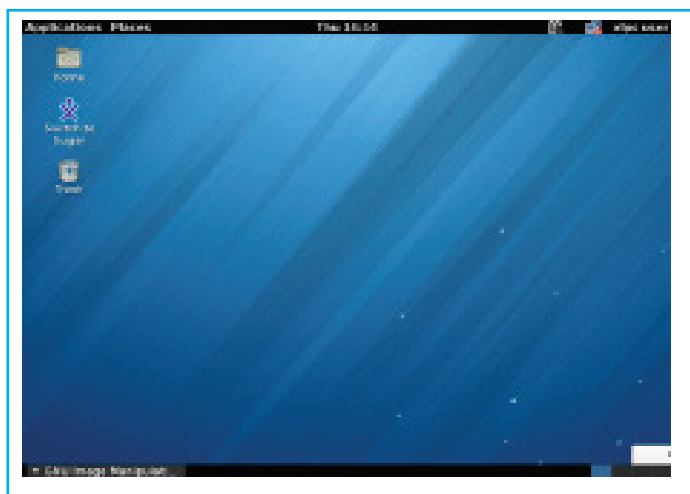


Image 7. 11. The Gnome main window

7.2.3. Switching from Gnome to Sugar

When you want to shift from Gnome interface to Sugar interface, you will click on **Applications**, then **System Tools** then go to **Switch to Sugar** the choose ok on the **Switch Desktop** window

Application Activity 7.2

- 1) Give the steps to switch from Gnome to Sugar interface
- 2) Using your XO laptop switch from Gnome to Sugar interface
- 3) Give and explain the different activities available on the Sugar interface

7.3. Desktop and Folder management

Activity 7.3

1. Identify different options which are found the **My settings** of an XO laptop
2. Yonna is an SET teacher at GS Muke and he has an XO laptop. He teaches in P4, P5 and P6 different subjects. In his laptop ,he has so many files such as lists of his students, marking guides, exams, quizzes and his personal documents. Advise him on how he can create files and folders to keep his computer in good state and to make documents easier to find.

Summary Notes

7.3.1. Desktop

The XO laptop has a number of categories of options that are found on its desktop and their roles are to give a brief detail of what is in this laptop. The main panel of the XO laptop has ten categories of options as show in the window below:

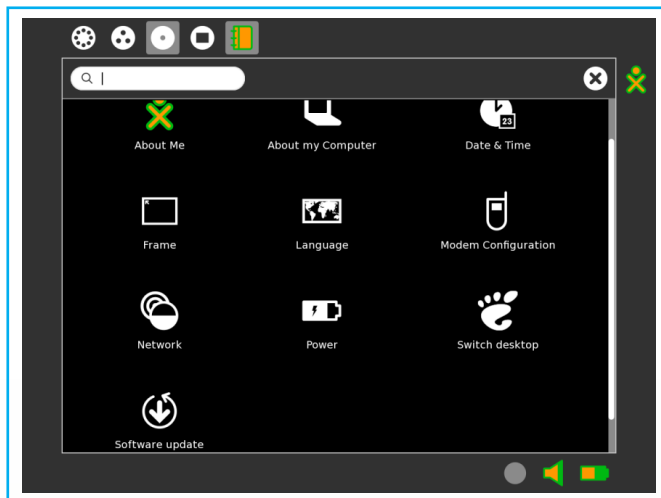


Image 7. 12. The main panel of an XO laptop after clicking on My Setting

1. About me

The about me option allows the user to change the computer username, the color of XO icon, As it is clear in the window below the username is TWAGIRAMUNGU Jean Louis

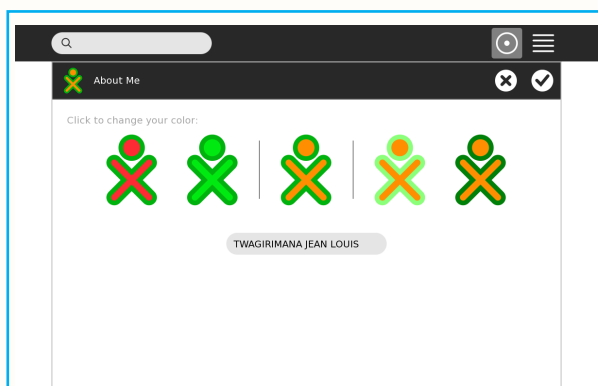


Image 7.13. The About Me window with TWAGIRAMUNGU Jean Louis as a username

The username and password can be changed. In the window below the username has been changed to IRAGENA GILBERT. After changing the username, you must restart the computer to apply the changes.

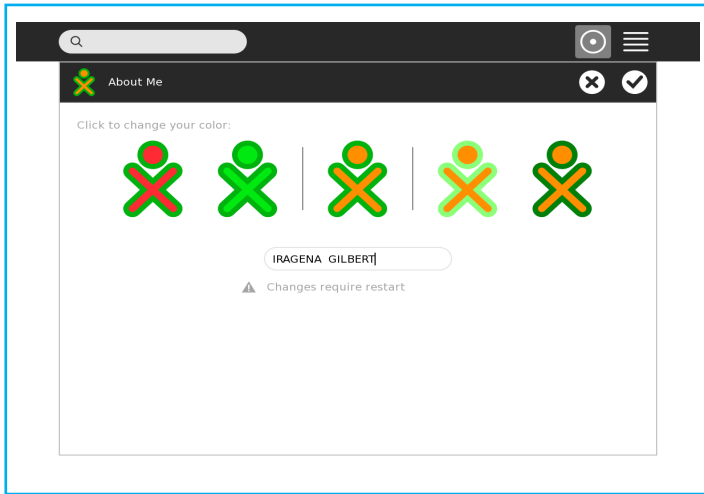


Image 7. 14. Window used to change the username to IRAGENA GILBERT

2. About my computer

The **About my Computer** option will display the identity, software and the licensing information about the XO laptop the user is using as show in the window below:

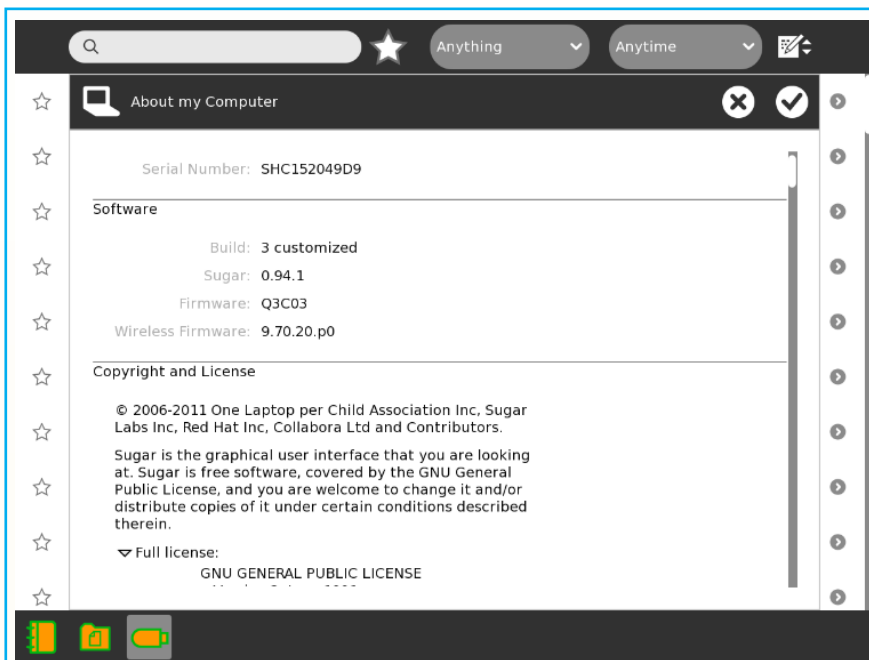


Image 7.15. About My Computer interface

3. Date and Time

You can set the time zone in many ways on an XO laptop by clicking on the Date and Time option found on the desktop main panel.

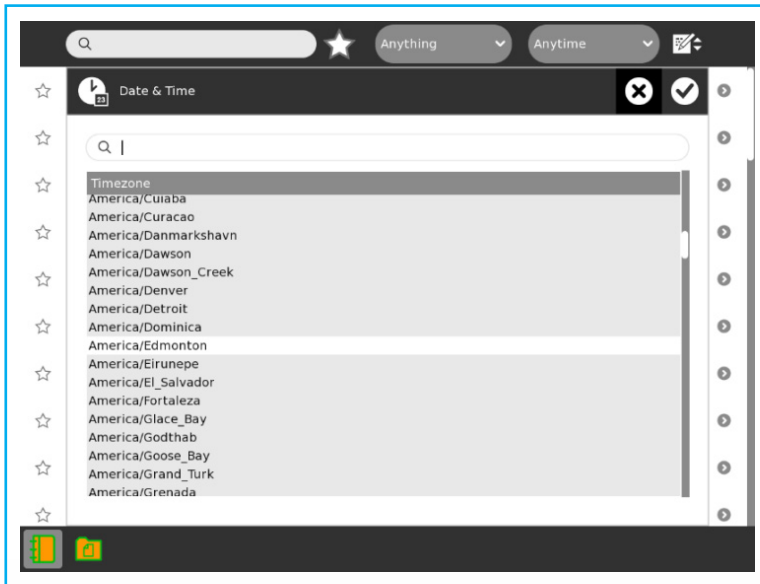


Image 7. 16. The Date & Time window

4. Change language

You can easily change the computer language by using the **Change language** option as it is shown in the window below which is reached by choosing it from the Desktop main panel.

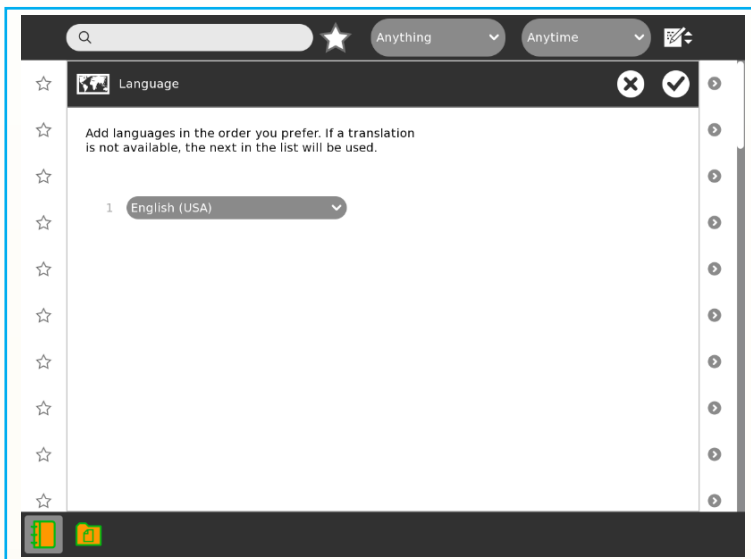


Image 7. 17. The change Language window

7.3.2. Folder management

A computer has a hard drive which serves as its secondary memory. Once it does not have folders, its files should be in a big list and it should be very difficult to find a particular file. Folder management is one of the Gnome options.

a. creating a file/folder

First you will need to right click in an empty area where you want your folder to appear. To create a folder a user will need to login into Gnome interface then right click in any empty place then choose create new folder.

b. Copying and pasting a folder

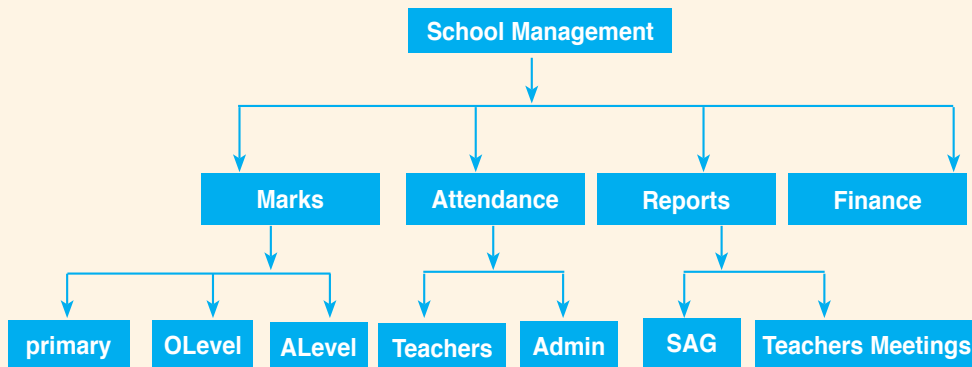
To copy a file, a user will need to right click on file then choose copy after he/she goes where to paste and does right click and choose paste.

c. Deleting a folder

To delete a folder/file, a user will right click and choose delete or press erase from the keyboard.

Application Activity 7.3

Create a folder named School Management and inside that folder create many others as shown on this diagram:



7.4. Work with AbiWord document

Activity 7.4

A teacher in primary school has a class with 40 pupils. The headteacher wants a list of those pupils which is written using a computer preferably an XO laptop. The teacher is used to desktop computer.

1. As a teacher to be are you able to do this ?
2. Write a list of your classmates using abiword installed in your XO laptop

Summary Notes

7.4.1. Abiword environment

Abiword is an application which supports both basic word processing features such as list, indents and character formats, and more sophisticated features including tables, styles, page headers and footers, footnotes, templates, multiple views, page columns, spellchecking, and grammar checking.

To open Abiword program

1. go to applications. A drop down menu like the one shown below appears
2. Place the cursor on office, then click on it.
3. Select Abiword then click on it. A window like the one below

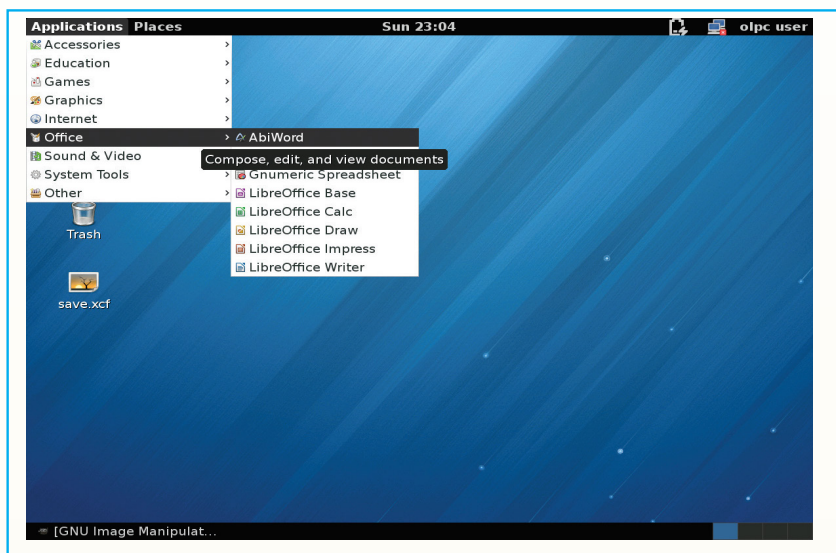


Image 7. 18. Window to start Abiword

The window of Abiword below will appear (but with no labels)

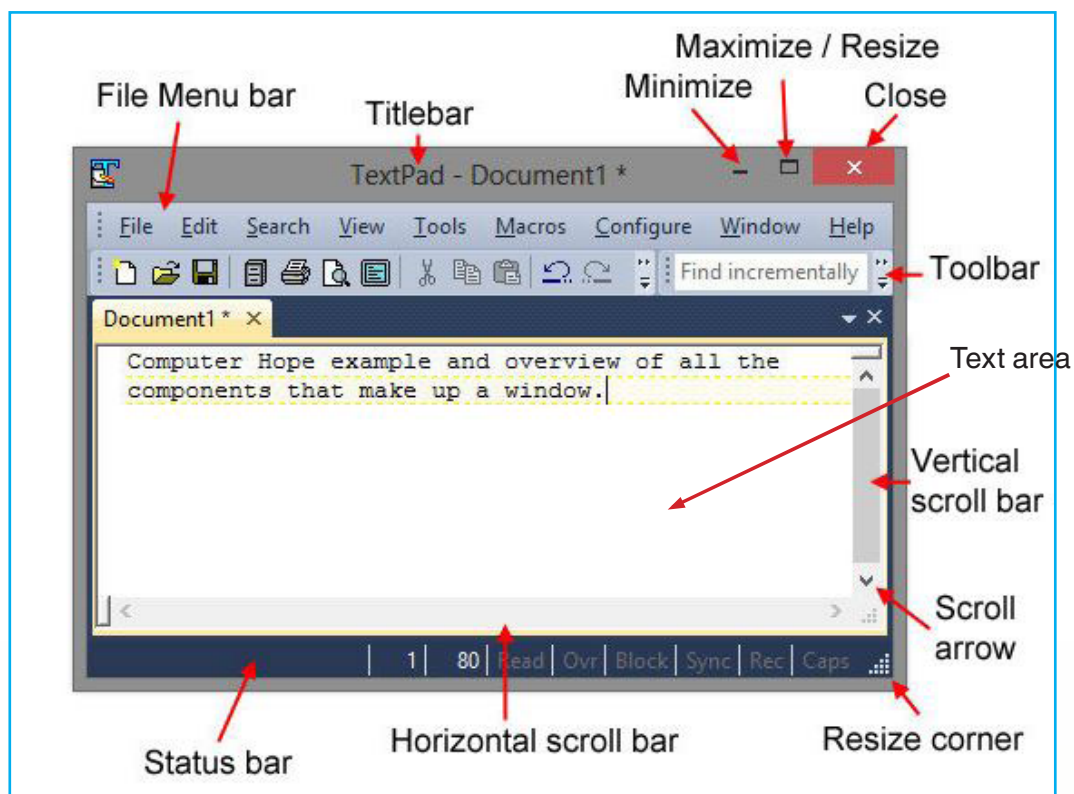


Image 7. 19. Elements of AbiWord window

The elements of Abiword window are identified as follow:

a. Title Bar: It is located at the top of the window as a horizontal bar. The title bar is typically used to display the name of the application, or the name of the open document, and may provide title bar buttons for minimizing, maximizing, closing or rolling up of application windows.

b. Menu Bar: This is where you will find access to all of the functions in AbiWord. Each function, when clicked on, will produce a drop-down menu with more features.

c. Tool Bar: This toolbar provides quick access to: creating a new file, saving and printing, along with cut, copy and paste functions.

d. Vertical Scroll Bar: A vertical or horizontal scrollbar commonly located on the far right or bottom of a window that allows you to move the window viewing area up, down, left, or right. Most people today are familiar with scroll bars because of the need to scroll up and down in almost every web page.

e. Text area: This is where a computer user puts his/her text.

f. Task Bar and Status Bar: A taskbar is an element of a graphical user interface which has various purposes. It typically shows which computer programs are currently running. A status bar is a graphical control element area typically found at the window's bottom.

7.4.2. Opening, saving and renaming an Abiword document

a. Opening a document

Step 1: Click the **File** menu and select '**Open**' option. An open dialogue box will appear which lets you move through different file folders and also lets you select a file, which you want to open.

Step 2: Finally locate and select the file which you want to open and click on open. In the above screen the file to be opened is named 'exercise.doc'.

When you want to open an existing document go to File Tab, select Open option, locate your file and click on Open button.

b. Saving a document

Step 1: Click the **File** menu and select '**Save As**' option.

Step 2: Select where you would like to save your file (can be documents, desktop or any other earlier created folder on the desktop).

Enter **file name** which you want to give (for example, **my test**) and Select '**Save file as**' type file. By default, it is AbiWord. **Abw**.

Step 3: Finally, click on save button and your document will be **saved** with the entered name in the selected folder.

c. Renaming a document

Step 1: Locate the folder where the document is (this may be in my documents, desktop or any other folder you created earlier).

Step 2: Right-click on the document, a drop down menu will appear.

Step 3: Click on rename, and write the name you want. Then after, press the '**Enter key**'

Application Activity 7.4

1. After opening a new Abiword document, show its different elements.
2. Write an Abiword document in which you are going to write this text: “Investment in ICTs is essential in taking any country to the next level of productivity and efficiency. Investing in ICTs is not at the expense of other sectors, investing in ICTs results in benefits for every sector and the earlier you start the better.” Said His Excellency the President Paul Kagame.
 - a) Save the paragraph in quotation marks as Important Quotations file in the folder called ICT
 - b) Rename the file *Important Quotations* and give it your name

7.5 Text formatting

7.5.1. Changing the font

Activity 7.5

1. Open a new Abiword file in the normal template. What is the default font for the normal template?

2. Type the following text “Nowadays the role of Information and Communication Technology (ICT), especially internet in the education sector plays an important role, especially in the process of empowering the technology into the educational activities.

Education sector can be the most effective sector to anticipate and eliminate the negative impact of ICT. Technology (internet) in another side can be the most effective way to increase the student’s knowledge.”

3. Change the default font for that paragraph to Nimbus Sans L bold.

Summary Notes

The presentation view of AbiWord, which permits easy display of presentations created on screen sized pages, is another feature not often found in word processors. AbiWord is a free word processing program similar to Microsoft Word. It is suitable for a wide variety of word processing tasks.

a) Bold, italic, underlined fonts

To make text bold, underlined or italic you can use one of the two options:

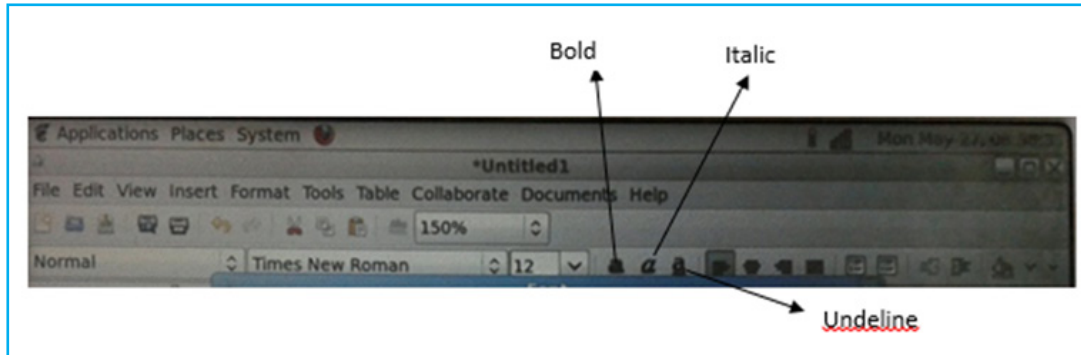


Image 7.20. Toolbar with Bold, Italic & underline options

Option one: selecting the text and choosing bold, italic and underlined that have their icons on the format toolbar.

Option two: Use the format menu

Make the text bold by using any of the two possible ways:

- Go to the Format menu and then click on “Bold” or
- Click on the “Bold” icon of the Format toolbar or
- Use the keyboard shortcut by pressing the “Ctrl” and “B” keys at the same time.

Make the text italic by using any of the three possible ways:

- Go to the Format menu and then click on “Italic” or
- Click on the “Italic” icon of the Format toolbar or
- Use the keyboard shortcut by pressing the “Ctrl” and “I” keys at the same time.

Make the text underlined by using any of the three possible ways:

- Go to the Format menu and then click on “Underline” or
- Click on the “Underline” icon of the Format toolbar or
- Use the keyboard shortcut by pressing the “Ctrl” and “U” keys at the same time.

b) Changing the font type

There exist different font types which help a user define the kind of characters he/she wants. To change the **Font** type go to **Format** menu then choose **Font** then choose among the available fonts.

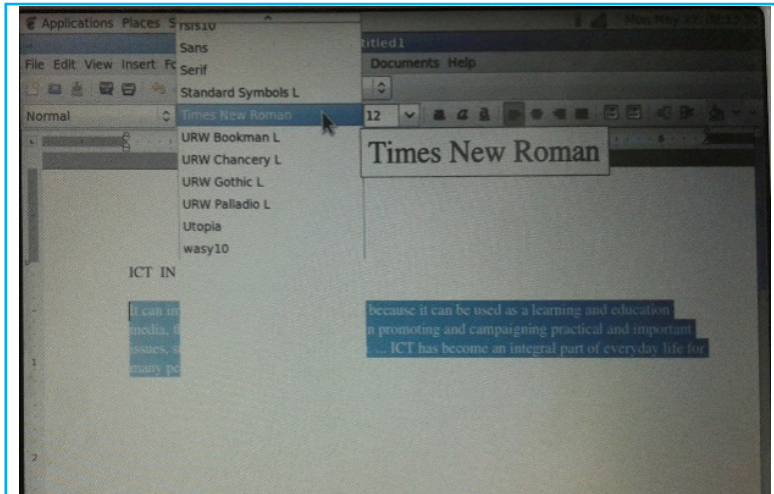


Image 7. 21. Window to change the font type

c) Change the font size

The font size defines the size of characters. For this you will first select the text for which you want to change the font size then go **Format** menu then choose **Font** then choose size.

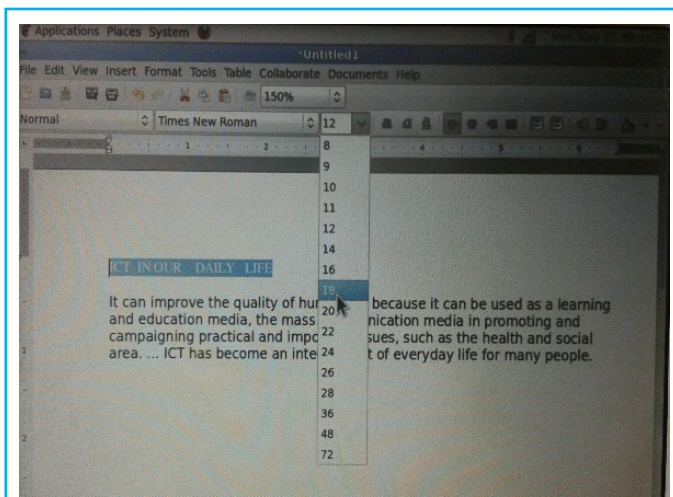


Image 7. 22. Window to change the font size

d) Change the font color

Characters can have different colors; they can be red, yellow, green, etc. To change the color of the font go **Format** menu then choose either **Text Color** or **HighLight Color**

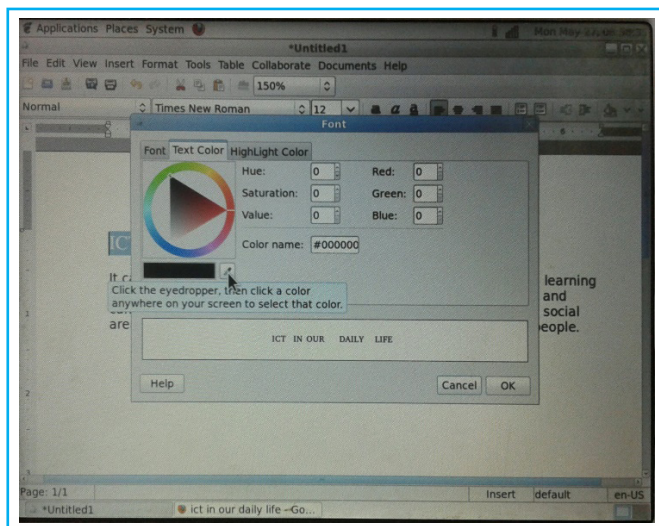


Image 7. 23. Window through which to choose font colors

Application Activity 7.5

In your XO laptop, write a short text talking about how you are good at using XO laptop and format it using different text formatting styles you have seen in this activity.

7.6. Inserting header & footer, end note & footnote

Activity 7.6

At the end of his secondary TTC education, a certain student teacher wants to apply for a teaching job. He has to submit a curriculum vitae of three pages with each page having at its end the name of the applicant and at its beginning the word "Curriculum Vitae"

1. Write such a curriculum vitae
2. What do you think is the importance of having that name at the end of each page?

Summary Notes

We can make our document look more readable by utilizing the header & footer and endnotes & footnote sections. The **header** is a section of the document that appears in the **top margin**, while the **footer** is a section of the document that appears in the **bottom margin**. Headers and footers generally contain information such as the page number, date, and document name and any other information that user may wish to add that he/she thinks is important.

a. Header and footer

You can display page numbers and other information on every page of your document by creating headers and footers regions at the top and bottom of a page that can be created and formatted independently. To create header and footer:

- Go to insert menu
- Click on header or footer the box will appear on the top or bottom of page
- Type the text you want to put in header or footer

b. Footnote and endnote

To insert a footnote or endnote:

- Select the Insert menu,
- Click either the Header or Footer, footnote or endnote command,
- From the drop-down menu, select Blank to insert a blank header or footer, or choose one of the built-in options.
- The Design tab will appear on the Ribbon, and the header or footer will appear in the document.

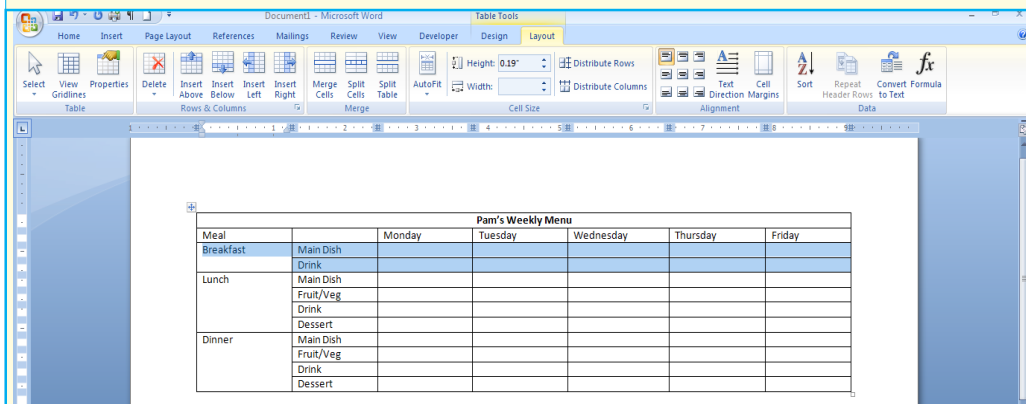
Application Activity 7.6

You want to apply for a technical writing position with a Marketing Consulting Firm in Rwanda. Write a letter to your Principal asking for recommendation letter for your diligent effort and hard work in your class. Use your full names as the header of your letter.

7.7. Working with tables

Activity 7.7

Here is a table with 7 columns and 12 rows.



- Using Abiword create a table like it.
- Replace the name Pam with your school's name and fill in the empty cells appropriate meals for your school.

Summary Notes

Abiword has a sophisticated table creation tools. You can create tables of any size, embed tables in one another, and merge cells to create headings. It is easiest to create tables in AbiWord if the Table toolbar is visible. It can be turned on from the View menu.

A. Create a Table

The left-most button of the Table toolbar inserts a new table. When you click it, you are presented with a grid, with some of the cells highlighted. The inserted table will be the same size as the highlighted grid. Alternatively, you can go to the Table menu and open the Insert Table dialog.

To insert a table:

- Go to insert menu
- Click on table insert table dialog box will appear
- Choose the number of column and row then click **ok**.

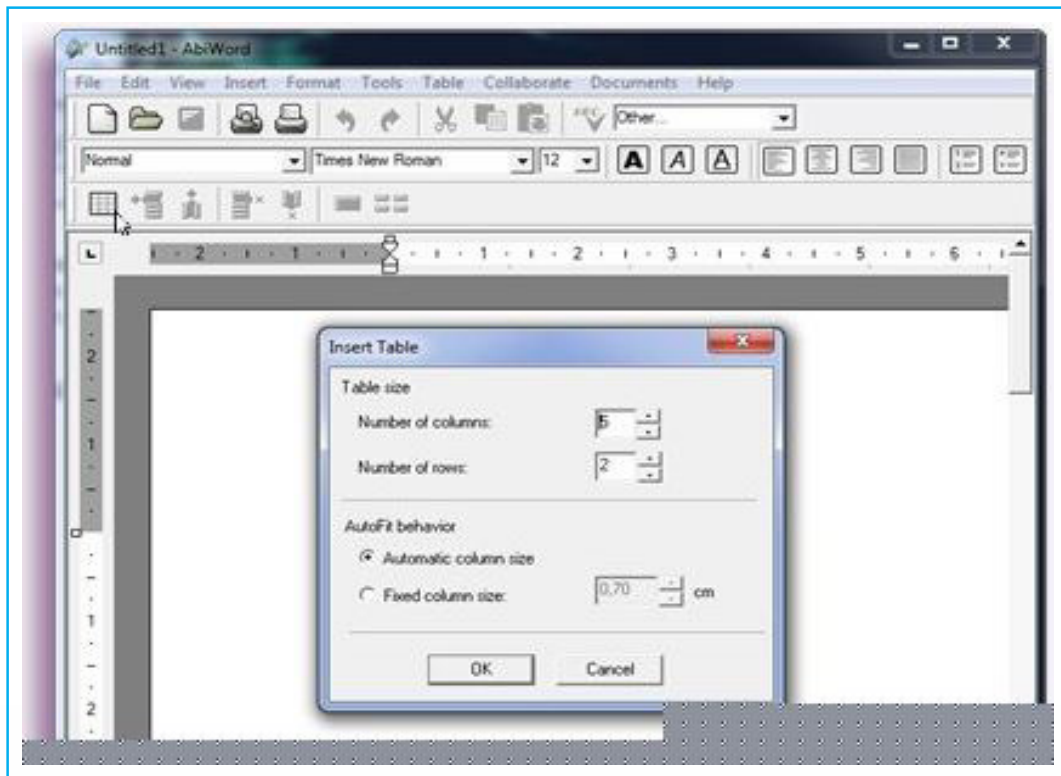


Image 7. 24. Create table window

Once you have already created a table, you can move between the cells using the arrow keys on your keyboard. As you type in a cell, the text is wrapped to fit in the cell, and the height of the row is automatically adjusted. To finish editing a table, use the arrow keys to move out of it.

B. Merging cells

To merge cell:

- Select the Insert menu
- Select the cells in your table you want to merge
- Put the cursor in selected cells then right click
- Go to table the dropdown menu will appear then click merge cell
- Select merge Right, merge above, merge left
- Click on close button

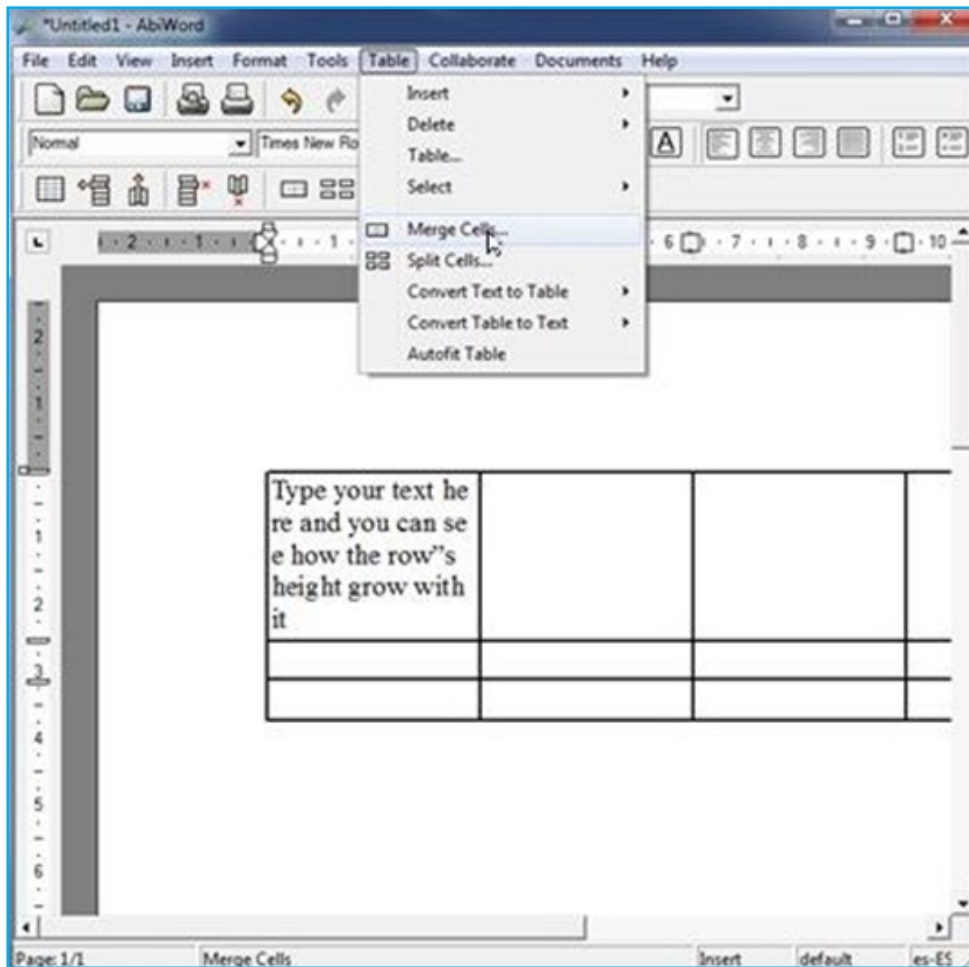


Image 7. 25. Window for merging cells

C. Deleting cells

To delete cell/ column or row/ table

- Select table menu
- Click on delete
- Click on delete table/ column/ row

Application Activity 7.7

The table below shows the Districts of Rwanda and their Provinces. Draw it by respecting the fonts where possible

SN	DISTRICT	PROVINCE
1	Bugesera	EASTERN PROVINCE
2	Rwamagana	
3	Kayonza	
4	Kirehe	
5	Ngoma	
6	Gatsibo	
7	Nyagatare	
8	Kicukiro	KIGALI CITY
9	Gasabo	
10	Nyarugenge	
11	Rulindo	NORTHERN PROVINCE
12	Gakenke	
13	Musanze	
14	Burera	
15	Gicumbi	
16	Kamonyi	SOUTHERN PROVINCE
17	Muhanga	
18	Ruhango	
19	Nyanza	
20	Huye	
21	Gisagara	
22	Nyaruguru	
23	Nyamagabe	
24	Nyamasheke	
25	Rusizi	WESTERN PROVINCE
26	Rutsiro	
27	Ngororero	
28	Karongi	
28	Rubavu	
30	Nyabihu	

End unit assessment

You work for a school as a School Head Teacher and you need to write a follow-up letter to your Direct Supervisor telling him /her how one of your employees is behaving. Using your XO laptop, create that letter in different styles, with as many font styles as possible.

UNIT 8 : GNUMERIC SPREADSHEET

Key unit competence:

Create Gnumeric Spreadsheet and perform different mathematical calculations.

Introductory Activity:

Yvonne is a shopkeeper in your region. In her shop, she has so many things ordered and she needs to calculate how much she will spend for each product and finally the grand total. Do you think that the Abiword application she has learnt in XO laptop will help her to quickly find the answer? If no which other application do you think can help her and why?

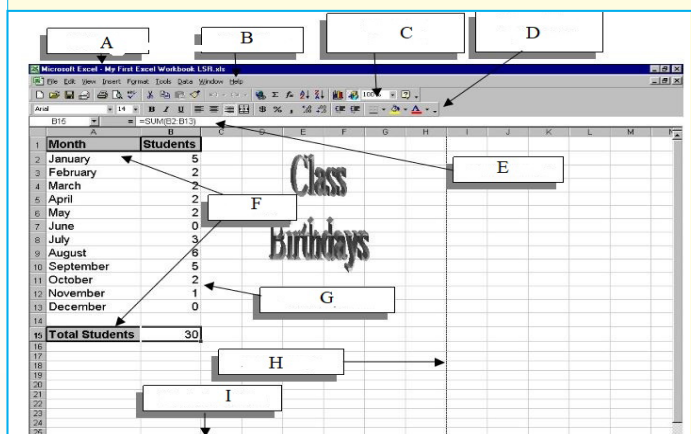
Summary Notes

Gnumeric is a spreadsheet, a computer program used to manipulate and analyze numeric data. It can help you to keep track of information in lists, organize numeric values in columns and rows, perform and update complex calculations.

8.1. Work with Gnumeric spreadsheet environment

Activity 8.1

Identify different features of Gnumeric spreadsheet environment



8.1.1. Starting Gnumeric

Before starting Numeric you have first to be in the Gnome interface and for this you have switch from Sugar to Gnome. After switching to Gnome go to **'Applications'** icon on the top right corner like in the screen below:

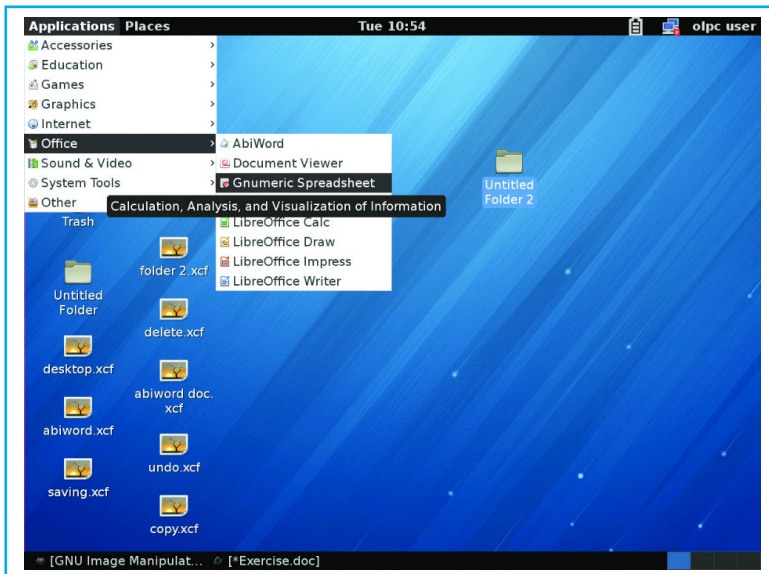


Image 8. 1. Window for accessing applications including Gnumeric Spreadsheet

After choosing Gnumeric Spreadsheet this program will get opened like in the window below:

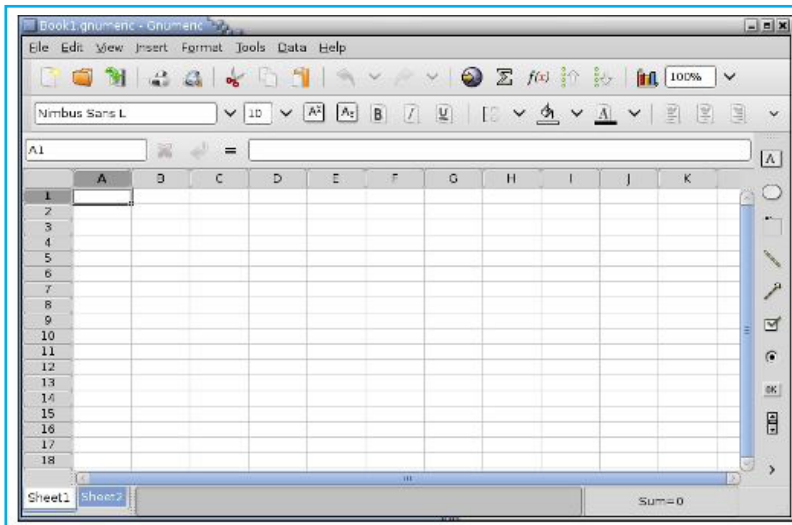


Image 8. 2. Gnumeric window

8.1.2. Gnumeric environment components

Gnumeric spreadsheet has different parts which help a user in carrying out different options provided by this program. Those options are presented as menu, submenu or tabs. The window below with labels shows different components of Gnumeric Spreadsheet environment.

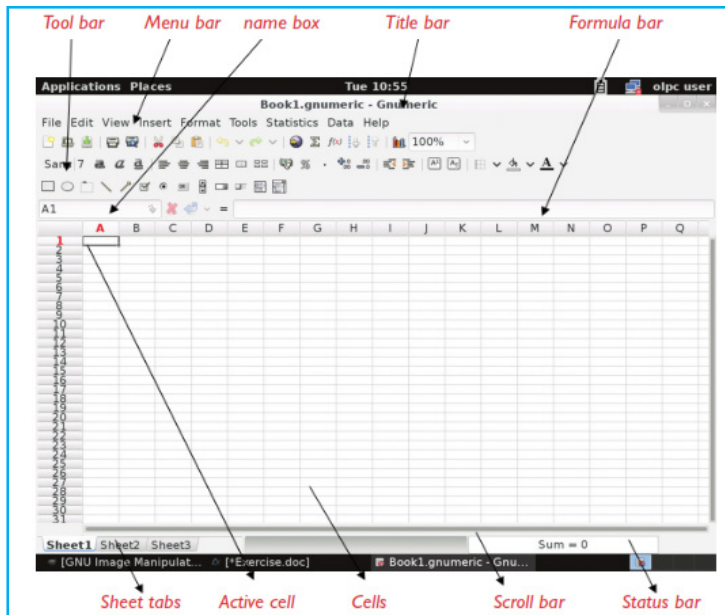


Image 8. 3. Different components of a Gnumeric window

A. Menu bar

This is a horizontal menu that appears on top of a window. Usually, each option in a menu bar is associated with a pull-down menu

1. File Menu

This menu which is the most used allows the user to create files containing all the work they have done to print the results of their work and to close Gnumeric.

2. Edit Menu

The Edit menu is mostly used for operations on a worksheet or between worksheets. This menu gives users powerful editing operations such as the ability to undo recent changes, the ability to cut and paste selections of cells and the ability to search for specific cell contents.

3. View Menu

View menu has menu items which allow the user to open multiple views of the same document such as **New View**, **Freeze Panes**, **Windows** which are Alternative views of the current document.

4. Insert Menu

Insert menu allow user to insert column, rows, images, functions, sheet, chart in worksheet

5. Format Menu

The Format menu allows users to control the formats of cells, columns, rows, worksheets and the workbook. This menu also gives users access to templates of standard formats.

6. Tools Menu

The tools menu contains different “tools” that an XO laptop user chooses from in order to put some craft in it

7. Statistics Menu

The **Statistics** menu and its submenus contain all available statistical analysis tools

8. Data Menu

Data menu is used to validate, filter, import and export data

9. Help menu

Help menu is very simple and it connects users to this manual, to the list of functions available for use in Gnumeric and to the list of people who created this wonderful application.

B. Title bar

The title bar which is located at the top of the screen displays the name of the workbook that is being used. The title bar when the opened workbook name is **Book1.gnumeric – Gnumeric** should look like the image below:

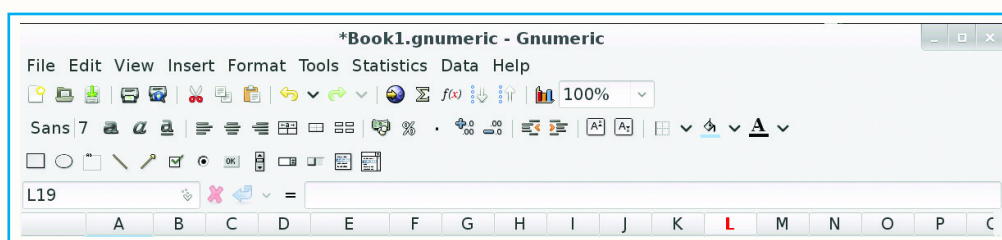


Image 8. 4. Title bar window

C. Name Box

The Name Box is located next to the formula bar above the worksheet area to the left of the formula bar. The name box displays a reference to a cell that is currently active.

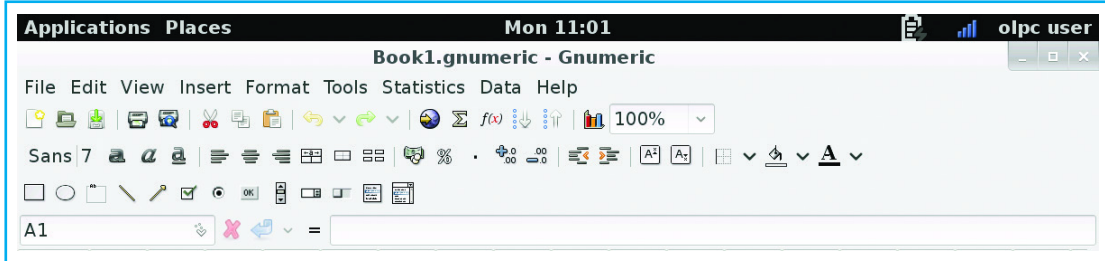


Image 8. 5. Name box

D. Tool bar

The Toolbars, which are represented as icons, are shortcuts to main commands.

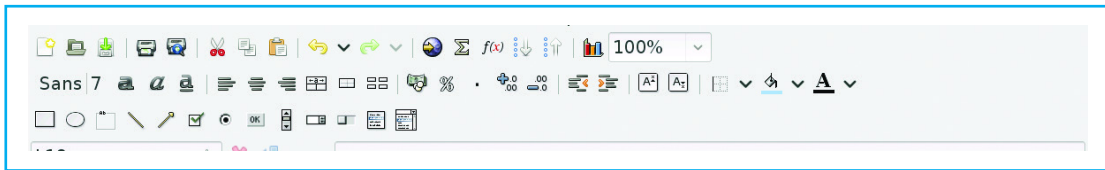


Image 8. 6. Toolbar window with different tools

E. Formula bar

The formula bar displays the formula that has been applied in a cell if there is one and if no formula was applied it displays nothing. Through the formula bar one can also write a new formula to apply on cells.

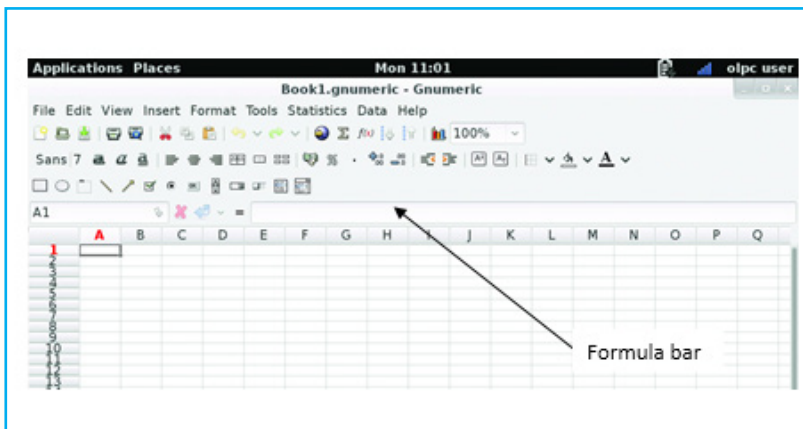


Image 8. 7. Gnumeric spreadsheet with a formula bar

F. Scroll bar

The scroll bar allows the moving in the workbook either horizontally or vertically

G. Status bar

A horizontal bar, usually at the bottom of the screen or window, showing information about a document being edited or a program running

8.1.3. Opening, saving worksheets and renaming a workbook

A. Opening a worksheet

- Click on **File**.
- Go to **Open** option on the drop down menu.
- In the **Look in list**, click the drive, or folder that contains the file you want to open.
- In the folder list, open the folder that contains the file. Once the file is displayed, click the file you want to open.
- Click the **Open** button.

B. Saving a workbook

To save a workbook so as to have access to it in the future any time needed follow these steps:

- From the Gnumeric spreadsheet window opened in Choose 'File'.
- Go to 'save as' option on the drop down menu. The 'Save As' dialog box appears Put file name here
- Select where to save your file, write the file name and click on save.

Every workbook created in Excel must be saved and assigned a name to distinguish it from other workbooks. The first time you save a workbook, spreadsheet will prompt you to assign a name through the 'Save As' option. Once the name is assigned any additional changes made to the text, numbers, or formulas must be saved using the 'Save' option.

C. Renaming a worksheet

To give a worksheet a name, do the following:

- Right-click on the sheet tab of Sheet1.
- Choose **Rename**.
- Rename it as you want

By default, the worksheets are named **Sheet1**, **Sheet2** and **Sheet3**.

Application Activity 8.1

Write the table below in Gnumeric spreadsheet

SN	Item	Quantity	Amount per item
1	Milk	10 litres	3500
2	Juice	1 litre	4500
3	Tomatoes	10kg	3000
4	Potatoes	20kg	4000
5	Fruits	5kg	5000
6	Cabbage	3	600
7	Onions	2kg	800

8.2. Formatting a table and cells

Activity 8.2

1) Reproduce the following table in Gnumeric and format a table as it is shown.

School enrollment 2019-2020				
Student ID	Last name	First Name	Age	Program
001	Iragena	Gaspard	35	Business
002	Kabera	Gad	17	Arts
003	Uwimana	Julienne	45	Computer Science
004	Ndayisenga	Jean Bosco	19	Agriculture
005	Tuyisenge	Emmanuel	39	Education

Summary Notes

To format a table in Gnumeric it very simple just make a simple selection of the cells that you want to appear in your table and then you go to borders and choose all borders. You will see that all your cells are bordered in form of a table.

8.2.2. Formatting a cell and its content

Cell formats allow you to only change the way cell data appears in the spreadsheet. It is important to keep in mind that it only alters the way the data is presented, and does not change the value of the data.

To change the formatting of a cell or a selection, you can either use the Format Cells dialog which holds all of the formatting options or use specific formatting elements available as buttons on the Format Toolbar.

This dialog shown below gives you access to all formatting options.

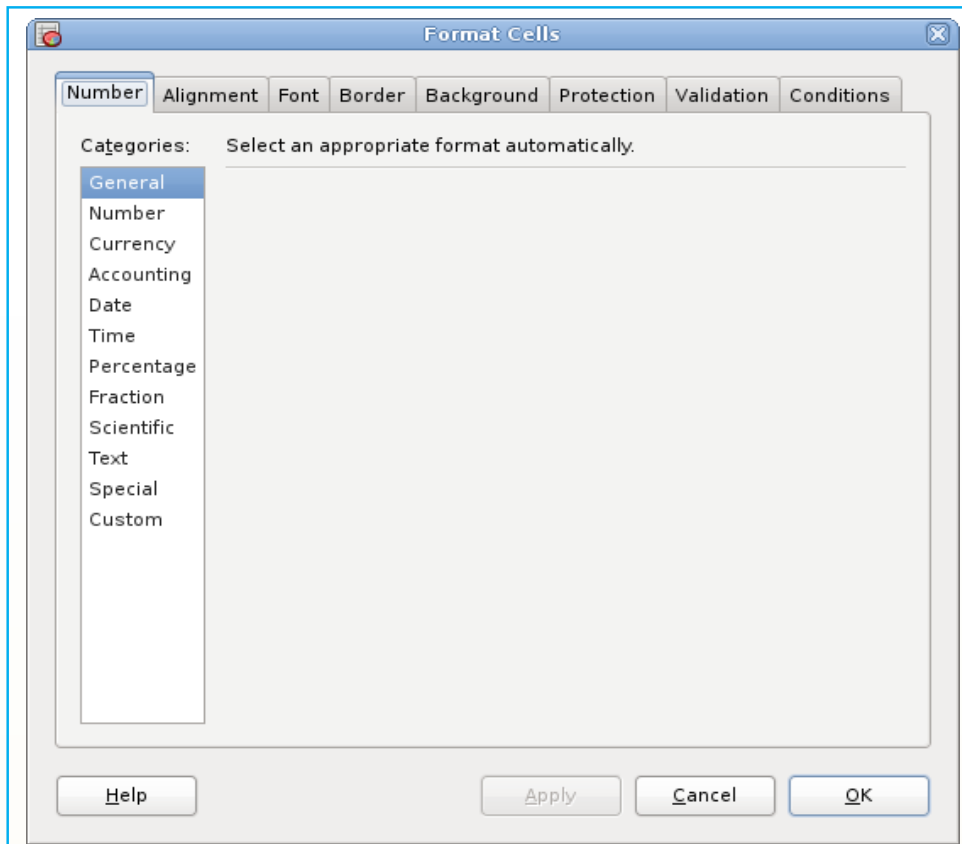


Image 8. 8. Format Cells window

To launch this dialog, select the cell or range of cells you want to format (see Section 5.6 – Selecting Cells and Cell Ranges for details on selecting cells) and then use one of the following methods:

- Use keyboard shortcut **Ctrl+1** (this is number one, not letter l).
- Choose **Format ► Cells...** in the menubar.
- Click with the right mouse button on the cell grid area and choose **Format Cells...** from the context menu.

The Format Cells dialog contains tabs **Number, Alignment, Font, Border, Background, Protection,** and **Validation.**

To set one of the formatting options:

- Select the corresponding tab,
- Choose the options you need, and click **OK.**

This will apply the options you selected (in all tabs) and close **Format Cells** dialog. You can also click on **Apply** to apply the and keep the dialog open, or on **Close** to close the dialog without applying changes.

a. To change the font

By default, the font of each new workbook is set to **Sans**. However, Gnumeric spreadsheet provides many other fonts you can use to customize your cell text.

To change font type or font size, follow these steps:

- Select the **cell(s)** you want to modify.
- Click on Format-Cells-Format-choose font tab then choose font name you want.

When creating a workbook in the workplace, you'll want to select a font that is easy to read.

b. To change the font size:

By default, when you open Gnumeric, the font size is 10. In order to change this size, are the following:

- Select the **cell(s)** you want to modify.
- Click on Format-Cells-Format-choose font tab then choose font size you want.

c. To change the font color:

The steps to change the fonts color are the following:

- Select the **cell(s)** you want to modify.
- Click on Format-Cells-Format-choose font tab then choose color you want

d. To align text

By default, any text entered into your worksheet will be aligned to the bottom-left of a cell, while any numbers will be aligned to the bottom-right. Changing the

alignment of your cell content allows you to choose how the content is displayed in any cell, which can make your cell content easier to read.

- Select the **cell(s)** you want to modify.
- Click on **Format-Cells-Format-choose alignment** tab then choose the type of alignment you want

Application Activity 8.2

1. Reproduce the following table in Gnumeric and save your work.

Income and Expenses Projection						
Year	1999	2000	2001	2002	2003	2004
Sales	10,000	12,000	15,600	18,720	20,592	22,651
% Growth over the previous year		20%	30%	20%	10%	10%
Materials	1,700	2,040	2,652	3,182	3,501	3,851
Wages	1,400	1,680	2,184	2,621	2,883	3,171
Other benefits	210	252	328	393	432	476
Others	100	108	117	126	136	147
Total Cost of Goods Sold	3,410	4,080	5,280	6,322	6,952	7,644

2. Change the font color of all the text to red and align it in the middle. Change also the font color of all the numbers to green.

8.3. Insert Mathematical Functions

Activity 8.3

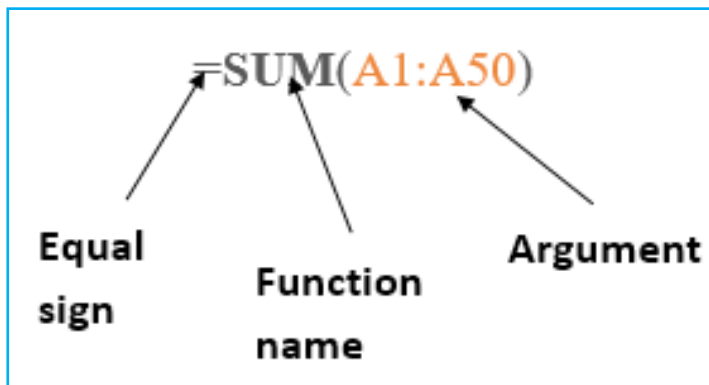
Scenario: A teacher at GS Ubumwe is required by his head teacher to submit the marks for his three classes each having 40 pupils by the end of the day and order them by their total marks. This teacher has three subjects in each class. For each subject, pupils have done at least four quizzes. The marks are entered in his notebooks and totals are not yet calculated. The teacher was advised before to use a computer but claimed that no computer is available yet XO laptops are available. Advise this teacher on how an XO laptop can help him so that he can meet the head teacher's deadline.

Summary Notes

A function is a predefined formula that performs calculations using specific values in a particular order. All spreadsheet programs include common functions that can be used for quickly finding the sum, average, count, maximum value, and minimum value for a range of cells.

8.3.1 The parts of a function

In order to work correctly, a function must be written a specific way, which is called the **syntax**. The basic syntax for a function is an equals sign (=), the function name (SUM, for example), and one or more arguments. Arguments contain the information you want to calculate. The function in the example below would add the values of the cell range A1:A20.



8.3.2 Using functions

There is a variety of functions. Here are some of the most common functions:

SUM: This function adds all the values of the cells in the argument.

AVERAGE: This function determines the average of the values included in the argument. It calculates the sum of the cells and then divides that value by the number of cells in the argument.

COUNT: This function counts the number of cells with numerical data in the argument. This function is useful for quickly counting items in a cell range.

MAX: This function determines the highest cell value included in the argument.

MIN: This function determines the lowest cell value included in the argument.

Cell referencing is a system that identifies data and gives it an address so that data can be located in a spreadsheet. A cell reference is used in spreadsheets to identify individual cells and is a combination of the column letter and row number where it is located.

A row is a series of data banks laid out horizontally in a table or spreadsheet. For example, in the picture below, the **row headers (row numbers)** are numbered 1, 2, 3, 4, 5, etc. Row 16 is highlighted in red and cell D8 (on row 8) is the selected cell.

A **column** is a vertical series of cells in a chart, table, or spreadsheet. Below is an example of a Microsoft Excel spreadsheet with **column headers (column letter)** A, B, C, D, E, F, G, and H. As you can see in the image, the last column H is the highlighted column in red and the selected cell D8 is in the D column

Most of the standard math, business, statistical, and scientific calculations are implemented in terms of functions.

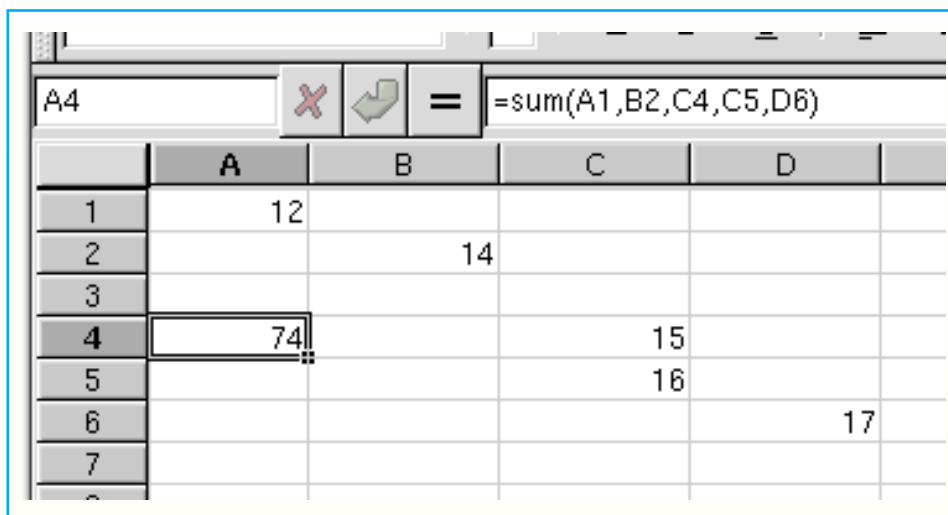
Example a. Basic Function syntax

=FUNCTION (ARGUMENTS)

While the documentation generally refers to functions and to cells in capital letters, their use is not actually case sensitive.

Example b. an example of function syntax

=AVERAGE (A1:A16)



The image shows a screenshot of an Excel spreadsheet. At the top, a formula bar displays the formula `=sum(A1,B2,C4,C5,D6)`. Below the formula bar is a grid of cells. The columns are labeled A, B, C, and D. The rows are numbered 1 through 7. The data in the grid is as follows:

	A	B	C	D
1	12			
2		14		
3				
4	74		15	
5			16	
6				17
7				

Image 8. 9. Insert formula window

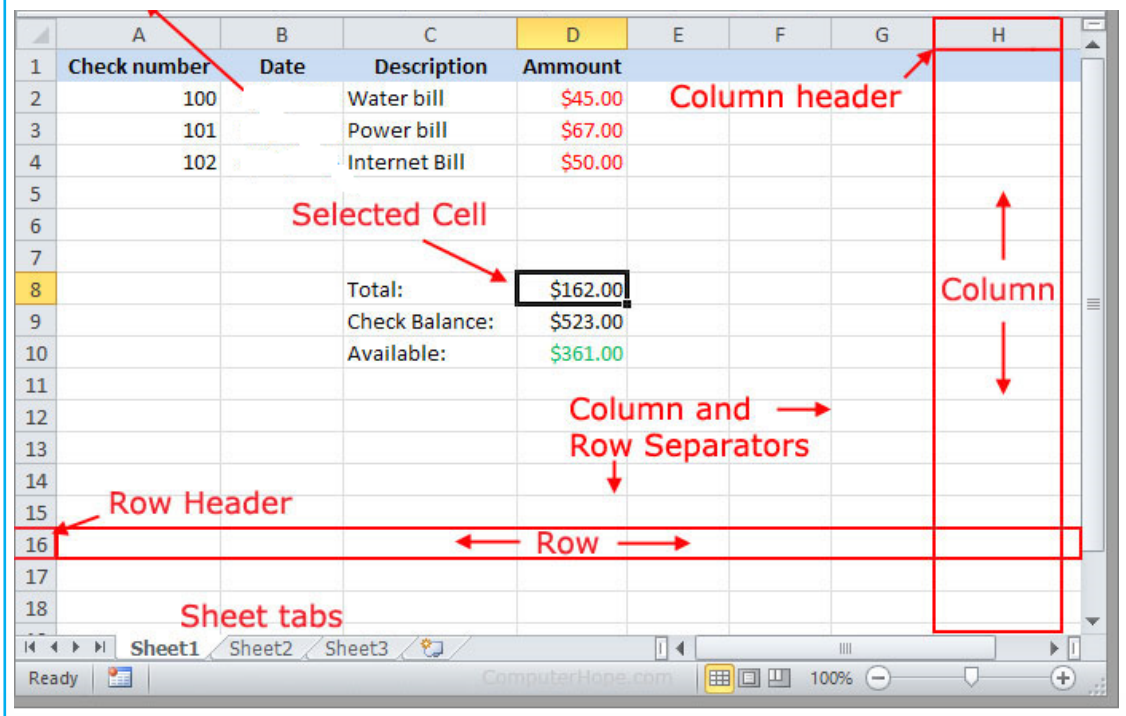


Image 8. 10.Gnumeric with its different parts

Automatically modifies the argument names to match; that is, you would have =sum(B1;B2) for column B.

While the text cursor is marking the spot in the cell where you need to insert an argument, you can simply click the required cell. Gnumeric draws a black and white frame around the cell and waits for more input.

You can then type a semicolon and click more cells to add more arguments. As an alternative, click the f(x) button to insert a function. This tells Gnumeric to pop up a window with a list of available functions.

The program lists the functions by field of application on the left: database, scientific, financial, statistics, and so on.

Application Activity 8.3

The data below represents day sales of a certain wholesale shop.

Enter the details into a worksheet using a spreadsheet package, and use it to answer the questions that follow.

Item	Needed Qty	Unit Price	Total Price
Sugar	250	130	
Unga	340	120	
Salt	271	107	
Kimbo	300	210	
Blue band	250	30	
GRAND TOTAL			

1. (a) Calculate the total price of items sold.
 (b) Calculate the grand total.
 (c) Save the changes to your document with your full names.
- 2) Use the worksheet given below to do the exercises that follow:

Employee Details						
Emp No	Name	Category	Basic Pay	Allowances	Gross Pay	Tax Deductions
E8	Cornell	Assistant	4,600	300		
E9	John	Assistant	3,500	450		
E2	Francis	Supervisor	6,508	500		
E3	Edwin	Management	8,006	1,801		
E10	Carl	Assistant	4,200	100		
E4	Bernard	Management	7,917	1,775		
E5	George	Supervisor	5,500	850		
E1	Lewis	Management	8,291	2,500		
E6	Albert	Supervisor	5,700	760		
E7	Edward	Supervisor	7,151	1,545		
Tax Rate						
12%						

- i) Make all the column titles bold, and size 9. Center the title, across columns A1:H1 and make its size 16, and Bold.
- ii) Make all the column titles bold, and size 9. Center the title, across columns A1:H1 and make its size 16, and Bold.

8.4. Mathematical formula in spreadsheet

Activity 8.4

Create the worksheet below which contains the temperatures of different Districts in degree celcius

	A	B	C	D	E	F
1	TOWN/ DAY	Mon	Tue	Wed	Thur	Fri
2	Kigali	30	29.5	31	28.5	32
3	Musanze	31	33	30	30	32
4	Muhanga					
5	Rubavu	24	23.5	22	23	24.5
	Average					

Table 1. District temperatures in degree celcius

7						
8	TOWN / DAY	Mon	Tue	Wed	Thur	Fri
9	Kigali					
10	Musanze					
11	Muhanga					
12	Rubavu					

Table 2. District temperatures in degree Farhenheit

- Use a formula to calculate the temperature for Muhanga, given that the temperature for Muhanga is $\frac{3}{4}$ that of Kigali.
- Calculate the average temperatures in degree celcius
- In Table 2 calculate the temperatures in degree Farhenheit
- Type “Temp. in degrees Celsius” in Cell A2 and “Temp. in degrees Fahrenheit” in Cell A9.
- Calculate the temperature in F using the conversion factor given as $F=(C+19) *9/5$.

Summary Notes

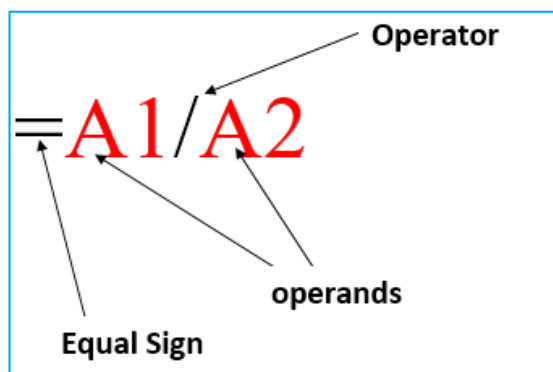
A formula is an expression telling the computer what mathematical operation to perform upon a specific value. When referring to computer software, formulas are most often used in spreadsheet programs, such as Microsoft Excel. Using formulas in spreadsheets can allow you to quickly make calculations and get totals of multiple cells, rows, or columns in a spreadsheet.

An example of a Microsoft Excel formula =A1+A2, which adds the total of cells A1, A2.

8.4.1 Using formula

Most of the standard math, business, statistical, and scientific calculations can be done using excel formula. To insert a formula in excel first one needs to know the cells that are going to be involved in that formula for example a formula to data from two cells may involve cells like A1 and A2.

Example a. Basic Function syntax



An excel formula will always start with an equal sign followed by an operand which can be a reference to a cell containing data or the actual data, followed by an operator (+, -, /, *, ...) and followed by another operand. A formula can have more than two operands.

Examples of formula usage in excel:

SN	Item	Unit Price	Quantity Bought	Total
1	Cement	10000	20	=D5*E5
2	Lamps	800	12	=D6*E6
3	Sheets	5500	50	=D7*E7
4	Locks	12000	10	=D8*E8
5	Doors	50000	10	=D9*E9
	Average	=(D5+D6+D7+D8+D9)/5	=(E5+E6+E7+E8+E9)/5	=(F5+F6+F7+F8+F9)/5

As it is clear in the excel sheet, the formula used are for addition, multiplication and average.

Application Activity 8.4

A Payroll consists of Basic Pay, Allowances, Gross Salary, Deductions and Net Salary. The Allowances are 23% of the Basic Pay while the Deductions are 12% of the Gross Salary.

1) Use formula to calculate the allowance and deductions for each individual.

	A	B	C	D	E
1	Stationery Supplies Ltd				
2					
3	Name	Basic Pay	Allowances	Gross Salary	Deductions
4	David	125000		170000	
5	Francis	80000		120000	
6	Jane	108000		140000	
7	Ange	90000		130000	
Totals					

End unit assessment

Complete the following questions, you must first copy the table below into a new Gnumeric Spreadsheet. Make sure the cell marked with (A1) is pasted in cell A1 on the spreadsheet. After the table is in place, proceed to the questions:

Maker A	Type	Class	Full model name	Qty	Unit Price	Total price
Missam	SLX	Business	Missam SLX	27	768657	
Doubaru	Double	Van		75	87653	
Tia	Jet	Van		86	900876	
ZMV	Cruise	Compact		45	16754	
Fonda	Life	Compact		34	4567	
Total						

Questions:

1. Align the Text to the right.
2. Insert a row between Missam and Dubaru.
3. Change the Page Orientation to Vertical.
4. Highlight every cell with annual Total price over 3 billion with green.
5. Under “Full Model Name”, in cell D4, write a function that combines the “Maker” and the “Type” (like in cell D3) where there is Missam SLX.
6. Calculate the two total prices

UNIT 9 : PROGRAMMING USING TURTLE, SCRATCH AND USING ETOY

Key unit competence:

Create shapes and animations using Turtle and Scratch programs.

Introductory Activity:

Enter the following code blocks in turtle, run the scripts and discuss about the output:

Start

Repeat 4

Forward 350

Right

9.1. Turtle art window environment

Activity 9.1

1. Give and explain the roles of the different components of the Turtle art window

Summary Notes

The turtle art/Blocks lets you program a Logo “turtle” to draw colorful and complex artwork. Simple programming elements easily snap together, to bring art to life. With repeating instructions and conditionals following instructions, turtle can draw shapes and lines over again with interesting results.

To open Turtle Go to home page and click on turtle art icon then select **start** or **start new** then click.

Here is a Turtle window:

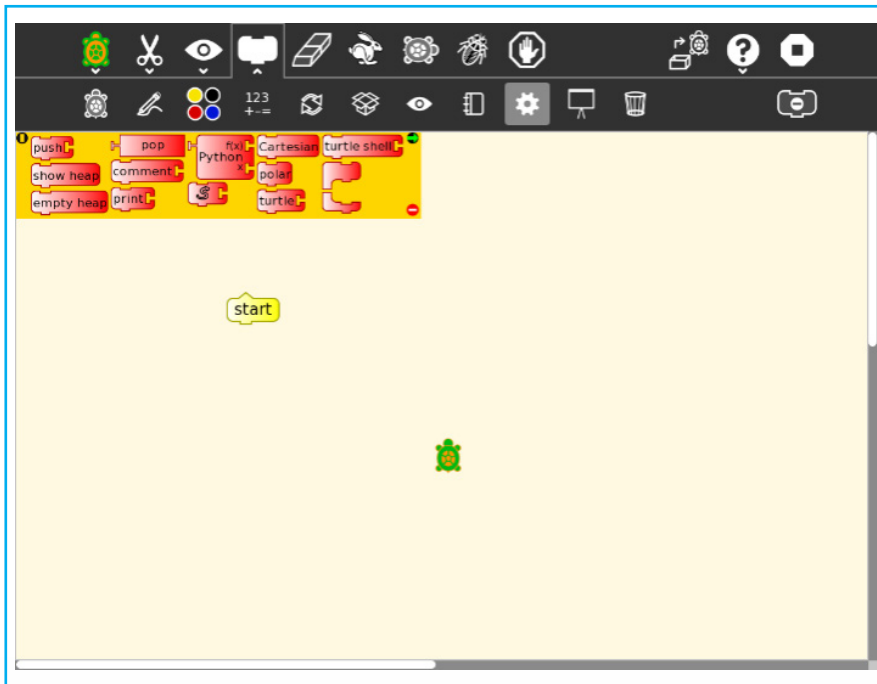


Image 9. 1. Turtle Art main window

9.2.1. Turtle Art Tool bars:

This has all the tools that a Turtle Art programmer uses in order to create instructions

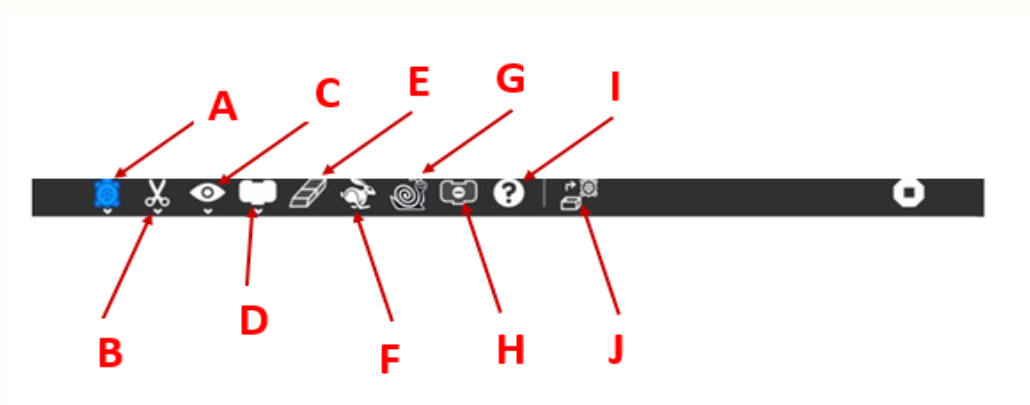


Image 9. 2. Turtle Art toolbars

The tools found on the Turtle Art toolbar are:

- A. Turtle block activity

- B. Edit toolbar (including copy and paste);
- C. View toolbar (including full-screen, coordinate overlays; turtle status, etc.);
- D. Palette toolbar (including all programming blocks);
- E. Clean canvas;
- F. run project fast (rabbit);
- G. run project slow (snail);
- H. hide blocks (This button is replaced by the stop button when the project is running);
- I. help;
- J. load examples;

9.2.2. Turtle Art palettes

Turtle art palette are icons located just under the Turtle Art toolbar which contain blocs that are dragged and fitted into one another in order to create programs (instructions)

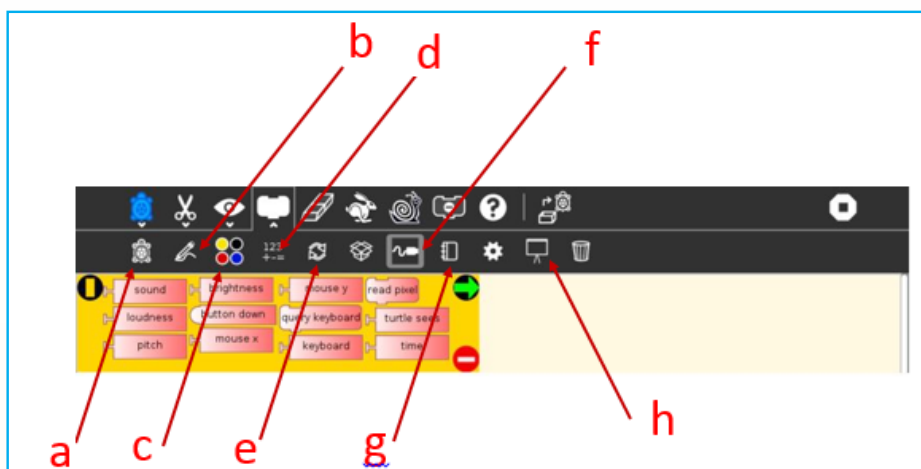


Image 9. 3.Turtle Art Palette

a. Turtle Art Palette



These blocks are used to control the movements of the turtle.

- Forward: Move turtle forward
- Back: Move turtle backward

- Clean: Clear the screen and position the turtle in the center of the screen, pen down, color red, heading 0
- Left: Rotate turtle counterclockwise
- Right: Rotate turtle clockwise
- Arc: Move turtle along an arc
- Set xy: Set turtle x,y position (0,0) is the center of the screen
- Seth: Set turtle heading
- Xcor: Holds current x-coordinate value of the turtle (can be used in place of a number block)
- Ycor: Holds current y-coordinate value of the turtle (can be used in place of a number block)
- Heading: Holds current heading value of the turtle (can be used in place of a number block)

b. Pen Palette

The pen palette is used to write or draw

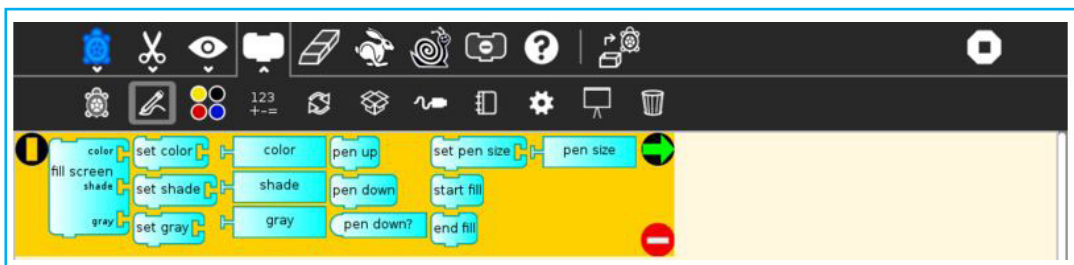


Image 9. 4. Turtle Art Pen palette

These blocks are used to control the attributes of the turtle's pen.

- Pen up: Turtle will not draw when moved
- Pen down: Turtle will draw when moved
- Set pen size: Sets the width of the line drawn by the turtle
- Fill screen: Fill the screen with a color/shade and reposition the turtle in the center of the screen
- Pen size: Width of the line drawn by the turtle (can be used in place of a number block)
- Set color: Sets the pen color
- Set shade: Sets the pen shade

- Set gray: Sets the gray-level of the pen (Only available in Turtle Blocks)
- Color: Current pen color (can be used in place of a number block)
- Shade: Current pen shade (can be used in place of a number block)
- Gray: Current pen gray level (can be used in place of a number block) (Only available in Turtle Blocks)
- Start fill: Starts a filled polygon (straight sides, not arcs)
- End fill: Ends a fill polygon (straight sides, not arcs)

c. Color Palette

The color palette is used in picking the color to use in order to create beautifully looking shapes

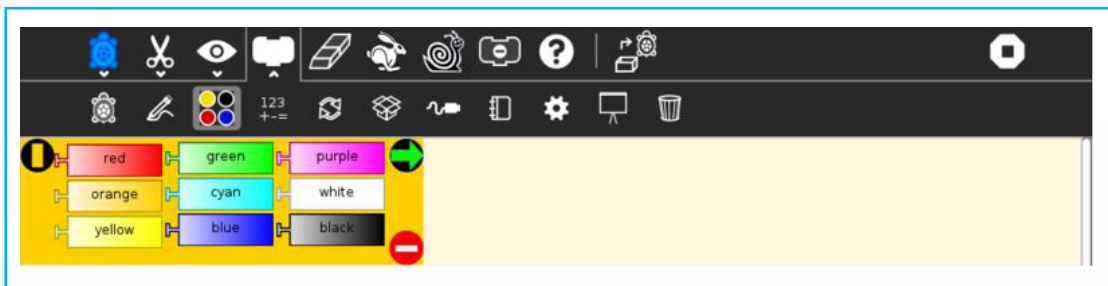


Image 9. 5. Turtle Art color palette

These blocks can be used with the set-pen-color block in place of a number block.

d. Numbers Palette

Numbers palette is used when the programmer wants to write numbers in the Turtle Art program.

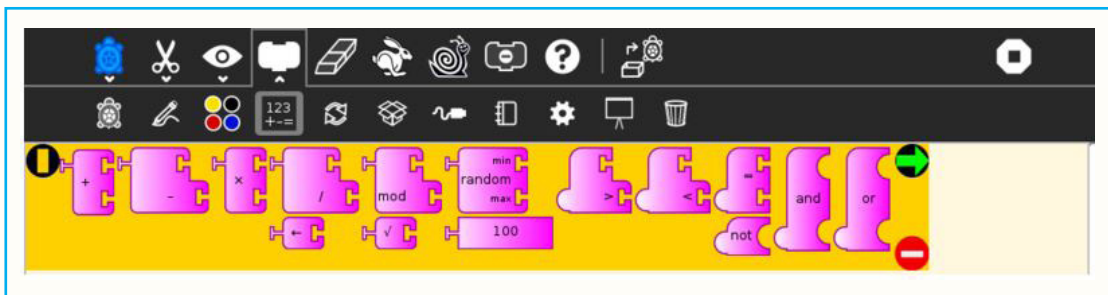


Image 9. 6. Turtle Art numbers palette

These blocks are arithmetic and boolean operators.

- Addition: Adds two numeric inputs (also can be used to concatenate strings)
- Subtraction: Subtracts the bottom numeric input from the top input
- Multiplication: Multiplies two numeric inputs
- Division: Divided top input (numerator) by bottom input (denominator)
- Identity: Identity function (used for spacing blocks)
- Modulo (remainder): Calculates remainder when dividing top input by the bottom input
- Square root (Only available with Turtle Blocks)
- Random number: Generates a random integer between the minimum and maximum values
- Number block: A numeric input
- Greater than: Boolean greater than operator (used with flow blocks)
- Less than: Boolean less than operator (used with flow blocks)
- Equal to: Boolean equal to operator (used with flow blocks)
- Not: Boolean not (Only available with Turtle Blocks)
- And: Boolean and (Only available with Turtle Blocks)
- Or: Boolean or (Only available with Turtle Blocks)

e. Flow Palette

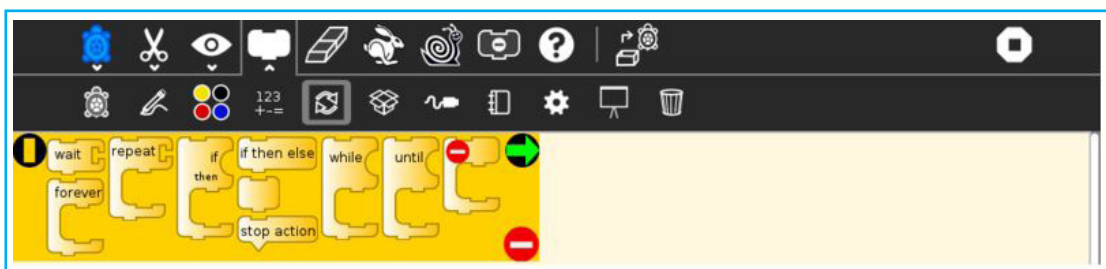


Image 9. 7. Turtle Art Flow palette

These blocks control the program flow.

- Wait: Pause program execution (unit is seconds)
- Forever: Continuously repeat execute stack under the right flow
- Repeat: Repeat the execution of stack under the right flow a specified number of times

- If/then: Conditional execution of the stack under the right flow (uses boolean operators found on the Number palette)
- If/then/else: Conditional execution of the stack under the center and right flows (uses boolean operators found on the Number palette)
- Vertical spacer
- Stop stack: Interrupt execution
- While: Execute stack under right flow while the condition is true (uses boolean operators found on the Number palette) (Only available with Turtle Blocks)
- Until: Execute stack under right flow until the condition is true (uses boolean operators found on the Number palette) (Only available with Turtle Blocks)

f. Sensors Palette

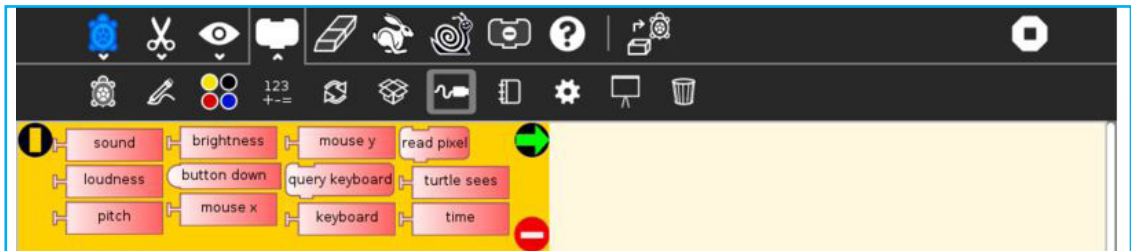


Image 9. 8. Turtle Art sensor palette

- Query keyboard: Check for keyboard input (results are stored in the keyboard block)
- Keyboard: Current value of keyboard input (can be used in place of a number block)
- Read pixel: Push the RGB value of the pixel under the turtle onto the FILO (blue is first, red is last)
- Turtle sees: The “palette color” of the pixel under the turtle
- Time: Number of seconds since program began
- Sound: Raw data from microphone ranging -32000 to 32000
- Volume (loudness): Ranging 0 to 32000
- Pitch: The resolution is +-8Hz
- Brightness: Average luminance seen through camera
- Button down: Current state of the mouse button (1 == down; 0 == up)
- Mouse x: x position of mouse
- Mouse y: y position of mouse

g. Media Palette



Image 9. 9.Turtle Art Media palette

These are a collection of blocks used for displaying media objects, such as images from the Journal.

- Journal: Sugar Journal media object (used with show block) (also available in Turtle Art)
- Audio: Sugar Journal media object (used with show block)
- Video: Sugar Journal media object (used with show block)
- Description: Sugar Journal description field (used with show block)
- Text: Text string (used with show block; also used with box and action blocks)
- Show: Draw text or display media object from the Journal
- Set scale: Sets the scale of images displayed with show block
- Save picture: Save the canvas to the Sugar Journal as a .png image (note: saves the canvas as displayed)
- Save SVG: Save turtle graphics to the Sugar Journal as a .svg image (note: only saves the changes to the canvas in the current execution run)
- Scale: Sets scale for show block (100% is full-screen)
- Media wait: Used to pause program while audio or video file plays
- Media stop: Stop current sound or video
- Media pause: Pause current sound or video
- Media resume: Resume playing paused media
- Speak: Sends text to the voice synthesizer
- Sine wave: Plays a sine wave of a given frequency, amplitude, and duration

h. Portfolio Palette

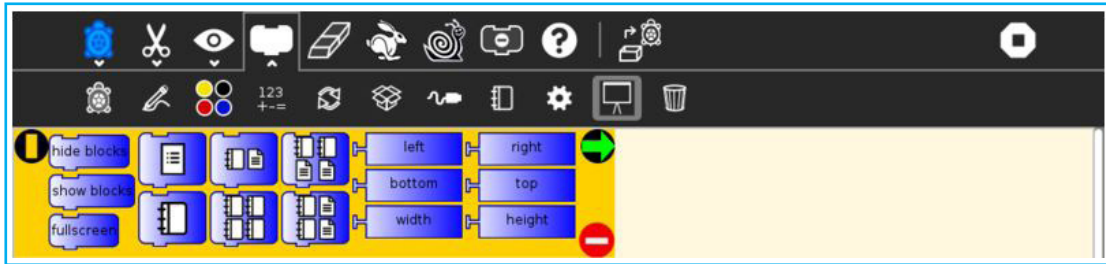


Image 9. 10.Turtle Art portfolio palette

These blocks are used to make multimedia presentations only available in Turtle Blocks.

- Hide blocks: Hides all blocks and palettes (useful for decluttering the screen during presentations) (also available in Turtle Art)
- Show blocks: Shows blocks and palettes (useful for resuming programming after a presentation)
- Full screen: Goes into full-screen mode (hides Sugar toolbars)
- List slide: Used for bulleted lists; This block is expandable, allowing you to add as many bullets as you need
- Picture slides: Used for picture slides (1×1, 2×2, 1×2, and 2×1)
- Left: Holds current x-coordinate value of the left edge of the screen (can be used in place of a number block)
- Top: Holds current y-coordinate value of the top edge of the screen (can be used in place of a number block)
- Right: Holds current x-coordinate value of the right edge of the screen (can be used in place of a number block)
- Bottom: Holds current y-coordinate value of the bottom edge of the screen (can be used in place of a number block)
- Width: Screen width (can be used in place of a number block)
- Height: Screen height (can be used in place of a number block)

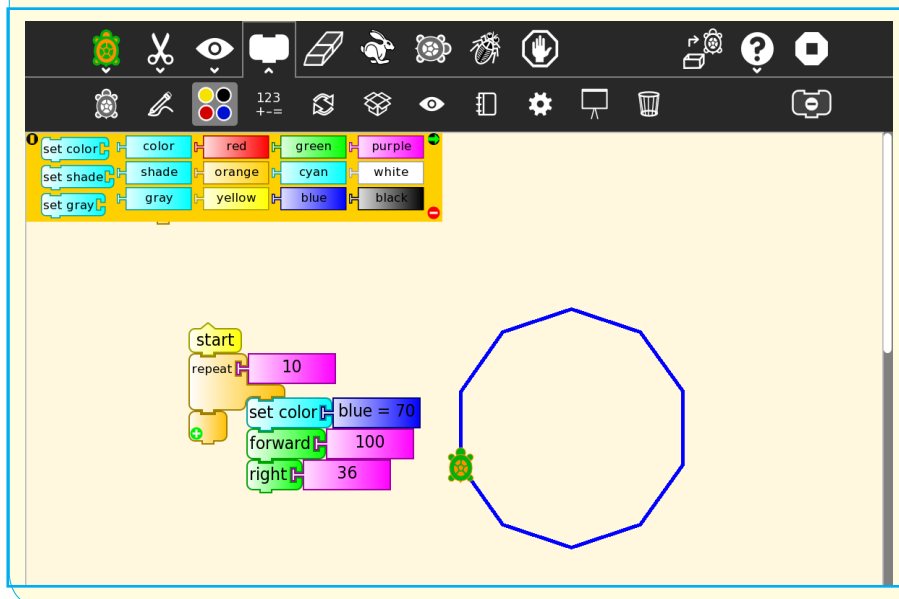
Application Activity 9.1

Describe the Portfolio Palette, its different blocks and their roles

9.2: Use Turtle Art Instructions

Activity 9.2

Analyse the codes below and describe how the image in the output will be drawn



Summary Notes

9.2.1. Principle for using instructions

To use a Turtle art instruction requires the user to know the principles for the real life object he/she wants the Turtle art to produce. For example if it is drawing geometric shapes like polygons one will have to know the length of each side and the angle between the sides. One will have to think what it may take a turtle to produce such a trajectory.

Examples:


- If a turtle moves forward 200 “steps” then turns right, does another 200 “steps” and turns right, does another 200 “steps” it will have made a square.
- If instead, the same turtle moves forward 200 “steps” then turns right, does 100 “steps” and turns right, does another 200 “steps” turns right and does 100 “steps” it will have made a rectangle.

The reasoning like the one illustrated must be made before starting the programming.

Generally, for drawing polygon which are n-sided closed figures with sides of equal length, the programmer will have to consider the size of an exterior angle of a polygon which is $360/(\text{number of sides})$. So, for a pentagon, it will be 72. For a hexagon, it will be 60. And so on. The table below gives the exterior angle values for different polygons.

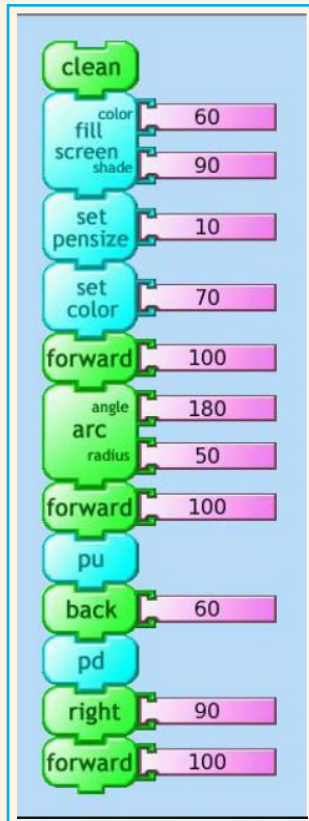
Number of Sides	Polygon Name	Exterior Angle
5	Pentagon	72
6	Hexagon	60
7	Heptagon	51.42
8	Octagon	45
9	Nanogon	40
10	Decagon	36

We start by clicking on (or dragging) blocks from the Turtle palette. Use multiple blocks to create drawings; as the turtle moves under your control, colorful lines are drawn.

You add blocks to your program by clicking on or dragging them from the palette to the main area. You can delete a block by dragging it back onto the palette. Click anywhere on a “stack” of blocks to start executing that stack or by clicking in the Rabbit (fast), Turtle (slow) or Bug (debug) buttons  on the Project Toolbar.

Application Activity 9.2

1. Analyse the set of commands below and predict its output. Run it and see.



2. Write Turtle Art instructions to draw the following letters:

a) **B**

b) **C**

c) **N**

9.3. Scratch window Environment

Activity 9.3

Describe different main features of a scratch window environment.

Summary Notes

A. Starting Scratch

To start Scratch go to the sugar interface and click on the Scratch icon then choose **Start new**.

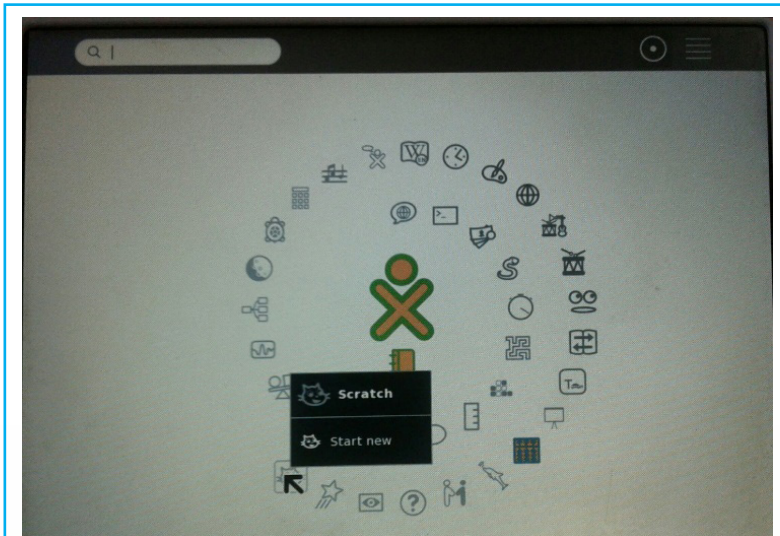


Image 9. 11. Window to start Scratch

The Scratch window that will be opened will look like the one below with its components labelled:

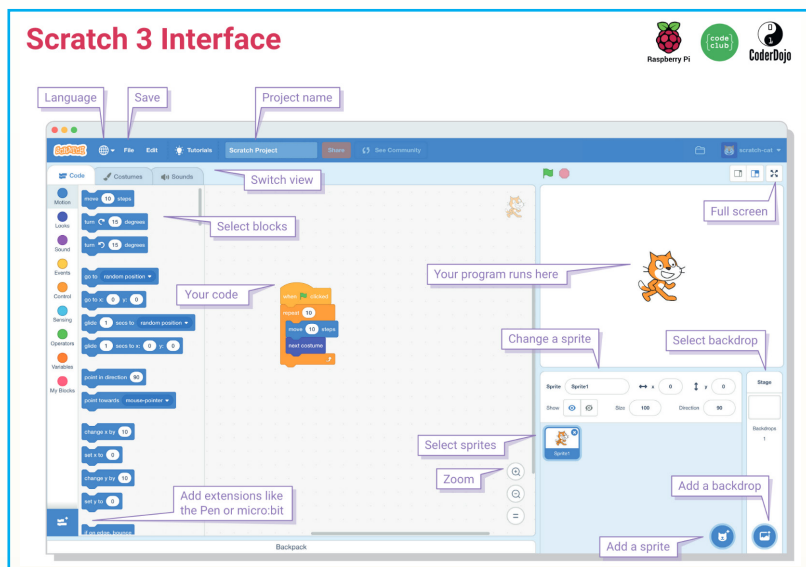


Image 9.12. Scratch command block

B. Scratch commands

The Scratch is an easy programming language which makes easy to create interactive stories, games and animations. The table below shows the different sections of the blocks palette in Scratch

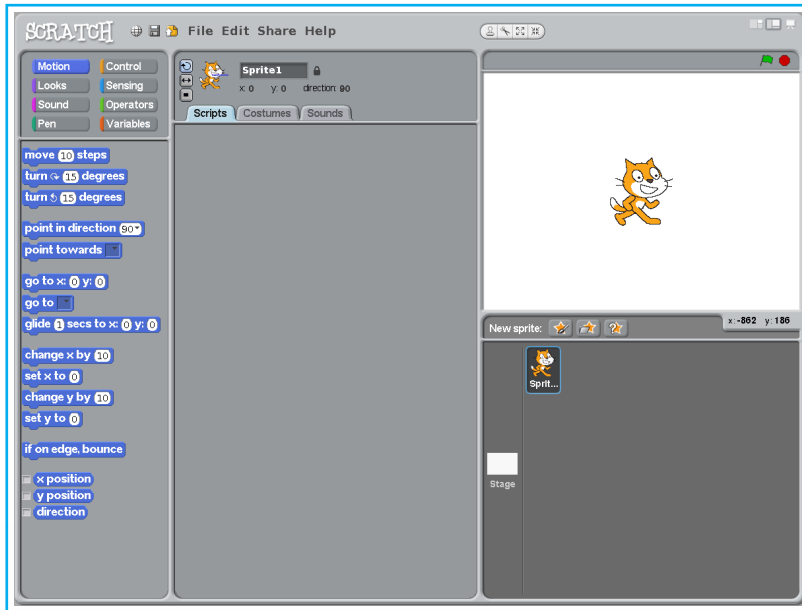


Image 9.13. Scratch commands window

This table shows the different blocks available in Scratch and their description:

SN	Section of the Block	Description
1	Motion	Moves sprites, changes angles and changes X and Y values.
2	Looks	Controls the visuals of the sprite; attach speech or thought bubble, change of background, enlarge or shrink, transparency, shade
3	Sound	Plays audio files and programmable sequences
4	Pen	Draw on the canvas by controlling pen width, color, and shade. Allows for turtle graphics.
5	Control	Conditional if-else statement, “forever”, “repeat”, and “stop”, etc
6	Sensing	Sprites can interact with the surroundings the user has created
7	Operators	Mathematical operators, random number generator, and-or statement that compares sprite positions
8	Variables	Variable and List usage and assignment

C. Sprites

The most important thing in any Scratch program are the sprites. Sprites are the graphical objects or characters that perform a function in your program. The default sprite in Scratch is the cat, which can easily be changed. Sprites by themselves won't do anything of course, without coding!

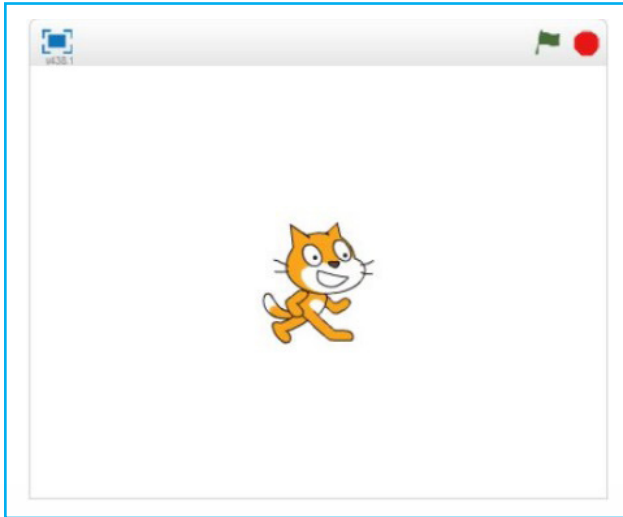


Image 9.14. The default sprite in Scratch (cat)

Application Activity 9.3

Write a scratch program which will give a square as its output

9.4. Scripts writing in Scratch

Activity 9.4.

Write a program that compare two numbers between 1 and 10. If num1 is greater than num2, the output will be True and if num1 is less than num2, the output will be false.

Summary Notes

In order to make a program in any programming language, you need to think on the sequence of steps that will be taken by that program in generating the desired output



Image 9. 15. Illustration of commands sequencing

A. Conditional Statement

A conditional statement is a set of rules performed if a certain condition is met. In Scratch, the if and if-else blocks check for a condition.

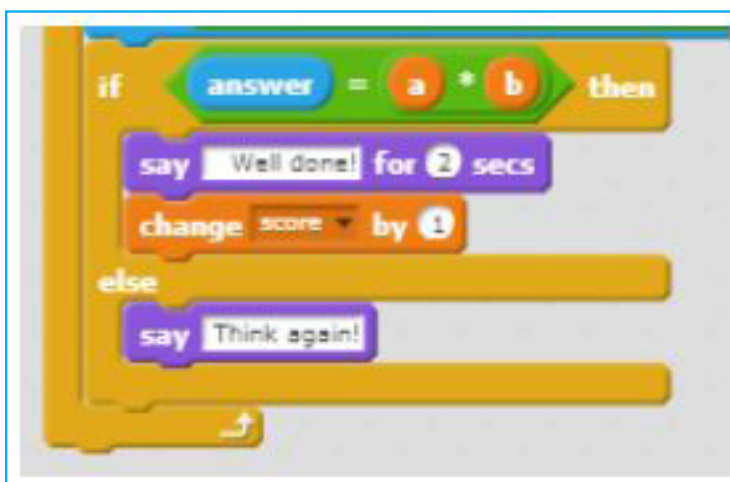


Image 9. 16. A scratch program with a conditional statement

B. Keyboard input

A keyboard input is any data read from the keyboard by a program and processes by that program. That read data is stored in a program's variable

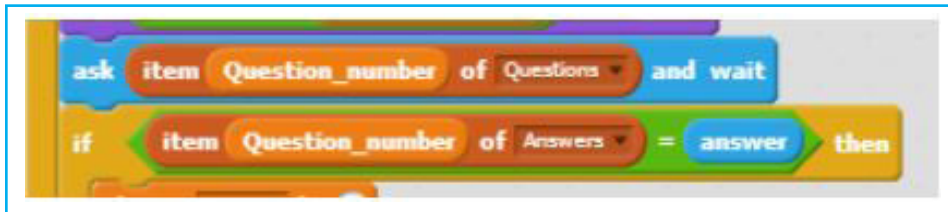


Image 9. 17.Interface for keyboard input

Application Activity 9.4:

1. Connect the blocks to create this scripts below and then run it :



2. Interpret the results you get from the above program

9.5. Sprite, Costume, Sound and stage settings

Activity 9.5

Write a Scratch program which will have a circle as its output and use elephant as your sprite then change your stage background.

Summary Notes

A. Sprite

In Scratch sprites are images which are animated by writing appropriate Scratch programs. Scripts can be written to make sprites do things like moving around, changing appearance, react to a user action, they can also speak

To create Sprites will require the programmer to drag and drop blocks from one location and drop them in a place where they properly fit. When you put all the instructions together it is called a block of the program. Explore the instructions in the options **Motion, Pen, and others**

The instructions blocks such as Motion, Sound from the Blocks Palette area and dropped into the Scripts area. These blocks are pasted one after another, to create the Script. (The blocks should fit into each other as jig-saw puzzle blocks) When you double-click on a Script, Scratch runs the program. It executes the instructions in the blocks, one by one, from the top to the bottom of the Script. The number of steps the Sprite moves can be changed by clicking inside the number area and typing the new number. Changing the direction will be changed by clicking on the arrow and selecting the direction.

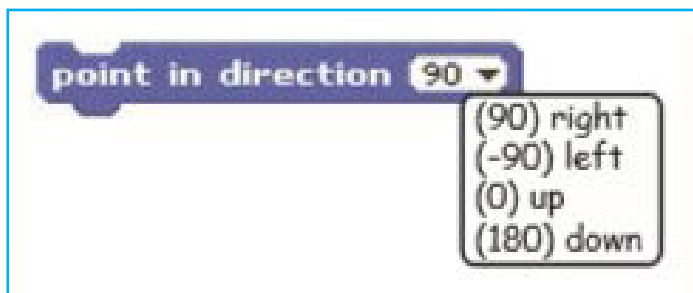


Image 9. 18. Illustration on how to change the direction

There is no need to use the cat as the only Sprite, there are some Sprites that are already available. You can therefore use those other Sprite or even draw your own Sprites and use them.

A. 1. Using a new sprite apart from cat

As the cat is not the only existing sprite, one can draw others that can be used. To draw a new sprite do like this:

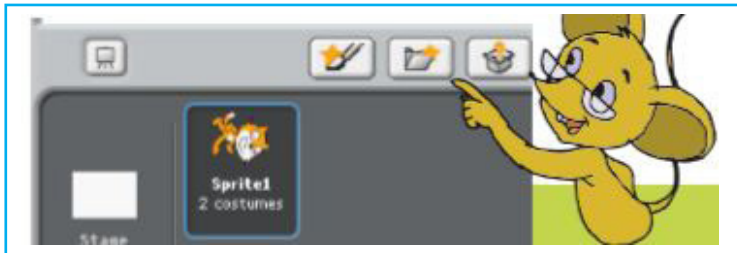


Image 9. 19. Creating new sprite tabs

The window above provides options to draw new sprite and choose from an existing list of sprites

A. 2. Deleting a sprite

To delete a Sprite, select the 'scissors' button on the Tool bar and click on the Sprite. You can also change the size of the Sprite and the direction it faces. To change the Sprites looks, we can use Costumes and we can use more than one Costume for a Sprite.

B. Costume

A **costume** is one out of possibly many «frames» or alternate appearances of a sprite. Sprites can change their look to any of its costumes. They can be named, edited, created, and deleted, but every sprite must have at least one costume. One of the most common uses of costumes is to make an animation for a game or other project.

Steps to change the Costumes of the Sprite:

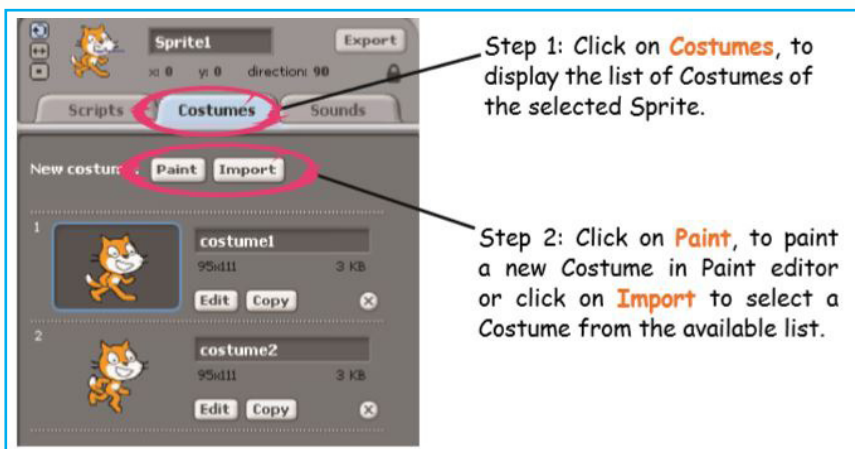


Image 9. 20. Change the Costumes of the Sprite

Once the import option is clicked on the import costume window will be opened and will provide folders from where to choose costumes.

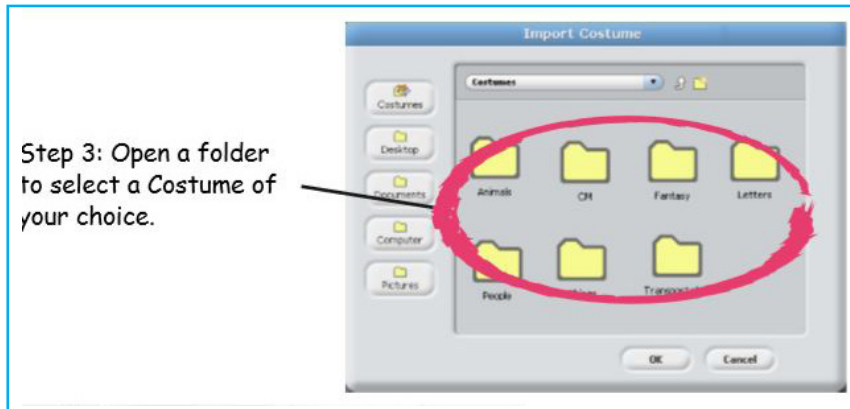


Image 9. 21. Import Costume window

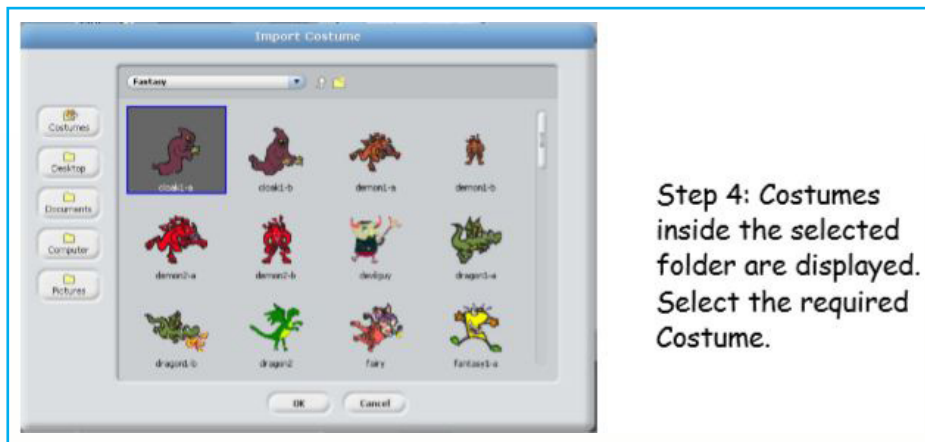


Image 9. 22. Examples of costumes that can be chosen from

Once the costume is chosen it will be applied to the current Sprite, in our case the current one is **Sprite 1**

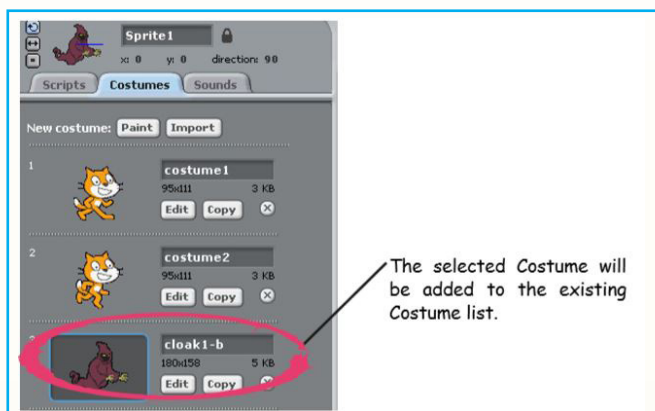


Image 9. 23. Adding a new costume to the existing one

Here is how we can use these Costumes in our program: Go to the 'looks' block. Here you can find the instructions to change the Costumes.

One can also change the costume by using the **Switch to Costume option** and choose the costume from the drop down list or use the **Next Costume** command

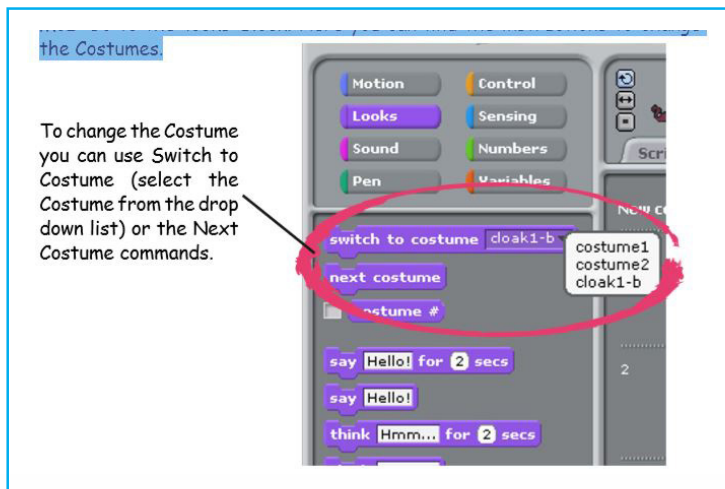


Image 9. 24. Using the "Switch to" costume

C. Stage settings

Stage is the background of a scratch projects. Like sprites, they can have sounds but are mostly motionless

D. Sound

For sound, use the sound block instructions: the sound block has instructions to make the Sprite speak, add musical notes, etc.



Image 9. 25. The sound block

Application Activity 9.5

1. Write a story using the animal Sprites, available in Scratch. Write a program in Scratch to tell the story
2. Using Scratch, teach one of the following topics to the class:
 - Uses of computers.
 - Dos and Don'ts of computers.
 - Parts of computers.

For this question you are going to create a kind of presentation to help you teach the topic you have chosen

9.6. Programming using Etoys

Activity 9.6

Kanuma wants to program a “hot air balloon” to go up and down as he drags a picture of sandbag up and down.

Summary Notes

Etoys is an engaging computer, media -rich authoring environment and visual programming system for children built to help student exploration and discovery in learning and thinking deeply about powerful ideas in mathematics and science. Squeak Etoys includes a wide variety of dynamic media that can be easily created, scripted or programmed, and shared publicly or used for collaboration with others.

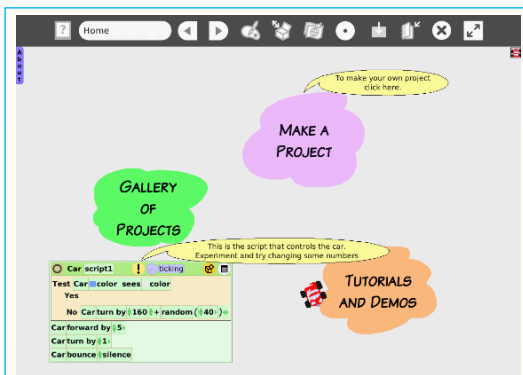


Image 9. 26. Etoy main window

The main tools that are found and used in Etoys are in the Etoys main window below:

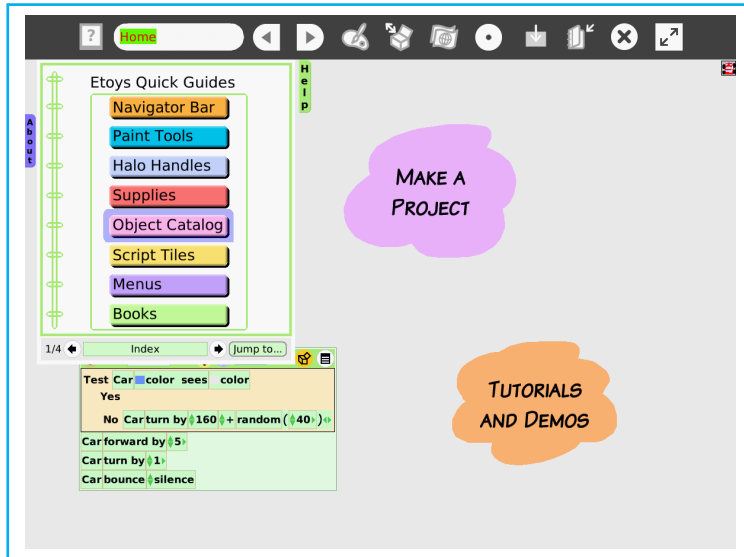
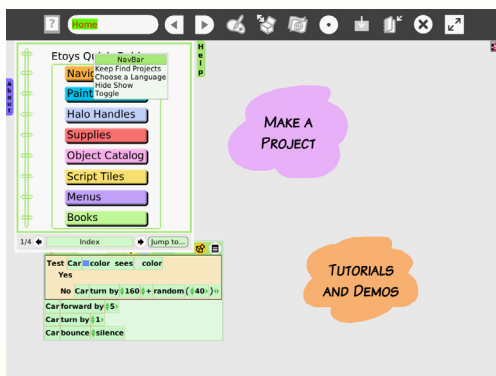


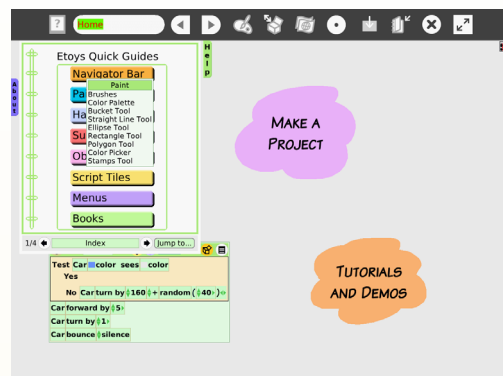
Image 9. 27. Etoys main tools

Different tools found in Etoys main tools

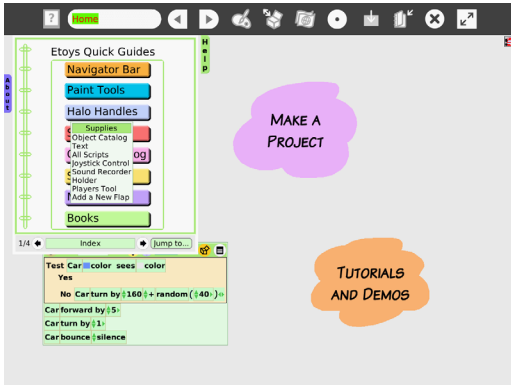
The different menu found on the Etoys main window has tools that can be chosen from depending on the task a user wants to carry out. Those tools are displayed in the windows below:



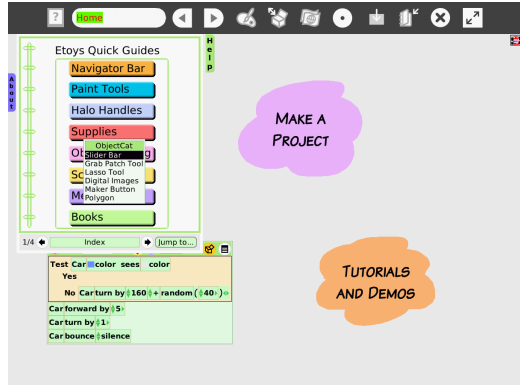
Etoys tools 1: Navigation bar tools



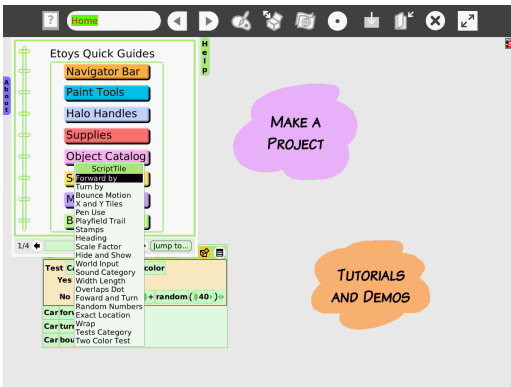
Etoys tools 2: Paint tools



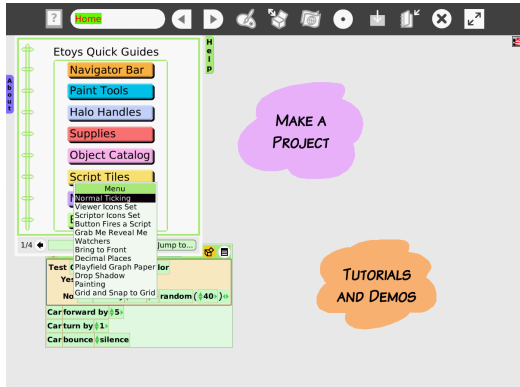
Etayo tools 3: Supplies tools



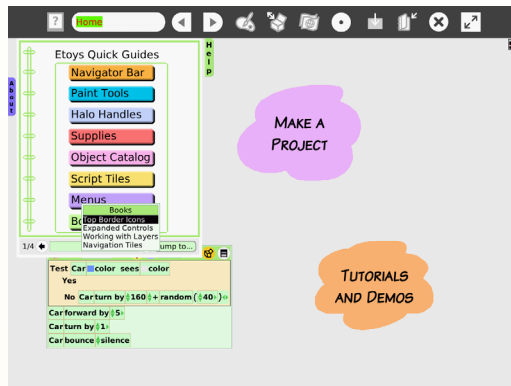
Etayo tools 4: Object catalog tools



Etayo tools 5: Script tiles tools



Etayo tools 6: Menu tools



Etayo tools 7: Books tools

Image 9. 28. Different tools found in Etayo

9.6.1. Basic actions in Etoy

A. Basics: Drive a Car

Etoys is a constructionist tool built to help children construct, reconstruct, and deconstruct their understandings of the world in ways that incite curiosity, questioning, and amplification of learning big ideas in powerful ways.

The drive a car curriculum provides children with authentic problems to be solved so that something works better. The idea of using gear ratios to make a smoother car ride is an example. One must have an understanding of how the concept of gears is applied to the problem.

B. Creating Objects

The Etoys system comes with an assortment of objects the user can readily use, and users can create new, similar kinds of objects anytime and anywhere in the system. Users can take an included object and easily change the color, size, and costume, a scripting term used to describe the objects appearance. The objects scripts can be easily changed, as well as its interaction with other objects. To create a new object, the user just makes a painting and clicks on “Keep”. The painting tool provides a new, blank sheet of paper, to draw your idea. Each new object can immediately be scripted, and many objects can be scripted separately, and set to run separately, or at the same time. Existing objects can be easily redrawn; the user can “change the costume” of the object at whenever desired. Objects include everything in Etoys, from the supplied objects to interface objects, text, fonts, shapes, arrows, balloon help, sound recorders, movies, and menu items. This is one of the powerful ideas of the structure of Etoys, the idea that you can handle every object, including all media, in Etoys, in the same way, and with the same power.

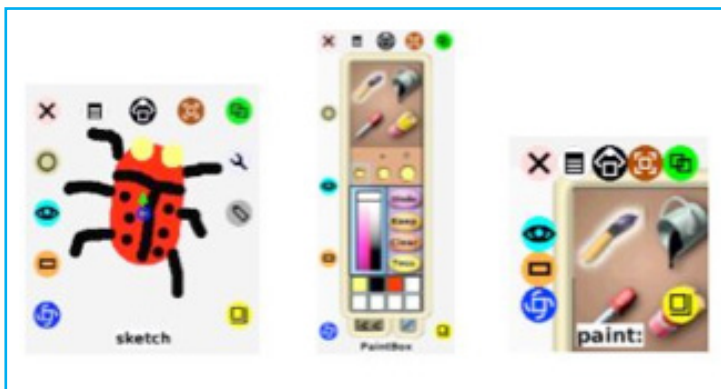


Image 9. 29. Etoy objects

C. Scripting Scripts

Bring the objects the user has created to life by telling the object what to do. Besides copying, rotating, resizing, embedding, or deleting, the most powerful way to manipulate the objects is to script them.

Dragging the tiles onto the desktop, and then dragging the tiles into the script makes scripts. By scripting in this way with tiles, the syntax is always correct and will always work when the script ticks, or is started. The turquoise halo opens the viewer, which shows properties and behaviors of the object, and is always available for analysis or change.

Anytime the user wants to view object attributes, they can open the object's viewer; it will reflect the current state of its object. For instance, the property "heading" shows the direction an object is pointing, and the number in the viewer corresponds with the actual graphical direction of the object on the screen. Changing the number or rotating the graphical object will always update each other.

The powerful idea here is to learn that there can be different representations of the same underlying data. Exploring with objects using heading is a powerful idea that bridges the known reality of the user to the computer, allowing direct manipulation and change in perception of the real world. In this process of exploring and discovering, users begin to comfortably represent their world symbolically.

To build scripts, the user arranges tiles from the viewer in a scriptor. The numbers in the tiles can be changed, and several tiles can be combined. The script itself is a Squeak Etoys object, so the user can get its handles and access the script's viewer, and use a script written for another object like the car. The user could make the scriptor, an object itself, leave a pen trail and make a circle or show any other path the user scripted.

There can be several scripts for every object, and all scripts can be executed at the same time, timed to start at different times, or manually started at different times. Child users often have an easier time with parallel processing than adult users. It is also possible to stop a script, make changes and start it again, while other scripts are still running.

Etoys user interface gives young children the appropriate instructional environment to explore, build, and eventually reflect on their constructions and powerful mathematics ideas

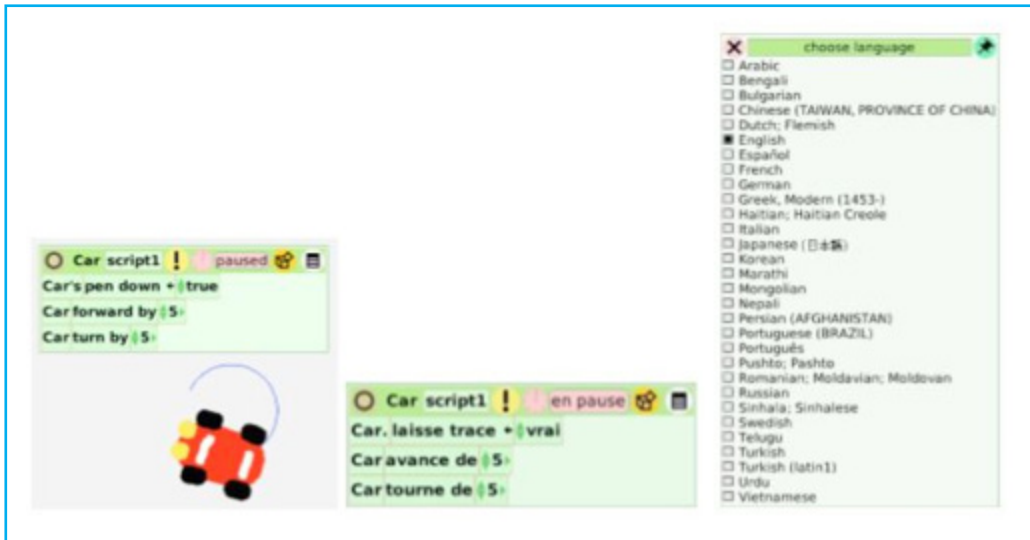


Image 9. 30. Writing numbers in etoy

D. Collaboration between objects

While creating one object and scripting that same object is easily accessed, creating objects that interact with each other requires the user to think about more than one viewer while scripting. While a script belongs to one object, you can easily add tiles from other objects into each script.

Here is a simple example of collaboration; you can of course build scripts that are more complex and create simulations and games. Using a tile of another object instead of a number also introduces the concept of a variable: that a name stands for a number.



Image 9. 31. Collaboration between objects

E. Animations

Animations are quickly and easily made. The user paints several “costume changes” for an object and drags tiles to a script to move the cursor and change the costume. Movies and videos in Etoys are just an implementation of the animated objects.

Etoys is a powerful constructionist tool that allows students on multiple platforms to publish and share projects and explore the world of powerful ideas by building and manipulating interactive simulations as active, not passive learners. Learning through play and exploration in the open world is an important part of the Etoys experience. The user interface is designed to openly allow the user access to play with powerful ideas in mathematics and science.

Application Activity 9.6

1. What is a halo of an object?
2. How do you open a viewer of an object?
3. What can you view in a viewer?
4. Name five properties of an object
5. What is the “Heading” of an object? What does it mean if a ticking program changes the heading so that it increases by 90? If you were riding the object, what would you say happened?

End unit assessment

Individually on your XO laptop, use messages to animate a short game of Simon Says between three sprites: the game leader and two game players. For example, the leader might say, “Simon says jump” and both players jump.

Or the leader might say, “Turn around!” and one player turns slightly but catches itself and the leader says, “Almost got you.” The game should end with one player winning. Use the say _____ for ___ secs block in the Looks menu to have sprites say things. Depending on how you structure your code, you might also want to use the broadcast _____ and wait block in the Events menu.

The broadcast _____ and wait block waits until all sprites have finished processing a message before passing control to the next block; the broadcast _____ block passes control immediately to the next block

UNIT 10 : EMAIL AND COMPUTER RESEARCH

Key unit competence:

Use email and carry out researchers in order to improve knowledge.

Introductory Activity:

Discuss how the internet can help people to improve their level of knowledge and discover new facts and ideas

10.1. Browsing for research

Activity 10.1

Brainstorm the different tips that you can use once you need to search for an updated book about the topic you are supposed to teach.


Summary Notes

The Browse activity is an activity that is used for browsing the World Wide Web (Internet). Internet a network of networks that consists of millions of smaller domestic, academic, business and government networks, which together carry various information and services, such as electronic mail, online chat, file transfer and the interlinked web pages and other resources of the World Wide Web. The internet allows computer users to connect to other computers and information stores easily wherever they may be across the world.

10.1.1. Starting the browse activity

Before going to the browse activity the XO laptop must be connected to the wireless network or get the internet connection through a modem. A wireless Access Point has a network name, also called an SSID that displays in the Neighborhood View.

The XO cannot recognize SSIDs that are hidden, which is configured on the access point. Sometimes you'll be asked to enter the "Wireless Key".

To start the browse activity go to Home View  then once to the home page click the browse activity icon located on the main desktop of the Sugar interface.

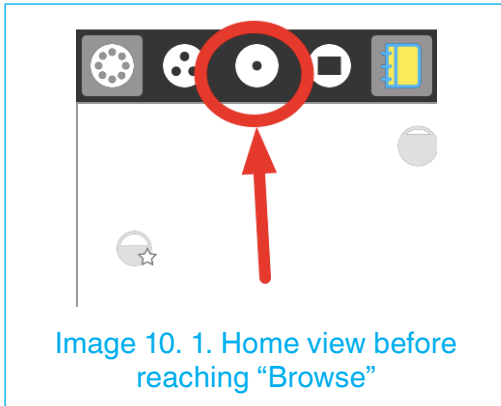


Image 10. 1. Home view before reaching "Browse"



Image 10. 2. The icon to click on for browsing

The window below will be opened.



Image 10. 3. Starting browse activity (google)

In the opened window, the user will write in the search box his/her search topic and click on "**Search the Internet**"

10.1.2. Search engines

A search engine is a specific web based software that returns to the user information related to the keyword he/she typed as a search topic by consulting a database of those information available on many computers connected through the internet.

Common search engines are: google, bing, yahoo, Ask.com, AOL.com, Baidu, Wolframalpha, DuckDuckGo.

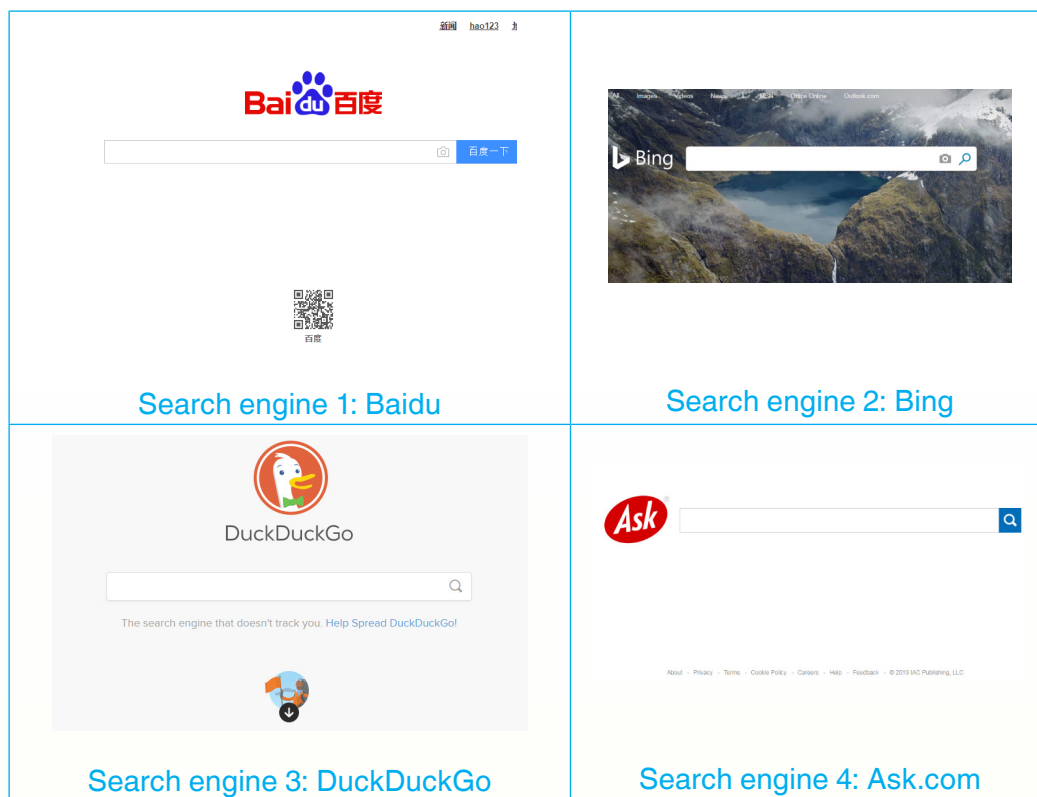


Image 10. 4. Windows for baidu, bing, DuckDuckGo and Ask.com search engines

10.1.3.a. Types of search engines

There are different types of search engines and those are: crawler based search engines, Human powered directories, Hybrid search engines and meta-search engines

- **Crawler based search engines**

These are search engines like Google and Alta Vista which create listings by the help of a special algorithm called Crawl or Spider which index what it finds on the web in order to create a search base.

When the web pages change, the crawler based search engines will be updated. These search engines are efficient when the user has a precise topic in mind but they are less efficient when the search topic is general in which case a crawler based search engine returns hundreds of thousands of irrelevant responses to simple requests including long documents in which the search keyword appears once or two times.

- **Human powered directories**

These search engines depend on human editors such as webmasters to create their listings. Those human editors create and submit to the directory a short description of their websites pages. Those manually edited descriptions will form a search base. For this reason when there are changes made to some pages those changes won't affect the listing of the entire website. The search results in these types of search engines are more accurate when the topic is general however when the topic is specific the results are less efficient.

- **Hybrid search engines**

These search engines combine the benefits of both crawler based and human powered techniques.

- **Meta-search engines**

The meta-search engines take results from all the other search engines results and combine them in order to create large listings

10.1.4. Getting better search results

For better search results, the person doing the search has to properly formulate the search question, and when the results are too many they can be narrowed down by using one or all of these techniques specifically on google:

- Use an hyphen followed by the word you don't want in the search results
- Use quotation marks to get an exact sentence as the one in the quotation marks
- Use colon followed by the name of the website to get just results from that website
- Use "define:" to get definitions of words instead of relevant articles
- Use the keyword "filetype:" to get results having a specific file in the attachment
- Use the "intitle:" keyword to get results having the specified keyword in the title

- Use special operators: an * for words or characters you don't know, OR operator will return results containing either one of the sentences on either side of the OR operator, the + operator will include results containing the keyword behind the + sign, the ~ (tilde) will return results that include the synonym to the keyword

Application Activity 10.1

You are given a research topic on components of a desktop computer. Using the search techniques you know narrow down the results up to getting less than 1000 relevant results instead of hundreds of millions of search results.

10.2. Email

Activity 10.2

A teacher was in the classroom and was asked to send to the officer in charge of education the trimestrial exam. Unfortunately he does not have an email address and has to go to the office of the education officer to hand the trimestrial exam

1. Explain how having an email address would have helped this teacher
2. What makes email different from other types of communication?
3. Using your XO laptop create an email which contain at least one of your names
4. With the email you have created write an email and send it to your colleague

Summary Notes

Email or electronic mail is a way of exchanging to each other messages using electronic devices namely computers. Emails requires the use of the internet and some of the old days emails required that both the sender and the receiver be online at the same time. Emails started being used in the early 1960 but at a limited scale, it then gained popularity as the internet was developed and common in many places.

Using emails requires that a user has an email address. With that email address one can read an email and send emails from/to another user who has also an email address.

10.2.1. Creating an email

There are many email service provider and once creating an email one will choose the one that suits his/her needs. The most prominent email service providers are Gmail and Yahoo.

The interfaces one sees in an email service provider are the same regardless of the browser you use, that is why the interfaces on an XO laptops are the same on any laptop or desktop computer

To create an email account on Gmail go through the following steps:

Step 1: Click on your browser icon and once it is opened write in the address bar ***gmail.com***

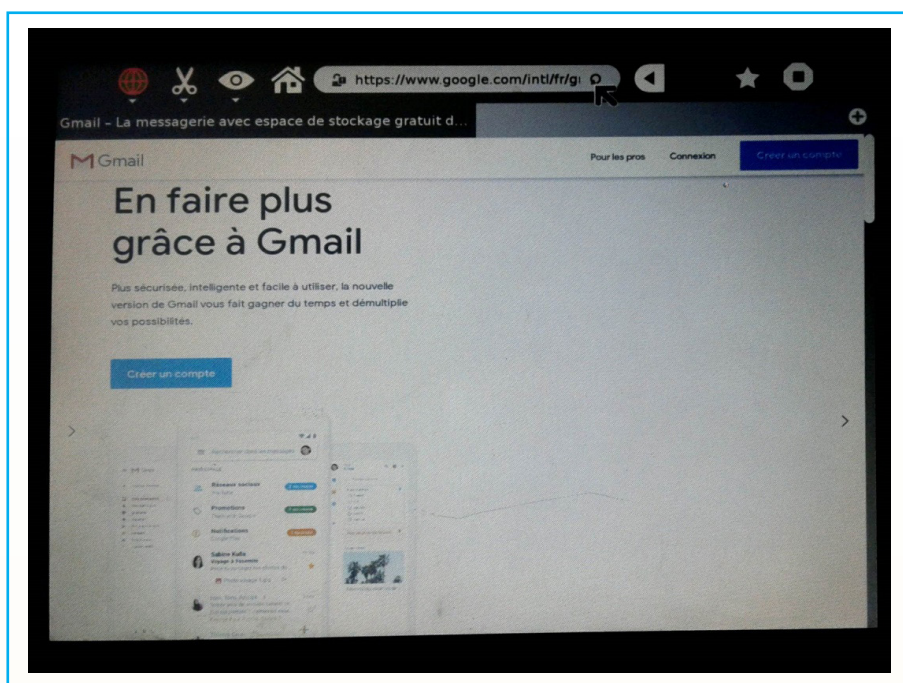
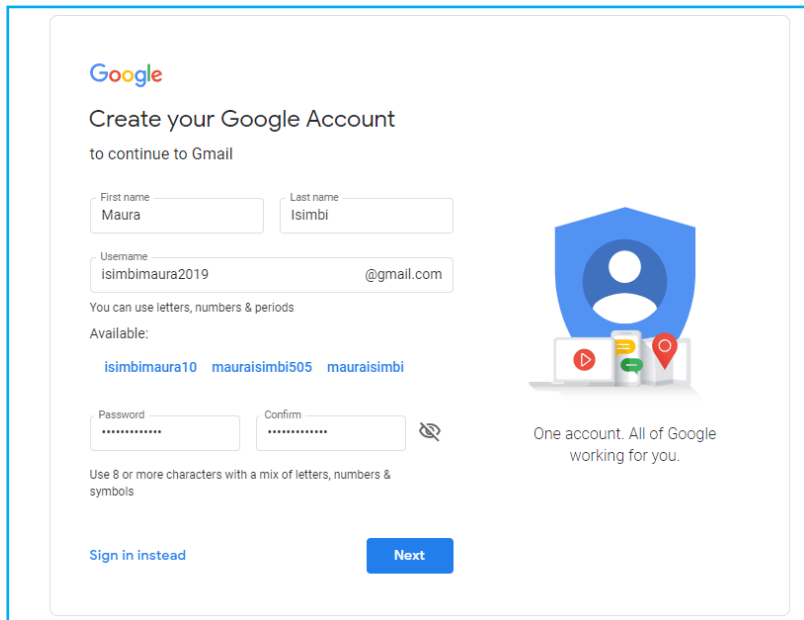


Image 10. 5. Gmail main window

Step 2: Click on *créer un compte/create account*



The screenshot shows the Google Account creation interface. At the top, the Google logo is followed by the text "Create your Google Account to continue to Gmail". Below this, there are input fields for "First name" (Maura) and "Last name" (Isimbi). A "Username" field contains "isimbimaura2019@gmail.com". A note states "You can use letters, numbers & periods" and "Available:" followed by suggestions: "isimbimaura10", "mauraisimbi505", and "mauraisimbi". There are "Password" and "Confirm" fields, both masked with dots. A "Next" button is at the bottom right, and a "Sign in instead" link is at the bottom left. On the right side, there is a graphic of a blue shield with a person icon and a laptop with icons for YouTube, Gmail, and Maps, with the text "One account. All of Google working for you."

Image 10. 6. Gmail window for filling user details

Step 3. Click on *next*. A window in which to fill the telephone number, the date of birth and other details appear

Step 4. Enter the verification code you will receive through your telephone sms and follow the prompts up to getting the last screen below

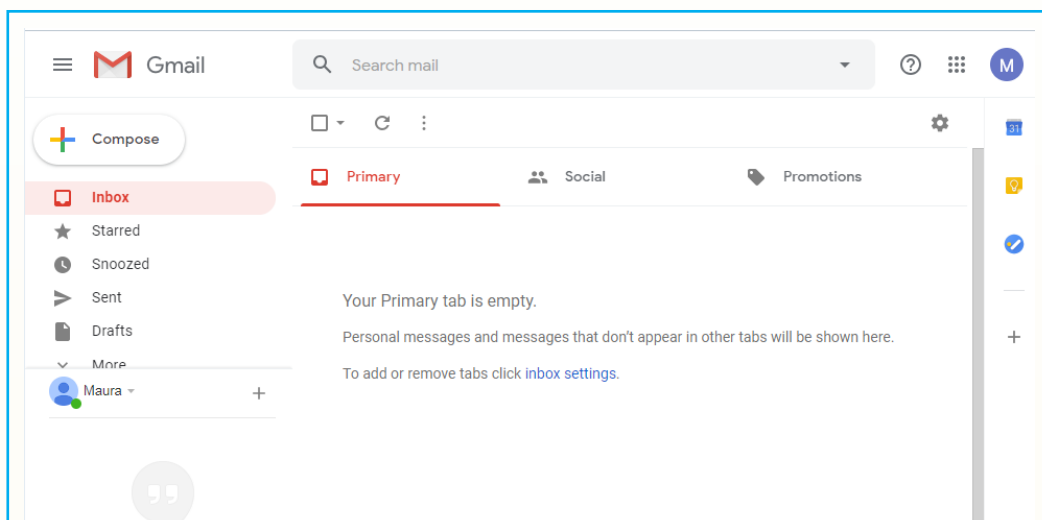


Image 10. 7. Gmail window for reading emails

Now your email is created, what is remaining is using it by reading and sending emails.

10.2.2. Reading and sending an email

To read an email the user will choose the **Inbox** option and see all the emails displayed as lists. For example the newly created email has one email inbox which has the title “Google Community Te.”

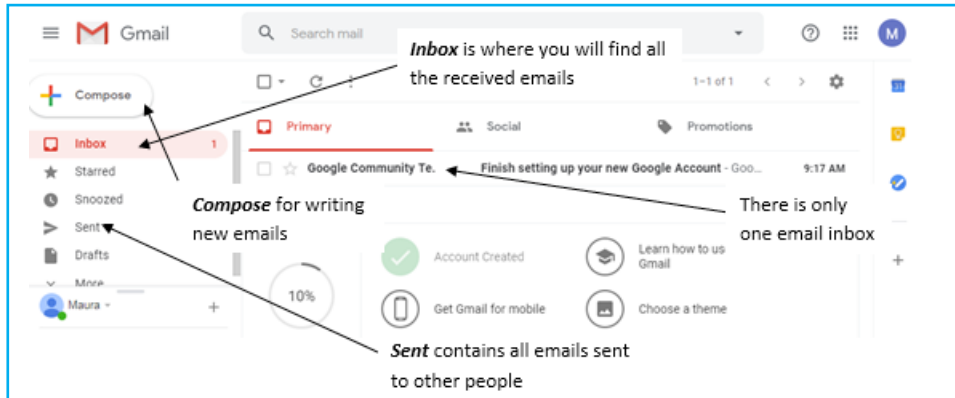


Image 10. 8. Components of a Gmail window for reading emails

To send an email do the following:

- Click on **Compose**
- Write the receiving emails in the To, Cc, and Bcc fields and write the email header (title). All these fields don't need to be filled but at least the To field has to be filled
- Write the body of the email. This will contain the message you want to transfer to the receiver
- Click on **Send** for sending your email

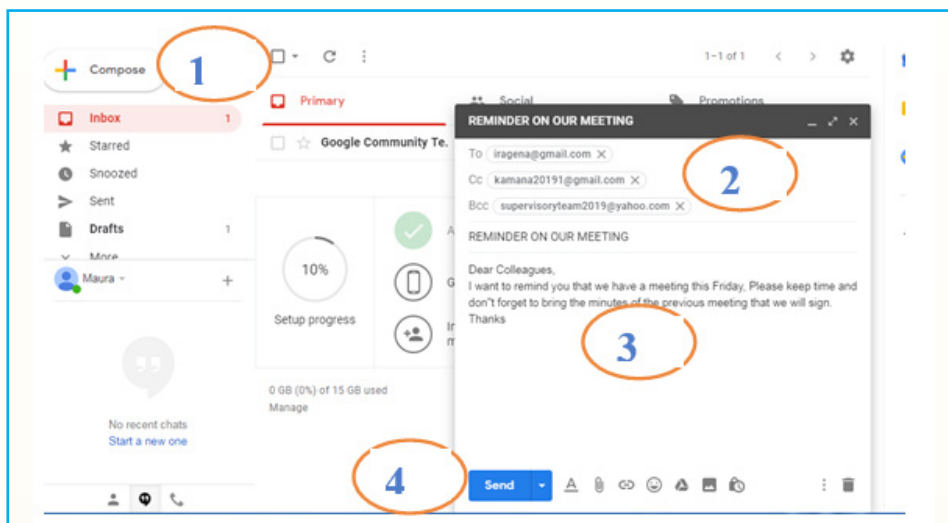


Image 10. 9. Steps to send an email in Gmail

Note:

- The steps and interfaces to create an email address vary slightly depending on the email service provider you want to create an email with but the common principle is that one fills his/her personal details, the email address he/she wants to have and the password and follow the prompts
- The steps to write, send and read emails also vary depending on the email service provider but when you know how to do it using one, it is easy to ready it using another

Application Activity 10.2

Set up your email account on a free e-mail service for example at www.gmail.com and send an email message to your friend.

10.3. Accessing resources**Activity 10.3**

Your school does not have enough books yet it has enough XO laptops with internet connectivity. Advise the leadership of the school how the presence of the internet connectivity and the XO laptop is going to help

Summary Notes

The internet is so rich in resources and there is virtually no content that can't be got from the internet. However the internet is not the only source of resources as there are also private Content Access Points (CAP)

To get a resource from the internet one should know its name or its content. From google one can get images, books, video or any other resource that can help in improving

Here is a window of google illustrating how search of different resources from the internet can be found:

a. Searching with google



Image 10. 10. Options presented by Google search

Option 1: Displays all the content related to the search topic those containing images, video, maps,...

Option 2: this option displays maps related to the searched topic

Option 3: displays different news articles that contain the keyword searched for

Option 4: when this option is chosen google displays results of pages containing images related to the search topic

Option 5: Displays topics that have books containing the keyword searched for, here books containing the sentence “finding resources on the internet” will be displayed

Option 6: With this option, all pages with video related to the search topic will be displayed

Option 7: The more option is clicked on in order to get the hidden options like Books, Finance, Personal

The **Tools** option will allow the user to restrict the search results by specifying the interval of time when the pages was posted on the internet

b. Categories of resources found on the internet

There are different types of resources on the internet some are just HTML text, images, attached text in word documents, pdf documents, images, maps, video,...To have access to those resources the person will have to make use

of the many search techniques and options provided by search engines like search by image, by video, searching for pages having attachments,...

Application Activity 10.3

Using your XO laptop search for pdf documents that are about the impact of ICT in education in Rwanda

End unit assessment

You are given a topic to teach in SET P5, name and compare different search engines using keyword and phrase search techniques that you will use and share the text teaching resources found via email.

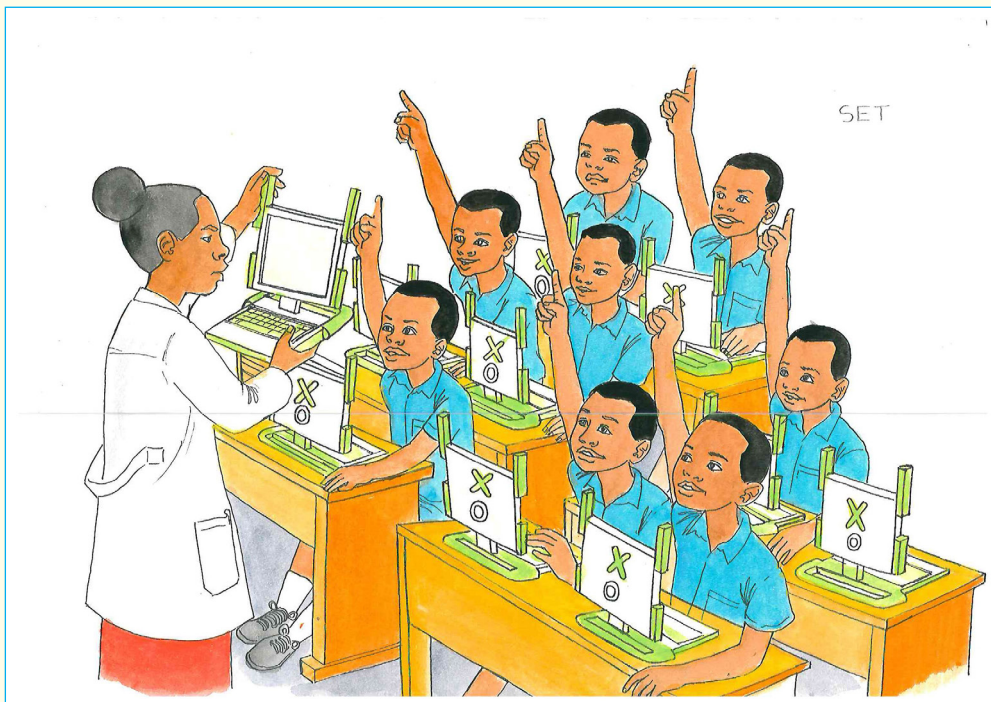
UNIT 11 : THEORY BASED SET/ICT LESSONS

Key unit competence:

Prepare theory based lessons related to ICT by developing generic competences and cross-cutting issues to each activity.

Introductory Activity

1. Observe the image below and give examples of lessons in primary that can be taught in this way
2. Suggest lesson steps for any one of the lessons you gave in question 1



The SET syllabus has two parts with one of those being more related to ICT. The lessons in the SET/ICT part can be taught using special approaches depending on whether they are theoretic.

11.1. Theory based SET/ICT lessons

Activity 11.1

1. Mr. Murenzi is presented with a situation where as a teacher he is required to facilitate the teaching and learning of the lesson “Data and memory” As a teacher who is used to using XO laptops whenever it is a SET/ICT lesson, he thinks that facilitating this lesson is going to be done in his old ways by using XO laptops. Then when Mr. Murenzi starts to prepare this lesson he finds it difficult to conceive how those laptops will be used in this lesson.
 - a) Advise Mr. Murenzi on how he is going to facilitate this lessons
2. What do you think can make a lesson called theory based?
3. Using the primary SET syllabus, the student book and the teacher’s book identify lessons that can be taught as theory based lessons. For lessons that appear difficult to you go to the internet in order to be able to teach them

Summary Notes

The table below shows the lessons found in the primary SET syllabus and textbooks that can be thought as theoretical lessons:

Level	Unit title	Lesson title
Primary 1	Unit 3: Basic ICT tools	<ul style="list-style-type: none">• Basic ICT tools (introduction)• Uses of basic ICT tools
Primary 2	unit 3: Computer my Friend	All lessons
Primary 3	unit 2: The use of a telephone	Main parts of a telephone keypad
Primary 4	Unit 3: Computer my Friend:	<ul style="list-style-type: none">• Computer• Data and information• Technology (one hour out of 2) check other units in book• Digital and analog data,• Hardware and software,

Primary 5	Unit 4: Computer My Friend	<ul style="list-style-type: none"> • Data and memory (2 lessons) • Examples of data and memories (3 lessons) • Evaluation (Answer theory questions in RevisionActivity 4)
	Unit 5: Writing skills	<ul style="list-style-type: none"> • Evaluation (Answering theory questions in Revision Activity 5)
	Unit 6: Computer research	<ul style="list-style-type: none"> • Evaluation (answering theory questions in revision activity 6)
	Unit 7. Programming for children(one part)	<ul style="list-style-type: none"> • Lesson 1: Drawing geometric Shapes(Learner's Activities:Group discussion on how to draw regular polygons using Turtle Artinstructions) • Lesson 3: Drawing geometric Shapes (Learner's Activities :Group discussion on how to draw a parallelogram) • Lesson 5: Drawing geometric Shapes (Learner's Activities: Group discussion on how to draw a rhombus) • Lesson 7: Drawing geometric Shapes (Learner's Activities :Group discussion on how to draw a trapezium) • Lesson 19: Evaluation (Answering theoretical questions)
Primary 6	Unit 5. Computer research	<ul style="list-style-type: none"> • Introduction to search engines • How to conduct an effective internet search

Application Activity 11.1

1. Briefly discuss the content of the lessons found in the SET/ICT syllabus that can be taught as theoretical
2. Discuss the difference between the lessons you have chosen as theoretical with the remaining lessons found in the SET/ICT syllabus

11.2. Technics and strategies to facilitate a theory based lesson

Activity 11.2

1. Discuss how you would help pupils learn a lesson which has a bigger part of theory
2. In that theory based lesson how are you going to teach the eventual small practical parts?
3. When it comes to theory content there is a tendency to think that when a learner can reproduce what he knows, it is already enough. What do you think of that tendency?

Summary Notes

A teaching strategy is the method you use to convey information to your students.

There are different strategies and techniques that a teacher can use in order to facilitate a theory based lesson and no one is better than another. Every technic and strategies to use will depend on the teacher's choice and the latter will depend among others on the learning objectives, the feedback got from previous lessons and the class size.

11.2.1. Criteria for a lesson to be theory based

Lessons can be classified in different ways depending on different criteria. Depending on the focus of a lesson in terms of whether the lesson provides practical skills or not lessons can be theory based or practical.

A theory based lesson is the one which focuses on concepts and their understanding. Such a lesson can be based by the learning of concepts with less practice.

Being called theory based does not mean that a lesson does not have portions of practice; practice can be included but in a lesser percentage far below 50%.

11.2.2. Theory lessons and active learning

There is a tendency for teachers to think that when it is a lesson based by theory rather than practice, the teacher will make learners memorize and recite what they have in their brain without necessarily understanding it. Content learned which cannot be internalized, applied in everyday's life, used to solve real life problems can be judged to be of no use.

A better lesson based by the theory should instill in learners the need to explore further solutions by arousing curiosity of what lies beyond the actual situation. It is the role of the teacher to create in the learners minds the need for further knowledge.

A theory based lesson will develop knowledge and understanding not the one that a learner can reproduce but that shows real change in that learner's life. The acquiring of this knowledge and understanding will materialize in the form of attitudes and values that she/he will exhibit vis a vis different real life situation therefore learning should not be taken out from real life, learning should not be said to have happened if there is no change in the behavior of the learner even outside the classroom.

Skills should also be thought about in a theory based lesson. The teacher, for every lesson should envisage which skills may be developed through the lesson.

11.2.3. Practice in a theory based lesson

A theory based lesson is not completely all theory, there can be some small items that can be thought in a practical way, in this way a teacher will devise mechanisms to facilitates those non theoretical parts in a theoretical lesson and basically he/she will go through the steps of that small part (say practice based lesson) very quickly in order to facilitate that lesson. While facilitating the small practical part, the teacher will make sure it does not occupy the bigger part of the lesson which is theoretical.

11.2.4. Active learning in a theory based lesson

Active learning is the kind of learning by which students are actively involved in the learning process more directly than being given by the teacher what to assimilate. Active learning can improve learners understanding and can help them develop their problem solving and critical thinking skills. Active learning helps develop higher order thinking skills such as application of knowledge, analysis and synthesis. In active learning the main tool is “active methods”

The main active methods used are:

- Whole class demonstration
- Dialog (group work, pair work)
- Investigation
- Problem solving
- Pattern finding
- Role play
- Research

- Experimenting
- Case study

In a theory based lesson, a teacher may use one of the above methods or any methods not mentioned provided it is an active one. In a lesson, the main part will be played by the learners and the teacher will intervene only to facilitate so that learners may properly explore the real situation.

Application Activity 11.2

1. Discuss the various active methods used in a theory based lesson
2. A teacher is about to teach a totally new topic on which he/she thinks learners may not have prerequisites. How can this teacher involve learners? Can he/she just do an expose? Justify your answer

11.3. Theory based lesson steps

11.3.1. Free and guided observation

Activity 14.3

1. A teacher at one school wanted to teach the keyboard keys and brought in the class the images below:



Image 1. XO laptop keyboard



Image 2. An XO laptop

- a) Criticize each of these images if they are to be used for free and guided observation

- b) If these images are not perfect suggest the features of the best image to use for that topic
2. Using the internet or books in the library search for the qualities of an object to use in a free and guided observation

Summary Notes

Nothing can be assimilated if not captured through senses, observation is one way by which information can be got. The getting of that information is done through observations.

Free observation and guided observation are one of the technics to channel the attention of the learners to the lesson to be taught. It captivates the attention by the nature of the object to observe, its beauty and plunge the learners in an urge to explore what is going to be taught.

For a better observation it is better that the features to be observed be highlighted and not hidden on the object to observe so that learners find it easy to observe that feature. The object for observation should not make things difficult for learners, it should not have a lot of features and its complexity should be appropriate to the age of the pupils. When there are features which are not at the appropriate level of the learners, they should be hidden or removed provided the nature of the object is not altered. Objects that can be observed in a SET/ICT lesson are: an XO laptop, a desktop or laptop computer, a written text projected or on paper,...

a. Free observation

Free observation is the one in which an object to be observed is presented to learners who are then given some time with no teacher intervention, to look at that object.

Conducting free observation can be done in one of these ways:

- The teacher prepares an observation text on any one of these resources: blackboard, book, flipchart, projected text, wallchart, slides, maps, or any readable text displayable to learners.
- The teacher may provide pictures of events, people, processes which learners can observe with no interruption.
- The teacher may bring in the class an actual object that learners are going to observe. An example of such an object is a real XO laptop
- Models, which are molded teaching aids mostly in three dimensions can also be brought for observation

When the teacher brings those teaching aids in the classroom, she/he presents them and instructs learners to observe them carefully as they are going to be asked questions on them. The teacher gives enough time depending on the importance of what he/she wants learners to observe.

b. Guided observation

Guided observation is the second step following the free observation. After giving time for observation without teacher interruption the teacher interacts with learners in a way that is to make them reproduce what they have observed. He/she steers that interaction in the direction he/she wants to orient the lesson.

With guided observation, the facilitator interacts with learners by giving instructions or by asking questions which will direct the attention of learners on the features he/she wants to be observed.

Example: If in free observation learners have viewed a keyboard in order to learn the special keys, the teacher may ask learners to show non-letter-characters that they have seen. Learners may see them and where time allows, touch them.

Application Activity 11.3

Referring to the SET/ICT syllabus, the SET Pupil's book and Teacher's Guide (specifically the table of lessons):

1. Identify different teaching materials that can be used in both free and guided observation when facilitating SET/ICT theory based lessons.
2. For each identified object discuss:
 - a. Which features of the object may divert the attention rather than captivate it
 - b. Which questions to ask in the guided observation

11.3.2. Analysis and Synthesis

Activity 11.4

1. Using books or the internet do a research on the following topics:
 - a. The importance of analysis and synthesis in a classroom lesson
 - b. How to better conduct analysis in a classroom
2. Take an example of a theory based lesson and explain how analysis and synthesis can be used in the conduction of that lesson.

Summary Notes

a. Analysis

Analysis consists into a detailed looking at something so as to come up with the parts that constitute it. In case of the objects used in facilitating a SET/ICT lesson, analysis will be carried out on specific aspects of the observed item.

For example, teaching the keyboard keys, and after observation, learners can realize that there are different types of keyboard like those having letters those that have other characters which are not used in entering text. Those which are not used to enter text can be identified as special characters.

b. Synthesis

It is a way of summarizing and concluding what has been done. Synthesis comes after analysis whereby a kind of summary, conclusion is reached. That conclusion comes in form of a short sentence which shows the rule that has to be followed for all aspects that are in the same category. For example a conclusion on the parts of a computer can be reached that a computer has three parts which are the input part, the output and the system unit.

While teaching keyboard keys a conclusion can be reached that a keyboard has text keys and special keys.

Note: In one lesson there can be observation of more than one object. There can also be more than one analysis-synthesis sessions with the closing synthesis being General Synthesis.

Application Activity 11.4

Write a research on the analysis and synthesis methods

11.4. Assessing a theory based lesson

Activity 11.5

Consider the table of lessons under section 11.1 of this textbook which are theory based.

Set sample valid formative assessment questions for each lesson by making sure that each lesson has at least two questions. Your questions must assess competences.

Summary Notes

In the classroom, assessment is the wide variety of methods that teachers use to evaluate and measure student's competences (knowledge and understanding, skills, attitudes and values). Assessment in the classroom can be formative (assessment for learning) or summative. A formative assessment can be oral spontaneous questioning, done online, class exercise, project work, debate, peer or self assessment, homework exercises, or even an observation of an in-class exercises

Summative assessment can be test and examinations, assignment, laboratory work, oral or written reports, written essays and performances

The results of an assessment have an informative role: they inform the teacher on pupils possible strength and weaknesses, the possible gaps on the methodologies used so as to improve future teaching. These same results also inform the pupil on how to improve his/her learning methods by providing feedback on his/her status vis a vis the learning objectives and thus helping them identify which areas they may have misunderstanding

For an assessment question to be valid, it has to evaluate what is stated in the learning objectives found in the syllabus which state the knowledge and understanding, skills, attitudes and values to be got

An assessment question can be on any level of the Bloom's taxonomy which ranges from level 1 to level 6. For assessing students in advanced levels like in Senior 6, it is good to use the higher levels of this taxonomy.

Types of questions to use in assessing a lesson

An assessment question can be either closed or open. A closed question is the one which provides to the learner options among them to choose or which require very short sentences as answers. while for open questions the learners have to formulate answers.

Closed questions can be multiple choice, true/false questions, sequencing (where steps of a process are ordered in their succession), labelling diagrams, matching, drag and drop (using a computerized system).

Application Activity 11.5

1. Explain how the different types of assessment can be used in a SET/ICT lesson
2. Formulate valid assessment questions for theory based lessons found in unit “Computer my friend” making sure that each level of the bloom’s taxonomy has at least one question
3. Using different types of closed questions, formulate valid closed questions for lessons in unit 7 in Primary 5 (Programming for children)

11.5. Lesson plan for a theory based lessons

Activity 11.6

Do a lesson plan for one of these lessons of your choice:

- a. Main parts of a telephone keypad (P3)
- b. Data and information (P4)
- c. Lesson 3: Drawing geometric Shapes (Learner’s Activities: Group discussion on how to draw a parallelogram) in P3

Summary Notes

In this topic, a lesson on “Hardware and software”, one of the theory based lessons found in the primary 4 syllabus is going to be prepared. The first step in this preparation is to have a mental image of what is the content to be taught. For this image to be accurate, there is a need to consult existing documentations namely the syllabus and the existing textbooks (Pupil’s book and Teacher’s Guide). The teacher can also look for additional documentation in other books and the internet.

11.5.1. Consulting documentations

The main documentation to look for are the SET syllabus and textbooks. The teacher can also look for additional documentations like library books and the internet.

In case of this lesson, there is a need to look for the unit it belongs to, the key unit competence, the knowledge, skills, attitudes and values corresponding to the lesson in the unit, the learners activities and the teacher’s activities. This will

help the teacher know what is to be given as a lesson and how to give it.

Note: As much as possible, the teacher, in whatever lesson will try to have knowledge, skills, attitudes and values to develop so as to have a developed competence per lesson.

11.5.2. Lesson preparation

After doing the basic analysis on the lesson to be taught and consulting rapidly the existing documentations, the teacher will go straight to the lesson preparation. Here is a lesson plan for Hardware and Software:

Some guidelines for preparing a lesson plan and lesson presentation:

a. Formulation of instructional objectives

- Objectives should cover all the main achievements in the lesson.
- Should be realistic and correspond to the learning objectives syllabus and the key unit competence.
- The verbs in objectives should imply learners' observable behaviour.
- While writing objectives, condition and degree (criterion) should be clearly stated.

b. Developing the content

Plan ahead on how you are going to manage the time allocated to the lesson. Indicate the time in minutes for each of these step: introduction, the main body: Step 1, Step 2...and conclusion. Organize all the activities in a way that you can complete in time

For developing the introduction part of a theory based lesson you can proceed in this way:

- Develop an introductory problem/puzzle that awakens the learners' minds
- Bring in the class a new or unfamiliar equipment to be used for the exploration of the new subject
- Tell a story that contains many scenarios related to what is going to be learnt
- Display text, motion and still images

While developing the content refer to Bloom's taxonomy so that you make it appropriate to the level you want to develop and make it consistent with the syllabus.

At the end, the lesson will be concluded by giving a summary of the main points,

giving an assessment exercise, giving a reading assignment to consolidate the content that has been learnt, using 'set induction' to prepare students for the next lesson.

11.5.3. Sample lesson plan for a SET /ICT topics

School Name: x Teacher's name: y

Term	Date	Subject	Class	Unit N°	Lesson N°	Duration	Class size
I		SET	P4	3	7	40	
Type of Special Educational Needs to be catered for in this lesson and number of learners in each category				None			
Unit title		Computer My Friend					
Key Unit Competence:		To be able to use common ICT terms and differentiate Sugar and Gnome user interfaces					
Title of the lesson		Hardware and Software					
Instructional Objective		By using Xo laptop, Pupils will be able to identify parts of a computer hardware and can differentiate hardware from software accurately					
Plan for this Class (location: in / outside)		In the computer lab					
Learning Materials (for all learners)		XO laptop					
References		SET Pupil's Book and Teacher Guide					

Timing for each step	Description of teaching and learning activity		Generic competences and cross cutting issues addressed
	Teacher activities	Learner activities	
Introduction 5min	<ul style="list-style-type: none"> - The teachers starts by asking technological materials that they find in different locations so as to come up with a computer. - The location to focus on may be the school, banks, hospitals - The teacher asks for which parts of a computer they know - The teacher asks what is the title of the lesson they are going to learn 	<p>Learners cite different materials including a desktop/laptop computer and an XO laptop</p> <p>Students cite the parts of a computer namely hardware and software</p> <p>Pupils discover the lesson title: hardware and software</p>	Communication: pupils answer to the teacher's questions
<p>Develop-ment of the lesson (25min)</p> <p>Free observation</p>	<p>The teacher asks learners to observe the computers they have in front of them</p> <ul style="list-style-type: none"> - The teacher instructs students to observe the desktop computer as a whole - The teachers draws the attention no specific parts by asking pupils to observe the desktop computer parts System unit, Screen, keyboard, mouse and printer but without telling them their names. - The teacher instructs learners to observe the XO laptop as a whole then draws the attention on every part to observe and to touch 	<p>Pupils observe freely the desktop computer and the XO laptop silently</p> <p>Pupils observe the whole desktop computer</p> <p>The pupils observe the part of a computer shown by the teacher and touch them(manipulate)</p> <p>Pupils observe the whole computer and then observe each part shown by the teacher and touch them</p> <p>Pupils push the power button</p>	Communication skills through answering question

<p>Guided observation</p>	<p>- The teachers asks questions aimed at discovering different parts of a desktop computer. For each part the teacher help them discover the name.</p> <p>Questions:</p> <p>a). What are the visible part of the desktop computer?</p> <p>b). What are the visible part of an XO laptop</p> <p>- The teacher asks questions aimed at making pupils discover that the visible parts are called hardware like:</p> <p>i) What is the name of the visible and hard parts?</p> <p>- The teacher instructs pupils to find the button used to switch on the computer (both desktop and XO) and push it. He then asks them what has happened</p>	<p>Pupils answer the question by showing each part of a desktop computer and thereafter state its name.</p> <p>Pupils show and name the parts of an XO laptop</p> <p>Possible answers: Physical parts Hardware</p> <p>Pupils locate the power button and push it. They realize that the computer is switched on.</p>	
<p>Analysis Synthesis</p>	<p>The teacher makes pupils come to a conclusions on the following:</p> <p>The visible part of a computer is hardware</p> <p>The invisible part is called software</p> <p>The hardware has the system unit, the screen, the mouse and the keyboard</p>	<p>Pupils answer questions aimed at discovering the parts of a computer both a desktop and an Xo laptop</p>	

Conclusion 5 min	The teacher gives an oral evaluation with the following questions by focusing mostly on slow learners. 1. Define software 2. Give different parts of hardware 3. Switch on your XO laptop	Pupils answer the given questions	
Teacher self-evaluation	The teacher evaluates the methods and technics he/she used during the lesson and identify what needs to be corrected		

For the above lesson the teacher will have to make sure in advance that all computers are properly plugged so as not to be surprised when he/she asks pupils to switch on the computers. In case the teacher is to use other teaching materials like pictures or images he/she will have to prepare them in advance

For a durable impact and in order to help those who may not have grasped the learned concepts, images related to the learned concepts, here computers and their peripherals, need to be hung on the wall. Learners will be reading images voluntarily or by the help of the teacher. After some while and when it is obvious that many image on the wall may constitute a distraction, the teacher will remove them and replace them with newer images of recent lessons.

Application Activity 11.6

1. Prepare a lesson plan on the lesson “Lesson 5: Drawing geometric Shapes (Learner’s Activities: Group discussion on how to draw a rhombus)” for unit 7 about Programming for children in primary 5.
2. What is the role of images hung on the wall of a classroom
3. Discuss different technics that can be used to introduce a SET/ICT lesson

End unit assessment

1. Explain the steps to teach a SET/ICT theory based lesson
2. Discuss how you can develop the body of a theory based lesson

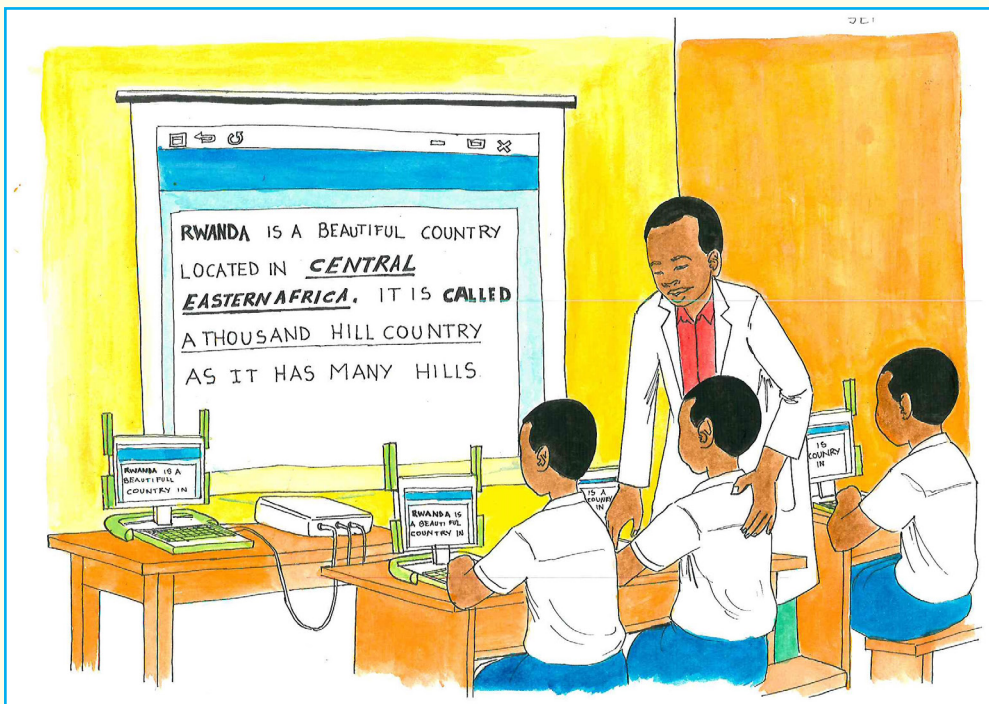
UNIT 12 : CONDUCTING PRACTICE BASED ICT LESSONS

Key unit competence:

To apply methodological steps and technics in conducting practice based lessons

Introductory Activity

1. Observe the image below :



- a. What do you think is the title of the lesson being taught?
- b. Suggest lesson steps for such a lesson
- c. Suggest at least 10 other lessons in the Primary P4, P5 and P6 syllabus/book that can be taught using the lesson steps suggested in b)

12.1. Practice based lessons

Activity 12.1

1. Using the SET syllabus, the SET Pupil's Book and Teacher Guide list lessons that are more practical than theoretical and give the criteria for a lesson to be called practiced based?
2. For each lesson discuss briefly the content to be given to pupils and for topics/lessons that appear difficult to you consult the primary SET textbooks or seek help from your tutor
3. A teacher of ICT at a given school was complaining that teaching using ICT is time consuming as the teacher has to move among the pupils as he/she teaches. He/she proposes teaching those lessons as theory based. Give a piece of advice to this teacher.

Summary Notes

Level	Unit title	Lesson title
Primary 3	Unit 2: The use of a telephone	All lessons under these topics: <ul style="list-style-type: none">- Writing, sending and receiving short messages on a telephone- Saving a telephone number and making a call- Taking pictures and recording sounds using a telephone- Transactions on mobile phone
	Unit 3: Computer my Friend	All lessons under these topics: <ul style="list-style-type: none">- Typing turtle program- Write Activity program- Record Activity Program
Primary 4	Unit 3: Computer my Friend	<ul style="list-style-type: none">- Communication- Technology- Activity and Project- Sugar Interface- Gnome Interface- The Journal- Searching and Retrieving a Saved Document in the Journal

Primary 5	Unit 4: Writing skills	<ul style="list-style-type: none"> - Text Selection - Formatting Text - The Keyboard and Touchpad
	Unit 5: Graphics and Multimedia	<ul style="list-style-type: none"> - Paint Application - Toolbar - Drawing with Free Hands - Drawing Using Shapes - Comments on a Picture and Save, Close and Open an Activity
	Unit 6: Computer research	All lessons
	Unit 7: Programming for children	<ul style="list-style-type: none"> - Drawing geometric Shapes (lesson 2, 4, 6, 8) - Arithmetic operations (lesson 9, 10, 11, 12) - Create Dialogues and Cartoons (lesson 13, 14) - Commands and speeches (lessons 15 and 16) - Working with backgrounds (lessons 17, 18 [2 lessons])
Primary 6	Unit 4. Writing Skills	All lessons in this unit
	Unit 5. Computer research	All lessons in this unit
	Unit 6: Programming for children	All lessons in this unit

Application Activity 12.1

1. Open the pupils' book of Primary 5 and identify which lessons can be taught as practice based in unit 6 (computer research)
2. Explain why it is not appropriate to teach a practice based lesson as a theory based one

12.2. Techniques and strategies for facilitating a practice based lesson

Activity 12.2

Using the internet or any book in your library:

1. Do a research on techniques you can use to facilitate a practice based lesson
2. Discuss different difficulties that pupils may have in learning a typing and practical based lesson

Summary Notes

While teaching, there are means that are used to make sure the methods are more effective so as to make teaching and learning even more effective. Technique can also be defined as the methodology or the skill a teacher is using while teaching in the class. Technics are therefore there to help the teacher get the most out of a method.

Typing is an activity in which the keyboard is much used. It is mostly the writing of text in Abiword. Practice is any activity that involves practical work in order to accomplish a given task and in this case the practice is done using a computer.

While facilitating a practice based lessons some technics and strategies can be the following:

- Pupils can be put in groups in order to discuss about a given topic related to practice
- Pupils can be given a task and work on it with each helping his/her peer
- Pupils can be given a broad topic on which they can do an investigation and come up with a solution
- The teacher can show an example of what to do and pupils do it
- Pupils can help one another carry out the exercise given by the teacher
- Pupils can do out-of-the lesson exercises which will help them consolidate what they have learnt

Application Activity 12.2

Explore additional strategies that can be used to facilitate a practice based lesson (lesson: Sugar Interface, P4, Unit 3: Computer my friend:)

12.3. Lesson steps for a practice based lesson

Activity 12.3

1. Explain and differentiate steps of a practice based lesson (a Teacher in P5 is going to conduct a lesson entitled: Drawing regular polygons (unit programming for children) what are the steps teacher will he follow to facilitate that lesson effectively)
2. In a practice based lessons there may be few theoretical concepts that need to be learnt. Discuss the methodologies to be used in learning them.

Summary Notes

Preparing a lesson which is based on practice requires having teaching and learning materials necessary for practical. For example a lesson to learn/teach how to write using Abiword program found in the XO laptop will require the presence of a computer laboratory with enough XO laptops and preferably one for each child. However the use of laptops in any lesson tends to make pupils attention be captivated by something else apart from the topic at hand; it is the responsibility of the teacher to make sure learners are not distracted and that only what he/she wants them to do is what they really do.

The teacher will also make sure in advance that the required teaching materials are ready to be used. For this reason, she/he will take some time before starting a lesson in order to set up the teaching laboratory. Sometimes teachers spend much time while already in the class in plugging computer, in helping learners do it and so many other activities. The teacher can avoid this by making sure all that is needed to conduct his/her lesson is already in place and ready to be used.

There is also a tendency for some learners who have more skills on computers to go astray and explore programs that are not being dealt with during the current lesson. These learners cannot properly acquire the content of the lesson as sometimes it is difficult for them to follow the teacher and come back where he/she is. This attitude also tends to distract nearby learners who see the screen of their comrade and feel amazed that they can do such things.

It is the responsibility of teachers to make sure all learners are at the same pace. For quick learners, the teacher may spot them and make them help their colleagues.

12.3.1. Description of lesson steps for a practice based lesson

A. Observation

This observation is on a teaching aid that will be used during the lesson. The teaching aid to use should as much as possible be a concrete one but a semi concrete can be used where a concrete one can't be found. With the teaching aid being observed, the teacher will ask questions aimed at directing learners to the lesson to be learned. As much as possible pupils will have to discover the lesson to be learned instead of the teacher announcing it.

The teaching aid to observe will illustrate what is to be done. For example if it is how to format text, the teacher may display text with different formatting and thus interest learners in writing the text like the one shown to them. If it is drawing geometric shapes he/she may produce a process of drawing that shape in the form of a video, or a drawing showing the drawing process.

The teaching aids can be auditory, visual or audio-visual aids

B. Analysis

Learners will do a critical thinking based on the observed teaching aid. They will identify highlighted parts on which the teacher wanted them to draw their attention. They will try to guess how it is done to have such results

C. Practical

The teacher makes pupils go to the computer and do tasks aimed at having results like the one illustrated in the teaching aid. The teacher will make sure it is done step by step so as to facilitate the understanding of the task to accomplish. He/she will lead and make sure they don't go astray and do other unrelated tasks on their XO laptops.

D. Evaluation/assessment

The evaluation of a practice based lesson should be practical, only few theoretical questions can be asked to complement the practical ones and the learner will be evaluated basing on the quality of the work accomplished.

The teacher may give extra work to do on the computer as skills are more consolidated when learners have extra time on computers. The time of the lesson is to learn how it is done but for the skills in doing it to be wired in the learners' brains, there is a need to have enough time for those skills to be acquired.

Learners will save their works in a way that will facilitate the teacher to locate them when she/he wants to evaluate. He/she can also evaluate as they are doing their work depending on what is to be evaluated. For example if the teacher wants to know if learners can write there is no need to wait for the saved work.

Application Activity 12.3

1. State and explain the steps for a practice based lesson
2. Having the following topics, discuss methodological steps of teaching them
 - a. A dancing sprite
 - b. Scratch projects
 - c. Sending and receiving email

12.3.2. Sample lesson plan for a practice based ICT lesson

Activity 12.4

1. Prepare a lesson plan on one lesson found in primary which is practice based

Summary Notes

Consider a lesson on Formatting Text:

Lesson Plan: School Name: x Teacher's name: y

Term	Date	Subject	Class	Unit N°	Lesson N°	Duration	Class size
I		SET	P4	4	2	40	
Type of Special Educational Needs to be catered for in this lesson and number of learners in each category				Visually			
Unit title		Unit 4. Writing skills					
Key Unit Competence:		To be able to perform write activity					
Title of the lesson		Text formatting					
Instructional Objective		Using many exercise, Pupils will be able write text and format it by making it bold, italic and underlined					
Plan for this Class (location: in / outside)		In the computer lab					
Learning Materials (for all learners)		XO laptop, Printed formatted text paper					
References		SET Pupil's Book and Teacher Guide					

Timing for each step	Description of teaching and learning activity		Generic competences and cross cutting issues addressed
	Teacher activities	Learner activities	
Introduction 5min	<p>The teacher write the text on the blackboard asks questions aimed at discovering different means used to write text: Which devices are used to write?</p> <p>The teacher then shows an example of text written using a computer.</p> <p>The teacher announces that the current lesson is about writing beautiful looking documents like the one shown to them He/she asks what they think is the lesson they are going to study</p>	<p>Devices that are used to write are computers.</p> <p>Pupils appreciate the the beauty of computer written document</p> <p>Pupils discover the current lesson that they are going to study</p>	Critical thinking through discovering other ways / means of writing text
Development of the lesson (25min)	<p>The teacher projects a sentence which has some text which is bold, italic, or underlined and asks questions on it aimed at discovering words that are differently highlighted.</p> <p>An entrepreneur is a person who sets up a <i>business or businesses</i>, by taking on <u>financial risks</u> in <i>the hope of profit.</i></p>	Pupils observe the sentence and realize that some words are written differently compared to others	Critical thinking through realizing how some word is written

<p>Observation</p>	<p>The teacher makes pupils analyze the sentence word by word by focusing on the words that are bold, italic and underlined. He/she ask questions so as to make them describe each word and when that word is analyzed they move on to another word</p> <p>Some of those questions may be: Which word is different from others? How is it different?</p>	<p>Pupils identify words that are differently highlighted by responding to the teacher’s question.</p> <p>Words that are different are: entrepreneur, <i>business or businesses</i>, <u>financial risks</u>, <i>the hope of profit</i>.</p> <p>Pupils respond to teachers questions by describing the word differently highlighted</p> <p>Responses are: The entrepreneurs more black the words <i>business or businesses</i> are inclined to the right (oblique), the words <u>financial risks</u> have lines under them while the words <i>the hope of profit</i> have lines under and are more black.</p>	
<p>Analysis</p>	<p>The teacher asks one pupil to give a sentence (related to Geography) on which they are going to practice boldening, underlining and italicizing. The teachers makes students choose words that they want to be bolded</p>	<p>Pupil give the sentence. That sentence can be:</p> <p>Rwanda is a <i>beautiful country</i> located in <u>central Africa</u> surrounded by <i>Uganda, Tanzania, DRC</i> and <i>Kenya</i>.</p>	

	<p>The teachers asks pupils to write the sentence with no formatting then tell them to format each word accordingly. He/ she moves to see if any child has done it properly</p> <p>The teacher ask if there are some pupils that have done it, they tell the class the steps they have followed to do it (by starting with bolding, then italization then underlining). When the provided answer is correct the teacher repeats it in simpler terms, demonstrates it and tell the pupils to do it on their sentences</p>	<p>Pupils write the sentence with no formatting then try to format it (before they are told how to do it)</p> <p>Pupils respond by stating the steps to make the text bold</p> <p>Following the demonstration by the teacher pupils make the words bold</p> <p>Pupils respond by stating the steps to make the text italic</p> <p>Following the demonstration by the teacher pupils make the words italic</p> <p>Pupils respond by stating the steps to make the text underlined</p> <p>Following the demonstration by the teacher pupils make the words underlined</p>	
Practical			<p>Creativity and innovation through writing the sentences</p> <p>Communication skills through answering oral question</p>

<p>Evaluation 10 min</p>	<p>The teacher gives an exercise to pupils of making bold the text in a given sentence. The sentence is shown using a projector or is written on the blackboard.</p>	<p>Pupils write this sentence given by the teacher: Misuse of agricultural tools can lead to injuries to people and their co-workers. <u>Incorrect storage of tools</u> could also lead to injuries. We may get cut with the sharp edges of the tools. Therefore, agricultural tools must be handled with care.</p>	
<p>Teacher self-evaluation</p>	<p>The teacher analyses how she/he conducted the lesson in order to improve in the text lesson</p>		

Application Activity 12.4

Analyze the lesson plan above and devise an alternative of how observation, analysis and practical can be conducted (do another lesson plan of the same lesson above)

End unit assessment

1. What are the lessons found in Primary six that can be classified as practice based lessons?
2. Develop a lesson plan for the lesson on “Lesson 4: Drawing geometric Shapes (Learning activity: Drawing parallelogram using Turtle Art instructions.)”
3. In the lesson plan on “Formatting text” given in this book, the examples of text given are related to different subjects already learnt. Explain the importance of this in a lesson.

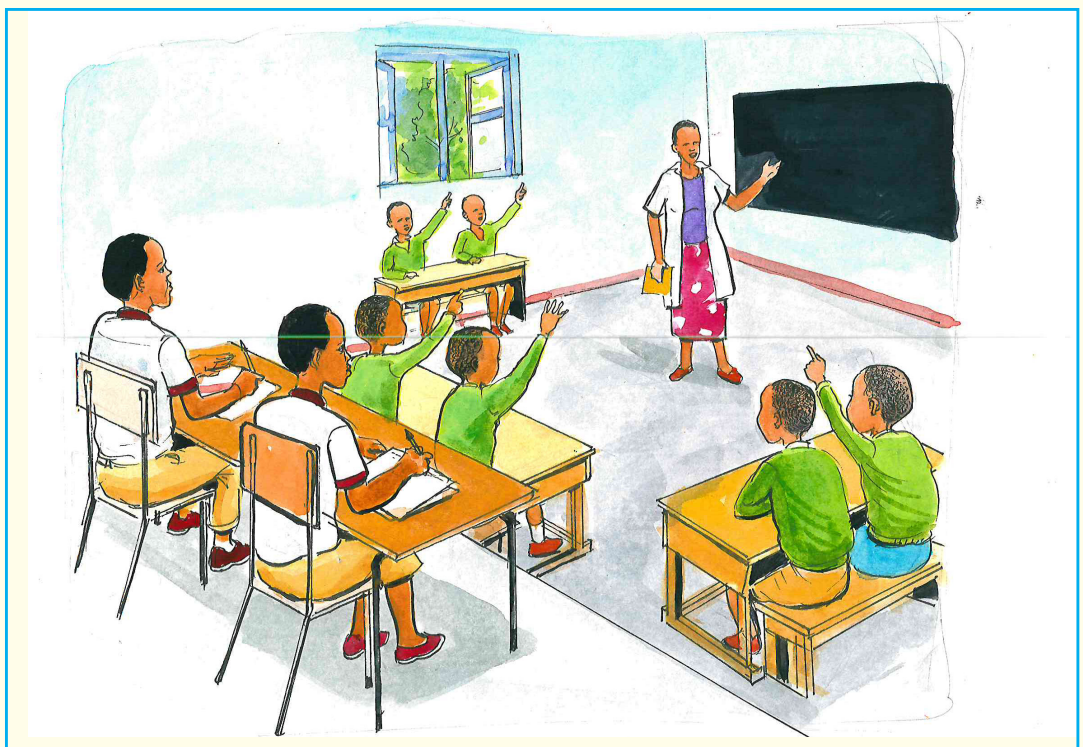
UNIT 13 : SCIENCE AND ELEMENTARY TECHNOLOGY LESSON OBSERVATION

Key unit competence:

Evaluate adequacy of teaching and learning techniques, strategies, resources and other practices used during model lessons performed in a specified teaching and learning environment.

Introductory Activity

The tutor of TMP plan with student teachers to visit neighboring primary school to observe a SET lesson taught by the teacher of primary. List and describe items you will observe to ensure that learners are engaged in the learning process.



13.1. SET classroom observation

Activity 13.1

1. Refer to the steps of lesson observation learnt in the Foundation of education and discuss the activities for a lesson observer.
2. List and describe the elements to consider when observing a SET lesson

Summary Notes

Evaluating and improving the teaching practice is done through the collection of the right information, analyzing it and providing feedback. In school, classroom observation can be used to characterize and identify both effective teaching and effective teachers.

The classroom observation to be done in TTC is designed for providing to student teachers insight and experience in teaching activities rather than evaluating teachers.

a. Before lesson observation

First and foremost, student teacher doing lesson observation must read the observation guide and be conversant with it. Apart from the lesson observation form, the observer must be equipped with a notebook to take down some important events (actions, gestures, teacher's or learners' attitudes, etc) that occurred during the lesson, which are likely to influence the teaching/learning process or the observer's appreciation. In addition, the observer should be equipped with SET knowledge so that feedback will be based on correct information.

b. During the lesson observation

The student teacher observing the lesson progressively completes the form and takes notes on events as they occur in his/her notebook. Those notes will be a referential basis for the appreciation on different aspects of the lesson. The student teacher observes every aspect of the lesson including those learnt in foundation of education and in the previous units of this SET TMP. The observer must avoid any open intervention during the lesson.

c. Feedback after the observation

The student teacher doing lesson observation re-writes events from the notebook as comments in corresponding rows of the lesson evaluation form.

He/she gives time to the teacher to give his/her point of view on the delivered lesson, the observer listens to teacher whose lesson was observed and tutor's feedback, and then takes time to ask questions related to his/her comments to the teacher whose lesson was observed and the tutor.

The lesson observer dedicates some minutes to the conversation with the teacher and tutor; the latter expresses him/herself about some facts that characterized the lesson. The teacher will have ample time to express his/her intentions/motivation about his/her choice of lesson objectives, activities envisaged for learners, methods used, organizational and evaluation styles, processes and results.

Eventually, the lesson observer makes his/her general appreciation on each item or aspect observed by ticking the box matching with the suitable letter in the lesson evaluation form. He/she writes (if necessary) on the observation slip relevant recommendations towards the teacher and/or the school. The lesson observer counts down ticks in each box to formulate the general appreciation.

The observer's general appreciation, expressed with verbal scale is then calculated on the basis of appreciations on all aspects of the lesson evaluation form.

Six tips for improving lesson observation feedback

i. Capture your lesson

Whether you are being observed or observing someone else, video can be an objective tool for you both, allowing you to have a two-way discussion rather than just a feedback session. Reviewing the video together means you can actively discuss, pause, rewind, fast-forward and allow your colleague to come to their own conclusions, making it more meaningful for you both.

ii. Use exploratory questioning

This type of questioning naturally opens up dialogue, giving you time to think and draw conclusions. For example, try saying: "What do you think you could do to tackle the problem of..." rather than "What you need to do is..."

iii. Make feedback constructive

Even if a lesson does not go to plan, the situation can be turned into a positive one if you give the teacher constructive feedback and help them to learn from the situation. Constructive feedback helps identify solutions for areas of weakness by looking at what can be improved rather than focusing on what went wrong.

iv. Relate back to previous objectives set

Always keep a clear focus in mind. Relate your discussion to the targets already set, if new topics arise; set these as development targets for your next session. Staying focused will allow you to give some 'easy wins'; developing a feeling of immediate progression. Be clear in your own mind about why you are feeding back. What exactly do you want your colleague to achieve with what you are telling them?

v. Be patient

Give you and your colleague time to draw your own conclusions and then explore them together without cutting across one another. You will develop a stronger, more professional relationship.

vi. Do it again

Whether giving or receiving lesson observation feedback, request you do it again and regularly. Only by continually discussing and breaking down what you saw can help you understand progression.

13.2. Components of a SET lesson observation sheet

The lesson observation sheet contains items to be verified but those items are given in a general way to help different subject teachers or observers to use it.

The following are the main components of a lesson observation sheet at the international level (Education Development Trust, 2018):

	Item	Indicator (detail)
1	Assessment and evaluation	Assessment is aligned with goals and instructional objectives
		The teacher gives explicit, detailed and constructive feedback
2	Differentiation and inclusion	The teacher creates an environment in which all learners are involved
		The teacher takes full account of learner differences
3	Clarity of instruction	The teacher shows good communication skills
		There is clear explanation of purpose
		Lessons are well structured
4	Instructional skills	The teacher is able to engage learners
		The teacher possesses good questioning skills
		The teacher uses various teaching methods and strategies

5	Promoting active learning and developing meta-cognitive skills	The teacher helps learners develop problem-solving and meta-cognitive strategies
		The teacher gives learners opportunities to be active learners
		The teacher fosters critical thinking in learners
		The teacher connects material to learners' real-world experiences
6	Classroom climate	All learners are valued
		The teacher initiates active interaction and participation
		The teacher interacts with all learners
		The teacher communicates high expectations
7	Classroom management	Learning time is maximized
		Clear rules are evident
		Misbehavior and disruptions are effectively dealt with

Source: *Education Development Trust, 2018.*

It is better to note that even though all of the items of the observation sheet are desired qualities of a SET classroom, not all of them are expected to be observed during a single lesson. Some items can be highlighted depending on the instructional objectives of a specified lesson observation. It is expected that all items can be considered in a formative manner.

The following items will be catered for during a SET lesson observation:

1. Learners engaged in exploration/investigation/problem solving

Score	Description
3	Learners regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the learners engaged in exploration/investigation/problem solving.
2	Learners sometimes engaged in exploration, investigation, or problem solving. Several learners engaged in problem solving, but not the majority of the class.
1	Learners not often engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few learners engaged in problem solving while other learners watched but did not actively participate.
0	Learners did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.

2. Learners used a variety of materials or means (models, drawings, graphs, concrete materials, manipulative, etc) to represent SET concepts

Score	Description
3	The learners manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or learners, as appropriate.
2	The learners manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were not explicitly discussed by the teacher or learners.
1	The learners manipulated or generated one representation of a concept.
0	There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the learners only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.

3. Learners were engaged in lesson activities

Score	Description
3	Most of the learners spend two-thirds or more of the lesson engaged in lesson activities at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a science activity unless the learners are filling in the notes and interacting with the lesson scientifically.)
2	Most of the learners spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level lesson activity. It does not matter if it is one prolonged activity or several shorter activities.
1	Most of the learners spend less than one-quarter of the lesson engaged in appropriate level lesson activity. There is at least one instance of learners' science engagement.
0	Most of the learners are not engaged in appropriate level lesson activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not scientific – such as a coloring activity.

4. Learners critically assessed scientific strategies

Score	Description
3	More than half of the learners critically assessed scientific strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
2	At least two but less than half of the learners critically assessed scientific strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
1	An individual learner critically assessed scientific strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a learner making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one learner.
0	Learners did not critically assess scientific strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the learners about the strategy (ies), and learners did not actively participate.

5. Learners persevered in problem solving

Score	Description
3	Learners exhibited a strong amount of perseverance in problem solving. The majority of learners looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of learners continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
2	Learners exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
1	Learners exhibited minimal perseverance in problem solving. At least one learner but less than half of learners looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary.

	When confronted with an obstacle (such as how to begin or what to do next), at least one learner but less than half of learners continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.
0	Learners did not persevere in problem solving. This could be because there was no learner problem solving in the lesson, or because when presented with a problem solving situation no learners persevered. That is to say, all learners either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.

6. The lesson promoted modelling with SET

Score	Description
3	Modeling (using a scientific model to describe a real-world situation) is an integral component of the lesson with learners engaged in the modeling cycle.
2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the learners to find the key pieces of information and how to plug them into a procedure.); or modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of scientific practice.
1	The teacher describes some type of mathematical model to describe real-world situations, but the learners do not engage in activities related to using scientific models.
0	The lesson does not include any modeling with SET.

7. The lesson provided opportunities to examine scientific structure. (Symbolic notation, patterns, generalizations, conjectures, etc)

Score	Description
3	The learners have a sufficient amount of time and opportunity to look for and make use of scientific structure or patterns.
2	Learners are given some time to examine scientific structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.
1	Learners are shown generalizations involving scientific structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.
0	Learners are given no opportunities to explore or understand the scientific structure of a situation.

8. The lesson included tasks that have multiple paths to a solution or multiple solutions

Score	Description
3	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different learners.
2	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; or more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; or a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages learners from trying different techniques.

9. The teacher's talk encouraged learner's thinking

Score	Description
3	The teacher's talk focused on high levels of scientific thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis , and evaluation. Analysis : examines/ interprets the pattern, order or relationship of the science; parts of the form of thinking. Synthesis : requires original, creative thinking. Evaluation : makes a judgment of good or bad, right or wrong, according to the standards he/she values.
2	The teacher's talk focused on mid-levels of scientific thinking. Interpretation : discovers relationships among facts, generalizations, definitions, values and skills. Application : requires identification and selection and use of appropriate generalizations and skills
1	Teacher talk consists of " lower order " knowledge based questions and responses focusing on recall of facts. Memory : recalls or memorizes information. Translation : changes information into a different symbolic form or situation.
0	Any questions/ responses of the teacher related to scientific ideas were rhetorical in that there was no expectation of a response from the students.

10. There were a high proportion of learners talking related to SET

Score	Description
3	More than three quarters of the learners were talking related to the SET lesson at some points during the lesson.
2	More than half, but less than three quarters of the learners were talking related to the SET lesson at some points during the lesson.
1	Less than half of the learners were talking related to the SET lesson.
0	No learners talked related to the SET lesson.

11. There was a climate of respect for what others had to say

Score	Description
3	Many learners are sharing, questioning, and commenting during the lesson, including their struggles. Learners are also listening (active), clarifying, and recognizing the ideas of others.
2	The environment is such that some learners are sharing, questioning, and commenting during the lesson, including their struggles. Most learners listen.
1	Only a few share as called on by the teacher. The climate supports those who understand or who behave appropriately. Or Some learners are sharing, questioning, or commenting during the lesson, but most learners are actively listening to the communication.
0	No learners shared ideas.

12. In general, the teacher provided wait-time

Score	Description
3	The teacher frequently provided a sufficient amount of “think time” for the depth and complexity of a task or question posed by either the teacher or a learner.
2	The teacher sometimes provided a sufficient amount of “think time” for the depth and complexity of a task or question posed by either the teacher or a learner.
1	The teacher rarely provided a sufficient amount of “think time” for the depth and complexity of a task or question posed by either the teacher or a learner.
0	The teacher never provided a sufficient amount of “think time” for the depth and complexity of a task or question posed by either the teacher or a learner.

13. Learners were involved in the communication of their ideas to others (peer-to-peer)

Score	Description
3	Considerable time (more than half) was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.
2	Some class time (less than half, but more than just a few minutes) was devoted to peer to peer (pairs, groups, whole class) conversations related to the SET.
1	The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.
0	No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.

14. The teacher uses learner questions or comments to enhance conceptual scientific understanding

Score	Description
3	The teacher frequently uses learner questions or comments to coach learners, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the learner responses that will be displayed in an intentional order, and/or connects different learners' responses to key scientific ideas.
2	The teacher sometimes uses learner questions/ comments to enhance conceptual understanding.
1	The teacher rarely uses learner questions/ comments to enhance conceptual scientific understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.
0	The teacher never uses learner questions/ comments to enhance conceptual scientific understanding.

Application Activity 13.1

Explain what you can do when the teacher whose lesson you observed refuses the feedback you are giving.

End unit assessment

1. Explain why a teacher should be smart in terms of dressing.
2. Discuss the documents a teacher should carry during teaching and learning process.

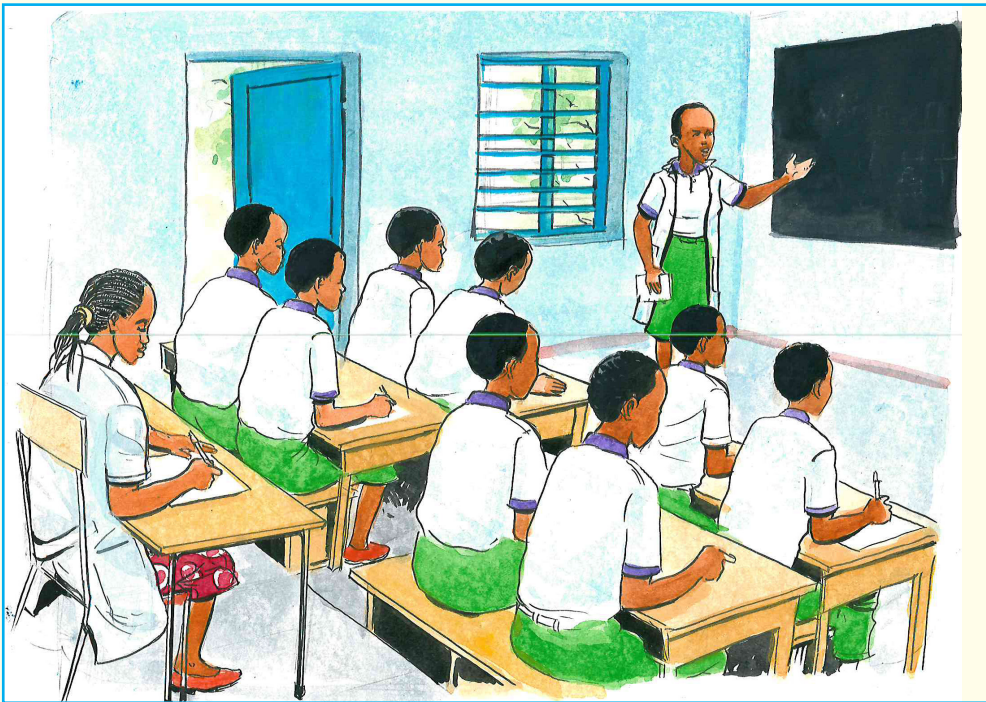
UNIT 14 : MICRO-TEACHING

Key unit competence:

Prepare and facilitate SET lessons to peers in a simulated context

Introductory Activity

Observe the figure below illustrating the micro-teaching and answer the asked questions.



1. Label the persons in this classroom
2. What are the roles of each category labeled?
3. Is the microteaching beneficial to student teachers and teachers? Why and how?

14.1. Concept of microteaching

Activity 14.1

1. What is microteaching?
2. What are the benefits of micro-teaching?
3. List and describe the steps involved in micro-teaching.

Micro-teaching is a method which enables student teacher to practice a skill by teaching a short lesson to a small number of student-teachers. A tutor, using an appraisal guide, usually rates the lesson and then discusses it with the student teacher. Where closed circuit television (CCTV) to take videos is available, the appraisal guide may be redundant. The student teacher may alter his/her approach if necessary and later re-teaches the lesson to another group of student teachers. This lesson is also rated by the supervisor and then analyzed and discussed with the student teacher.

Microteaching is one of the most recent innovations in teacher training program which is used as a professional developmental tool in pre-service or in-service teacher training programs. Microteaching helps student teachers to better understand the processes of teaching and learning and provide the opportunity to learn teaching skills, to study their own teaching, and to study the teaching of others. The microteaching has the potential to improve the student teachers' pedagogic skills, competencies, self-confidence, beliefs, and attitudes with minimum available facilities and to provide student-teachers with valuable teaching experiences and make them aware of the benefits and relationships between theory and practice.

In Rwandan context, microteaching is organized in teacher training programs where a student teacher plans a short lesson, teaches it to a reduced group of student teachers (Three to ten) or all his/her colleagues in a limited time (20 to 30 minutes) lesson, and then reflects on their teaching afterwards. The lesson is video recorded for either individual or peer review. The student teacher's micro-lesson is reviewed, discussed, analyzed, and evaluated to give a feedback. Based on this feedback, the student teacher re-teaches the micro-lesson, incorporating those points raised during the discussion and analysis.

14.2. Core skills applicable in microteaching

The teaching activity as a whole is divided into its individual component skills.

1. **Lesson planning** with clear-cut objectives and an appropriate planned sequence. The content should be concise, appropriate, relevant, and could cover the specified duration.
2. **Introduction skill (Set induction)** - The process of gaining learner's attention at the beginning of the class by establishing rapport with learners, promoting their attentions, exposing them to essential contents, and linking their previous knowledge with the topic.
3. **Presentation and explanation skills** – Teacher enthusiasm, explanation, narration, giving appropriate illustrations and examples, planned repetition, and encouraging group discussion wherever necessary. The student teacher should be able to rightly explain the concept by simple, relevant, and interesting examples to increase learners' understanding.
4. **Skill of stimulus variation** – Securing and sustaining the attention of the learner is imperative for a good teacher. The effective components of the skill are gestures (hand, facial, body), change in the speech pattern, voice variation and modulation (pitch, volume, speed), change in the interaction pattern, focusing, pausing movement, emphasis on significant points.
5. **Proper use of audio-visual aids** – The increased awareness of the audiovisual aids and other equipment is important for this skill. Neatness, readability, adequate spacing, distinct size, proper spacing between words and lines, and use of relevant words or phrases are the key components for this skill.
6. **Skill of black-board writing:**
Legibility – easy to read, size and alignment (in a straight line), highlighting main points, utilization of the space, black-board summary, correctness, position of the teacher, contact with the pupils.
7. **Reinforcement** - Recognizing pupil's difficulties, listening, encouraging pupil participation and response. The use of positive verbal and non-verbal cues would be the key components for this skill.
8. **Skill of probing questions** - Probing questions are those which help the pupils to think in depth about the various aspects of the problem enabling pupils to understand the subject deeply. It is important to allow and encourage the fellow student teachers to ask structured questions and clarify doubts. Redirection, refocusing, and increasing critical awareness are important components of this skill.

9. Silence and nonverbal cues (body language)

10. Classroom management – Providing proper instructions, restricting inappropriate behavior, and calling the pupils by name are essentials of this skill.

11. Skill of achieving closure - Method of concluding a teaching session so as to bring out the relevance of what has been learnt, its connection with past learning and its application to future learning. Questions and statements by the teacher by consolidation of the major points covered during the lesson and ability for applying the knowledge gained by pupils during the lesson to new situations. Closure should be timely! Prepare to start and end in time.

14.3. Benefits and roles of microteaching

- Microteaching provides the student teachers with real teaching situations
- It provides opportunity for practice and mastery of selected skills
- It offers feedback from tutor and peer that help to improve teaching skills,
- Student teachers get the opportunity to reflect and improve teaching skills.
- It boosts the confidence of student teacher
- It allows student teachers to correct any mistake that may arises in scheming and lesson planning.

14.4. Steps in microteaching

The following are steps followed in microteaching:

1. Orientation of the student teachers: It involves providing necessary information and theoretical background about micro teaching on the following aspects:

- Concept of micro teaching
- Significance of using micro teaching
- Procedures of micro teaching
- Requirements and setting for adopting micro teaching technique.

2. Discussion of teaching skills: In this step the concept of teaching skill is clarified to the student teacher so that they develop knowledge and understanding about the following:

- Analysis of teaching into different component teaching skills.

- Significance of these skills in classroom teaching.
 - Component teaching behaviors of different teaching skills.
3. **Selection of a particular teaching skill:** The student teacher selects a particular teaching skill for practice.
 4. **Presentation of a model demonstration lesson:** A demonstration lesson in that particular teaching skill is presented to the student teachers. This stage is known as modelling. Demonstration can be given in a number of ways.
 - By exhibiting a film or a video tape.
 - By making them to listen to an audiotape.
 - By arranging a demonstration lesson from a live model i.e by the teacher educator or some expert.
 - By providing written material such as hand book, guide etc.
 5. **Observation of the model lesson and criticism:** An observation schedule is designed for the observation of the lesson and is distributed to the student teacher. A critical appraisal of the model lesson is made by the student teachers on the basis of the observation and analysis.
 6. **Preparation of micro lesson plan:** For practicing the demonstrated teaching skill, the student teacher prepares a micro lesson plan. For this he may take guidance and help from the teacher educator, books etc.
 7. **Creation of micro-teaching setting:** The model of micro-teaching gives the following setting:
 - Number of students/pupils to teach
 - Type of pupils: real pupils or preferably peers
 - Type of supervisors - teacher educators or peers.
 - Time duration for micro-teaching lesson
 - Time duration for micro-teaching cycle (plan, teaching, feedback, re-plan, re-teach, re-feedback).
 8. **Practice of the Skill:** Under this step the student teacher teaches a micro-lesson to a micro- class. This lesson is observed by the tutor and the peer group with the help of the appropriate observation schedule. The lesson can be recorded using an audiotape or video tape.
 9. **Feedback:** Immediate feedback is given by the tutor and the peer group.

10. Re-planning: On the basis of the feedback the student teacher re-plans the lesson.

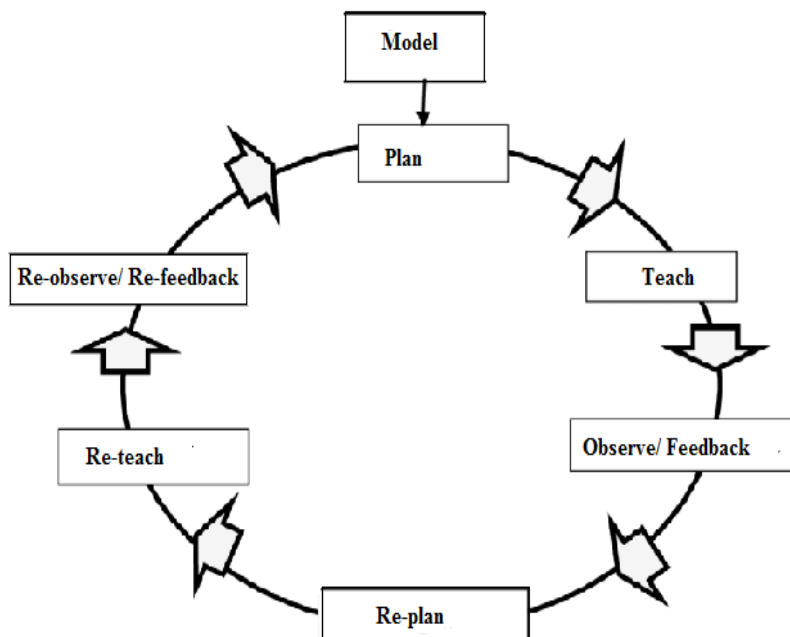
11. Re-teaching: The session where the student teacher re-teaches his/her micro-lesson on the basis of his/her re-planned lesson.

12. Re-feedback: The student teacher is provided re-feedback on the re-taught micro-lesson.

13. Integration of the skills: This is the last step and is concerned with the task of integrating several skills individually mastered by the student teacher. It is helpful in bridging a gap between training in isolated teaching skills and the real teaching situation faced by a teacher.

Microteaching cycle

To sum up, during microteaching process, the “teach-re-teach” cycle may be repeated several times till desired level of skill or adequate mastery is achieved. Such repeated cycles of teaching, feedback and re-teaching help the student teacher to improve his teaching skills one at a time. The microteaching cycle continues up to when a student teacher will be able to master a specific skill.



Source: Reddy KR, 2019; adapted by the content provider

Application Activity 14.1

1. In the teaching practice, summarize the following: who is supposed to give feedback, to whom, when and why to give feedback; the process of giving feedback and receiving feedback: readiness to accept and to improve.
2. Organize a microteaching with your peers who will fill the observation sheet while observing your teaching practice. Respect all steps of microteaching.

End unit assessment

1. What do you understand by microteaching?
2. Discuss the skills a student teacher gain from micro-teaching.
3. Describe how microteaching is applicable at primary school.

UNIT 15 : CLASSROOM TEACHING PRACTICE

Key unit competence:

Plan and facilitate various SET lessons in a demonstration schools

Introductory Activity

Choose a SET topic to be taught in a demonstration school, analyze it and draw its implementation, step by step.

15.1. Teaching practice

Activity 15.1

1. What do you understand by teaching practice?
2. Discuss the purpose of teaching practice.

Summary Notes

Teaching practice is a period that a student teacher spends teaching at a school as part of his or her training. It is also an organized activity that helps the student teacher to real teaching and learning situation with an aim of helping him/her to gain confidence and experience in teaching.

It aims at preparing the student teacher for a teaching career at the primary school (the classroom organization, classroom management and the SET teaching skills).

The teaching skills to be enhanced by the student teacher during the teaching practice include, among many others the skills of introducing a lesson, the skills of questioning, the skills of reinforcement, the skills of probing, the skills of explaining, the skills of stimulus variation, manipulative skills, the skills of illustrating

with examples, skills of demonstration, the skills of using blackboard, the skills of silence and non-verbal cues, the skills of using different teaching and learning materials, the skills of recognizing and managing different behaviors, the skills of achieving closure.

Purpose of teaching practice

The teaching practice aims the following:

- It provides the opportunity to develop positive approach and attitudes to the school and school community which facilitate to grow in profession awareness and development of the student teacher.
- It provides the opportunities to establish relationship with learners, teachers and other stakeholder involved in education.
- It provides opportunity to discover and develop one's ability as a future teacher,
- It gives the opportunity to interact and understand learners and attempt to cater for their individual need ;
- It provides the opportunities to have classroom experiences and apply the theoretical skills learnt in college;
- It gives the opportunity to develop qualities crucial to teaching such as humility, interpersonal skills, openness and patience.
- Generally, it provides opportunity to develop necessary teaching skills mentioned in previous part.

Application Activity 15.1

1. Discuss the teaching skills to be possessed by a SET teacher of primary school.
2. A student teacher of Year 3 will go in school attachment next month. By categories of teaching practices, provide to him a letter of advices which will guide him in his teaching at primary.

End unit assessment

1. What do you understand by teaching practice?
2. Discuss the skills a student teacher gains from teaching practice.
3. What will you do to increase the learners' readiness and their engagement when you start teaching SET for the first time at primary?

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