



Information and Communication Technology

for Rwandan Schools

Secondary 2

Teacher's Guide



© 2024 Rwanda Basic Education Board

All rights reserved

This book is property of the Government of Rwanda. Credit must be given to REB
when the content is quoted.



FOREWORD

Dear teacher,

Rwanda Basic Education Board is honored to present to you the ICT Teacher`s Guide for Senior Two which serves as a guide to competence-based teaching and learning to ensure consistency and coherence in the learning of ICT. The Rwandan educational philosophy is to ensure that learners achieve full potential at every level of education which will prepare them to be well integrated in society and exploit employment opportunities.

In line with efforts to improve the quality of education, the government of Rwanda emphasizes the importance of aligning teaching and learning materials with the syllabus to facilitate their learning process. Many factors influence what they learn, how well they learn and the competences they acquire. Those factors include the relevance of the specific content, the quality of teachers` pedagogical approaches, the assessment strategies and the instructional materials available. We paid special attention to the activities that facilitate the learning process in which learners can develop ideas and make new discoveries during concrete activities carried out individually or with peers. With the help of the teachers, learners will gain appropriate skills and be able to apply what they have learnt in real life situations. Hence, they will be able to develop certain values and attitudes allowing them to make a difference not only to their own life but also to the nation.

This is in contrast to traditional learning theories which view learning mainly as a process of acquiring knowledge from the more knowledgeable who is mostly the teacher. In competence-based curriculum, learning is considered as a process of active building and developing of knowledge and understanding, skills and values and attitude by the learner where concepts are mainly introduced by an activity, situation or scenario that helps the learner to construct knowledge, develop skills and acquire positive attitudes and values.

In addition, such active learning engages learners in doing things and thinking about the things they are doing and they are encouraged to bring their own real experiences and knowledge into the learning processes. In view of this, your role is to:

- Plan your lessons and prepare appropriate teaching materials.
- Organize group discussions for learners considering the importance of social constructivism suggesting that learning occurs more effectively when the learner works collaboratively with more knowledgeable and experienced people.
- Engage learners through active learning methods such as inquiry methods, group discussions, research, investigative activities and group or individual work activities.
- Provide supervised opportunities for learners to develop different competences by giving tasks which enhance critical thinking, problem solving, research, creativity and innovation, communication and cooperation.

- Support and facilitate the learning process by valuing learners' contributions in the class activities.
- Guide learners towards the harmonization of their findings.
- Encourage individual, peer and group evaluation of the work done in the classroom and use appropriate competence-based assessment approaches and methods.

To facilitate you in your teaching activities, the content of this teacher's guide is self-explanatory so that you can easily use it. It is divided in 3 parts:

- **Part 1:** It explains the structure of this book and gives you the methodological guidance;
- **Part 2:** It gives the sample lesson plan as reference for your lesson planning process;
- **Part 3:** It provides details of the teaching guidance for each concept given in the student book.

Even though this Teacher's Guide contains the answers for activities given in the learner's book, you are requested to work through each question and activity before judging learner's findings.

I wish to sincerely appreciate all people who contributed towards the edition of this teacher's guide, particularly REB staff who organized the whole process from its inception. Special gratitude goes to all experts in design and layout services, illustrations and image anti-plagiarism, lecturers and teachers who diligently worked to successful completion of this book. Any comment or contribution would be welcome for the improvement of this textbook for the next edition.



Dr. MBARUSHIMANA Nelson
Director General, REB





ACKNOWLEDGEMENT

I wish to express my appreciation to all the people who played a major role in editing process of ICT Teacher's Guide for Senior Two. It would not have been successful without their active participation.

Special thanks are given to those who gave their time to read and refine this book to meet the needs of competence-based curriculum. I owe gratitude to different Universities and Secondary Schools in Rwanda that allowed their staff to work with REB to edit this book. I therefore, wish to extend my sincere gratitude to lecturers, teachers, illustrators, designers and all other individuals whose efforts in one way or the other contributed to the success of this edition.

Finally, my word of gratitude goes to the Rwanda Basic Education Board staff particularly those from Curriculum, Teaching and Learning Resources Department who were involved in the whole process of editorial work.



Joan MURUNGI,

Head of Curriculum, Teaching and Learning Resources Department

Contents

Foreword.....	iii
Acknowledgement.....	v
Introduction.....	1
Background: The Competence-based Curriculum.....	1
Why teach and learn ICT?	2
Application of ICTs in Society.....	2
Empowering the Learner with ICT Skills	2
The Structure of this Teacher’s Guide	2
The Competencies to be Developed	3
Generic Competencies	3
Broad ICT Competencies at the End of Ordinary Level	4
Developing ICT Competencies in a Learner	5
Pedagogical Approaches.....	5
What is Your Role as the Teacher?.....	5
What is the Role of the Learner?	6
Special Needs Education and Inclusive Approach	7
Incorporating Cross-Cutting Issues during the Learning and Teaching Process.....	8
Assessment Approaches	10
Types of Assessment.....	10
Formative and Continuous Assessment (Assessment for Learning)	10
Summative Assessment (Assessment of Learning).....	11
Record Keeping	11
Sharing the Progress Report with Parents/Guardians	11
Development of Assessment Tests	12
Structure and Format of the Examination	12
ICT Tools Required for Practical Assessment	13
Teaching and Learning Resources	13
Materials Needed for Successful Teaching and Learning Activities	13

Human Resources	14
The Skills and Attitudes Required for the ICT Teacher	15
Content Structure.....	15
General Presentation	15
Key Competencies at the end of Secondary Three.....	16
A Sample of a Competence-Based Lesson Plan.....	18
Self Assessment.....	21

Unit 1: Data Protection

1.1 Content Map for the Unit	23
1.3 Reference to the Student’s Book for Senior 2	25
1.4 Key Unit Competency	25
1.8 Additional Content for the Teacher	26
1.14 Suggestions for Accommodating Special Needs Education (SEN)	30

Unit 2: ICT in Financial Transactions

2.1 Content Map for the Unit	37
2.3 Reference to the Student’s Book Senior 2	39
2.4 Key Unit Competencies	39
2.8 Additional Content for the Teacher	40
2.14 Suggestions for Accommodating Special Needs Education (SEN)	44

Unit 3: Objects in a Document

3.1 Content Map for the Unit	54
3.3 Reference to the Student’s Book for Senior 2.	56
3.4 Key Unit Competency	56
3.8 Additional Content for the Teacher	57
3.14 Suggestions for Accommodating Special Needs Education (SEN)	63

Unit 4: Spreadsheet Basics

4.1 Content Map for the Unit	74
4.3 Reference to the Student’s Book for Senior 2.	76
4.4 Key Unit Competency	76

4.8	Additional Content for the Teacher	78
4.14	Suggestions for Accommodating Special Needs Education (SEN).....	81

Unit 5: Worksheet Data Presentation.....

5.1	Content Map for the Unit	90
5.3	Reference to the Student’s Book for Senior 2	92
5.4	Key Unit Competency	92
5.8	Additional Content for the Teacher	93
5.14	Suggestions for Accommodating Special Needs Education (SEN)	97

Unit 6: ArcGis

6.1	Content Map for the Unit	104
6.3	Reference to the Student’s Book for Senior 2.	106
6.4	Key Unit Competencies	106
6.8	Additional Content for the Teacher	108
6.14	Suggestions for Accommodating Special Needs Education (SEN)	110

Unit 7: Complex Formulae and Functions.....

7.1	Content Map for the Unit	117
7.3	Reference to the Student’s Book for Senior 2.	119
7.4	Key Unit Competencies	120
7.8	Additional Content for the Teacher	121
7.14	Suggestions for Accommodating Special Needs Education (SEN)	124

Unit 8: Network Components and Social Media Applications.....

8.1	Content Map for the Unit	133
8.3	Reference to the Student’s Book for Senior 2	135
8.4	Key Unit Competencies	135
8.8	Additional Content for the Teacher	137
8.14	Suggestions for Accommodating Special Needs Education (SEN)	139



Unit 9: Game Programming.....

9.1	Content Map for the Unit	149
9.3	Reference to the Student’s Book for Senior 2.	151
9.4	Key Unit Competency	151
9.8	Additional Content for the Teacher	152
9.14	Suggestions for Accommodating Special Needs Education (SEN)	162

Introduction

Background: The Competence-based Curriculum

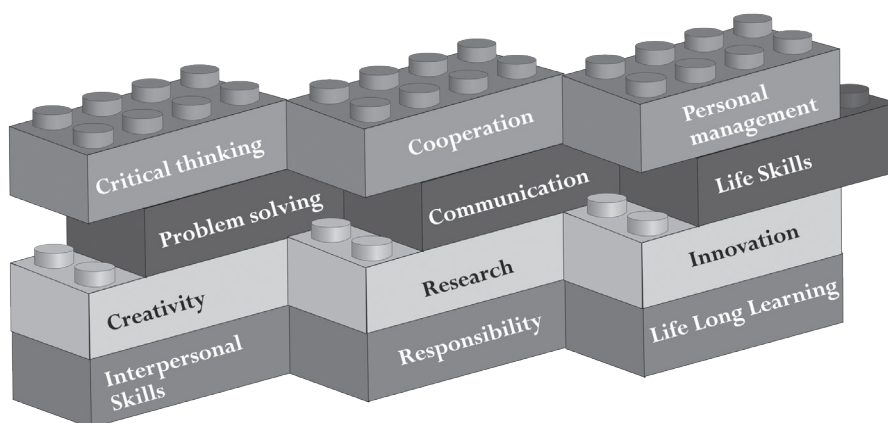
The revised ICT syllabus on which this Teachers' Guide has been developed is competence-based. This means that this is an enhanced curriculum. In addition to knowledge in a learner, it emphasises the development of the learners' competencies.

The ICT syllabus is emphatic on what the learner can do. In this way the learner is able to apply the knowledge and skills acquired. In this competence-based curriculum, the teacher is required to use the learner-centred approach during the teaching and learning process. The focus should be on application rather than recall.

The structure of the competency-based curriculum ensures that the learner is able to apply relevant and modern ICT technologies. Technology is dynamic. New developments take place all the time. For this reason, it is important that learners are up-to-date on modern technologies in terms of application, user devices, and their relevance to daily life.

The syllabus is in line with recommendations, guidelines, and vision for our country as provided in different government policies that relate to education and its role in development. Of particular interest is the *Education Sector Strategic Plan 2013 and Vision 2020* that gives guidance on the quality of education, and emphasises on the role of science, technology and innovation in education.

The syllabus addresses the *Second Economic Development and Poverty Reduction Strategy (EDPRSII)* and the draft *ICT policy in Education 2014* to offer ICT to learners at all levels. It is also in line with the NICI III plan. This is the strategic plan for ICT development in Rwanda in line with Vision 2020.



In addition to knowledge, a competence-based curriculum develops learners' competencies.

Why teach and learn ICT?

Application of ICTs in Society

Information and communications technology (ICT) is an important part of modern life. It is being applied in every aspect of human society. The government is keen on the application of ICTs in every sector in order to achieve efficiency in governance and sustainable development. Globally, the application of ICTs has become key in attaining sustainable development and efficient government services. It is also notable that acquiring skills in ICTs also give the learner an edge to participate in economic development at the global scene.

Empowering the Learner with ICT Skills

This course on ICT is intended to empower the learner with skills on varied subjects. They include computers, the Internet, telecommunication technologies, and mobile telephony. The learner also gets exposure on the application of ICT in various sectors including banking, education, medical, security, and manufacturing among others.

In this course, the learner will get introduced to common application software such as word processing, spreadsheets and presentations. Others are programming, Internet security, and graphic and multimedia manipulation. The learner also gets some exposure to skills of spatial data analysis and manipulation through Geographical Information Systems (GIS).

The Structure of this Teacher's Guide

This Teacher's Guide gives the basis for teaching and learning ICT in Senior 2. It also spells out the objectives of learning the course, the pedagogical approach, and the assessment approach. The course is divided into learning units. For each unit, the following are provided:

- A brief introduction
- Content map for the unit
- Reference to the Student's Book for Senior 2
- Number of lessons
- The key competencies to be developed: These make up the expected outcomes after the completion of the unit
- The learning objectives: These are the knowledge, skills, attitudes, and values to be developed
- Preparation by the teacher
- The content to be covered: This presents the concepts to be covered in line with the competence-based syllabus.

- Key terms to be introduced and explained to the learner
- Suggested Teaching and Learning Materials
- Suggested learning and teaching activities the class will be involved in
- Additional content for the teacher
- Cross-cutting issues to be integrated in the teaching and learning activities
- Suggestions for accommodating Special Education Needs (SEN)
- Support for the development of positive attitudes
- Suggestions for supporting multi-ability learning
- Suggestions for assessments
- Suggested formative and summative assessment
- Links to other subjects
- Additional remedial, consolation, and extension exercises
- Answers to the learning activities and exercises in the Student's Book

Note: A sample lesson plan is included in this Teacher's Guide. See page 18.

The Competencies to be Developed

Competencies refer to abilities or skills that the learner is expected to demonstrate after a learning process. Competencies indicate that the learner has the capability to perform to the expected standards in a given field of expertise.

Basic competencies are stated in the comprehensive subject competencies and in the given objectives for the subject units covered in the course. The generic and the basic competencies to be developed during the teaching and the learning process are briefly described below. Every teacher is expected to create teaching and learning activities or tasks that will create opportunities for learners to acquire the given skills.

Generic Competencies

1. **Critical and problem-solving skills:** These are essential skills. Developing these skills in a learner will help him or her think independently, become creative, and seek to discover solutions to problems encountered in everyday life.
2. **Creativity and innovation:** The development of these skills in a learner will help him or her become resourceful in society. A learner equipped with creativity and innovation is able to think beyond the knowledge acquired at the classroom level. He or she is likely to take initiative in tasks and activities. He or she is able to come up with ideas or strategies in solving problems that are experienced from day to day.
3. **Research:** Skills to carry out research are critical as they help learners to gather and analyse information. In this way they are able to explore and discover answers to arising questions.

4. **Communication in official languages:** This skill is key to the teaching and learning process. It serves as the medium of instruction during the learning activities. It is expected that all teachers, regardless of the subjects they are teaching, will guide the learners to use the proper language. Teachers should guide the learners to communicate clearly and share ideas effectively in both spoken and written language. New vocabulary and its usage should also be explained to the learner.
5. **Cooperation skills:** Learners should be sensitised about the importance of teamwork in any activity. In most learning and teaching activities and projects, they will be expected to work with others. It is important that they embrace team spirit in order to achieve their targets.
6. **Interpersonal skills:** The ability of every learner to relate with others is key in any task. In this way they will be able to respect the opinion of others and treat each other courteously.
7. **Management skills:** The ability of every learner to be organised and achieve the set targets is important in the learning process. Learners will be assigned tasks and projects in pairs, groups or as individuals. It is expected that they will be able to manage time as well as other resources at their disposal optimally and achieve to the expected standards.
8. **Life skills:** These are abilities that enable an individual to live a healthy life and cope with situations that arise in day-to-day situations.
9. **Lifelong learning:** This refers to the acquisition of skills that enable a learner to keep themselves informed in knowledge and skills. In this way, learners keep themselves up-to-date in varied knowledge fields.

Broad ICT Competencies at the end of Ordinary Level

As spelt out in the ICT competence-based curriculum, the aim of this course is to:

- Transform Rwandan citizens into technology-skilled human capital for the socioeconomic development of the nation.
- Provide a solid foundation of technological understanding for learners to integrate into society and the world of work.
- Familiarise learners with the use of ICT tools and the impact of ICT in daily life.
- Familiarise learners with communication and research techniques by combining skills, attitudes and values.
- Demonstrate communication, research, practical problem solving, observation, creativity and innovation in everyday life.
- Organise and manipulate information using common application software namely word processing, the Internet, spreadsheets, presentations, graphics, and multimedia.

- Manipulate spatial data using Geographical Information Systems (GIS).
- Develop computational thinking and logical reasoning through computer programming.

Developing ICT Competencies in a Learner

This ICT course is expected to contribute to a learner's development of critical thinking, research and problem solving, creativity and innovation, communication and cooperation skills. This is achievable. Learners will learn about both hardware and software. Learners will also be sensitised to handle ICT safely, securely, and ethically. They will be expected to learn computing tools. The topics to be covered include word processing, spreadsheets, presentations, Geographical Information Systems (GIS), and graphics and multimedia application software.

Through ICT, learners will be expected to identify problems in information processing. They may require to carry out research, analyse the existing factors and develop solutions to the identified problems.

Learners will be equipped to use appropriate identified methods to solve problems. They will be expected to explore, test, evaluate and refine solutions to societal problems.

Pedagogical Approaches

In a competence-based curriculum, teaching and learning activities are centred on the learner. For this reason, the learner should be actively involved in the learning process. This can be achieved through engaging them so that they can participate actively. Guide them to contribute to discussions. Involve them in group or pair activities, and let them take leadership positions in the groups. Every learner should get an opportunity to either chair and take notes, or give the group presentation.

It is also important to appreciate each learner as an individual. Some are slow, others are fast, others are average, while others may have special needs. Plan and execute every lesson with all the needs and abilities of the learners in mind. You may have to use different strategies to take care of each group of learners. Be flexible to accommodate all the learners. Although the learner is the element of focus during every lesson, your role, of guidance, is key for effective teaching and learning to take place.

What is your Role as the Teacher?

The competence-based curriculum is learner-centred and learner-oriented. This transformative approach ensure that the students learn by doing. They do not just get knowledge for recall. In this way, the teacher becomes a facilitator. He or she shifts from giving instructions and takes up the role of giving guidance.



This could be achieved in the following ways:

- Allow learners to experience ICT content through the use of available resources. This will help to meet each of the learner's needs.
- Identify the needs of each of the learners, and find ways to meet those needs at the individual level.
- Make the lessons participatory. Organise the learners into pairs or small groups so that the level of interaction is high. Working in groups will nurture teamwork and cooperation.
- Always give learners an opportunity to explore a concept before giving details about it. Use the oral question-and-answer method. Regardless of the answer a learner gives, your role is to encourage them to be participatory.
- Structure the teaching and learning activities in a way that will help the learners enrich their own knowledge, skills, and attitudes.
- Expose learners to different technologies. The use of teaching aids such as models, digital content, and simulators will go a long way to enrich the learning process.
- During the practical lessons, guide the students carefully. Give clear instructions. Use demonstrations as a guide on how to proceed with the activity. Once you have given clear instructions, allow the learners to embark on the activities. Indicate to them that they are free to seek clarifications at any one time. Ensure that every student participates in the activities.
- Institute remedial strategies in and outside the classroom/computer laboratory to accommodate slow learners and those with special needs. Help them to keep pace with fast and average learners.
- During practical lessons, guide learners to work individually, in pairs, or in groups. This will be dependent on the availability of computers and other ICT resources. Regardless of the situation ensure that every learner gets an opportunity to work with the equipment or resource.

What is the Role of the Learner?

All the teaching and learning activities must be learner-centred. The following are ways in which you could engage the learners to ensure that the process is based on their interests, experiences, and needs:

- Ask them to make observations.
- Ask them to suggest appropriate learning resources.
- Ask them to propose ways in which they could improvise learning resources.
- Encourage them to ask questions directing them to the teacher, as well as to their fellow learners.
- Ask them open-ended questions that will encourage discussions and debate.

- Ask them to suggest activities they could carry out for selected topics.
- Encourage them to participate in the planning of the activities.
- Guide them to search for information relevant to the topics to be learnt.
- Guide them to make observations and report their findings.
- Guide them to work collaboratively with others as a team.
- Guide them to consider the ideas of others.
- Allow them to communicate their ideas, findings, and explanations effectively.
- Engage them in constructive debates through dialogue with both the teacher and the rest of the learners.
- Guide them to defend their work and explanations effectively without offending members of the group.
- Allow them to apply their learning experiences to real-life situations.
- Appreciate the initiative of the learners and urge them on.
- Use the learners' explanations to drive the lessons and delve deeper into topics.
- Encourage the learners to be open-minded and share freely their thoughts on concepts.
- Prompt them to further explain, or clarify their responses and findings.
- Present situations that may seem to contradict the learners' experience in order to encourage discussion.
- Nurture curiosity among students by encouraging them to ask questions.

Special Needs Education and Inclusive Approach

Every learner has a right to access education regardless of their varied needs. For this reason, every learner is expected to benefit from the educational program in this competence-based syllabus. Hence, the need to give emphasis to special needs education.

In a class of learners, there may be children who are enabled differently in the way they live and learn. This difference could be emotional, physical, sensory, or intellectual. The difference may pose a challenge for the learner. In embracing globally recognised human rights, these learners have a right to receive education. The expectation is that the school with such different learners will subsequently enrol them and set strategies to provide them with a platform to learn and benefit from education.

It is expected that where such cases exist, the teacher will consider the affected learner's needs during the teaching and learning process. In each unit presented in this Teachers' Guide, suggestions have been given on how to assist such learners. The assessment strategies adopted and the activities should take into consideration the needs of these learners.

Incorporating Cross-Cutting Issues during the learning and teaching process

Depending on the topic you are handling, the Cross-Cutting Issues to be integrated in the teaching and learning activities include the following:

- (a) **Genocide studies:** Provide young people with an understanding of the circumstances that led to the genocide and the remarkable story of recovery and re-establishing national unity.

Genocide studies help the learners to comprehend the role of every individual in ensuring nothing of the sort ever happens again. In this way, students are nurtured to become peace ambassadors.

- (b) **Environment sustainability:** There is growing awareness of the impact of the human race on the environment. This has led to the recognition of the need to ensure that our young people understand the importance of sustainability and become responsible for the world around them. Hence environment and sustainability is a very important Cross-Cutting issue.

Learners need basic knowledge from the natural sciences, social sciences and humanities to understand and interpret the principles of sustainability. They also need skills and attitudes that will enable them in their everyday life to address the environment and climate change issue, and to have a sustainable livelihood.


- (c) **Gender:** There is a strong moral imperative to afford every individual their basic human rights and gender inequality results in women and girls being treated less favourably than men.

A strongly negative impact of unequal treatment affects the nation as a whole. This results in women being held back, and their talents and abilities not being fully realised. With a good understanding of the principles of Gender Equality, it is intended that future generations will ensure that the potential of the whole population is realised.

- (d) **Comprehensive sexuality education (HIV/AIDS, STI, Family Planning, Gender equality and reproductive health):** Comprehensive sexuality education which is age-appropriate, gender-sensitive, and life skills-based can provide young people with the knowledge and skills to make informed decisions about their sexuality and lifestyle.

Preparing children and young people for the transition to adulthood has been one of humanity's great challenges with human sexuality and relationships at its core.

Few young people receive adequate preparations for their sexual lives. This leaves them potentially vulnerable to coercion, abuse and exploitation, unintended



pregnancy, and sexually transmitted infections (STIs) including HIV/AIDS. Many young people approach adulthood faced with conflicting and confusing messages about sexuality and gender. This is often exacerbated by embarrassment, silence, disapproval and open discussion of sexual matters by adults (parents, teachers) at every time when it is most needed.

Comprehensive sexuality education supports a rights-based approach in which values such as respect, acceptance, tolerance, equality, empathy, and reciprocity are inextricably linked to universally agreed human rights.

(e) **Peace and Values Education:** The need for peace and values education in the curriculum is obvious. Peace is clearly critical for society to flourish and for every individual to focus on personal achievement and their contribution to the success of the nation. Values education forms a key element of the strategy for ensuring young people recognise the importance of contributing to society, working for peace and harmony and being committed to avoiding conflict.

(f) **Financial Education:** Financial education makes a strong contribution to the wider aims of education. It makes learning relevant to real life situations. It aims at a comprehensive financial education program as a precondition for achieving financial inclusion target and improves the financial capability of Rwandans.

Financial education has a key role of not only improving knowledge of personal but also transforming this knowledge into action.


It provides the tools for sound money management practices on earnings, spending, saving, borrowing and investing. Financial education enables people to take appropriate financial services, both formal and informal, that are available to them. It also encourages financial behaviours that enhance their overall economic wellbeing.

(g) **Standardisation Culture:** Standardisation culture develops the learners' understanding of the importance of standards as a pillar in economic development and in the practices, activities and lifestyle of citizens.

It is intended that the adoption of standardisation culture should have an impact upon health improvement, economic growth, industrialisation, trade and general welfare of the people.

While education is the foundation and strength of a nation, standards are one of the key pillars of sustainable economic development.

(h) **Inclusive Education:** Every government in the world is obligated to ensure that all learners are engaged in education, and that they are welcomed by other students so that each learner can achieve his or her potential.



An inclusive practice embraces every individual regardless of gender or ability, including those with learning difficulties. The utmost focus of inclusive curriculum is one of ensuring participation in education of learners with different learning styles and other difficulties.

To be successful, inclusive education entails a range of issues including nurturing a positive attitude in teachers, adapting the learning resources, differentiating the teaching and learning methods, and working together for a common goal. Overall, the benefits of an inclusive curriculum extend to all learners.

Assessment Approaches

As a teacher, how do you evaluate the progress made during the teaching and learning processes?

The process of assessment provides the teacher with the opportunity to gauge how each learner is fairing on in the learning process. The teacher will be expected to evaluate the learner, collect and interpret data related to the learner's progress, and make judgment about a learner's achievements measured against the defined standards.

Assessment is a fundamental process in the progression made during the teaching and learning processes. In this competence-based curriculum, the evaluation must focus on the competencies gained by the learner. The learner is expected to demonstrate ability to use the knowledge and skills gained to identify and develop a solution to a given real-life situation. Note that the evaluation will be done at the following levels:

- School-based assessment
- District examinations
- National assessment (LARS)
- National examinations


Types of Assessment

Formative and Continuous Assessment (Assessment for Learning)

This type of assessment will involve the use of both formal and informal methods to gauge whether any learning is taking place. The teacher is encouraged to integrate this type of assessment in the learning and teaching process. Having interacted closely with the learners in his or her class, the teacher is expected to be in a position to establish measures or standards that each learner should be able to achieve.

At the planning stage of a lesson, the teacher should establish the targets to be achieved by each learner during the learning and teaching process. The targets should be competence-based, and should be guided by the expectations of the syllabus. At the end of each unit, the teacher should use these to gauge how each learner has performed.

It is desirable that the teacher ensures that each learner will have mastered the stated key unit competencies, both the subject and generic, as spelt out in the syllabus



before proceeding to the next unit. Continuous assessment enables the teacher to gain a broad understanding of how the learner is making progress in all aspects of learning. In this type of assessment, the teacher could use varied methods, either singly or as a combination. Appropriate methods include observation, manipulation of learning resources, use of ICT tools in task and practice, written tests, and question and answer (oral questioning).

Summative Assessment (Assessment of Learning)

Assessment is used to gauge the progress the learner is making in acquiring the competencies spelt out in the syllabus. In this way, assessment then becomes summative. The teacher is able to place the progress made by the learner in acquiring skills and knowledge.

Summative assessment enables the teacher to evaluate whether the laid out learning objectives have been achieved or not. Upon establishing this status, the progression of the learner to the next level is determined. If the objectives have not been achieved, remedial measures could be taken to correct the situation and consequently make further recommendations.

Summative assessment could be internal or external. Internal assessments are school-based. They should be conducted at the end of the term, and at the end of the academic year. Based on internal guidelines, the average scores for the subject will be weighted and subsequently be included in the final national examinations grade.


Record Keeping

The teacher will be required to gather facts and evidence from the assessments conducted on the learners. The strengths and weakness of the learner should be stated clearly. These will then be used to gauge the learner's performance and the progress achieved. The teacher will assign an indicator against the set guidelines.

The assessment methods used should generate data that is computed into scores. These should then be recorded and filed in a portfolio. The records should include the papers, assignments, activities, and projects undertaken during the learning and teaching activities. Attendance to the learning activities should also be well documented to serve as evidence that the learner participated in the process as expected. Decisions made regarding the progress of the learner, or required remedial actions should be based on these records.

Sharing the Progress Report with Parents/Guardians

It is important to share the learner's progress with parents and guardians. The most helpful approach is to share the progress of the learners with their respective parents or guardians. The progress records should, therefore, be shared with the learner together



with his or her parents or guardian. Both areas of progress, as well as areas that need improvement should be shared. In case of any remedial action to be taken, the teacher should discuss the arising issues with the parents/guardian and arrive at the best action for the learner.

Development of Assessment Tests

When developing an assessment test, it is important to ensure that the intended questions measure up to the expected standards, and that they are competency-based. The following are important factors to consider before developing questions for a test:

- (i) Plan what is to be tested.
- (ii) Specify what is to be tested. This is done by identifying the topic areas to be tested from the syllabus.
- (iii) Elaborate what is to be tested in order to show the units or topics to be tested. Outline the subject concepts to be considered in developing the test.
- (iv) Identify the learning outcomes to be measured by the test.
- (v) Determine the number of questions to be developed in each level of Bloom's taxonomy. Consequently prepare a table specifying the questions.
- (vi) Determine the marks to be allocated for each question.
- (vii) Ensure that the verbs used in writing the questions do not require memorization or recall answers. The verbs should test broad competencies as stated in the syllabus.

Note that in a competence-based curriculum, questions from higher levels of Bloom's taxonomy should be given more weight than those from knowledge and comprehension level.

Structure and Format of the Examination

ICT competencies for the Ordinary Level makes ICT content a practical-oriented subject. The learner is expected to display a high level of hands-on-skills. There are two (2) papers for Information and Communication Technology (ICT) in the Ordinary level. The first paper tests theoretical knowledge, skills, and attitudes.

Learners will be assessed on their competencies to effectively use computing tools and how to locate, extract, record and interpret, exchange, retrieve, manipulate, store and use information through technology. There will be an emphasis on ICT fundamentals, safety and security, application software, programming for juniors, and network and data communication, as identified in the syllabus.

The practical paper will be arranged on the same topic areas namely ICT fundamentals, safety and security, application software, programming for junior secondary, and network and data communication, to test learners' hands-on skills.

The practical paper will have questions related to manipulation of computing tools and solving real life problems using application software, communication using technological tools, and developing logical reasoning through programming. The content distribution table will assist in the choice of the content to be assessed. Note that not all topic areas and subtopic areas are to be covered.

Structure and format of ICT assessment

Topic Areas	Theory	Practice
Topic Area-1	X%	Z%
Topic Area-2	Y%	T%
	50%	50%

ICT tools Required for Practical Assessment

In assessing ICT competencies, different types of equipment will be used to test the ability of learners. The computer is the key tool used to test ICT skills during practical examinations. Learners will have been exposed to other technological devices in this syllabus to offer competencies required by society.

Depending on the availability of devices, the practical paper could use them as well. During the national examinations, for both computer, portable devices, and other ICT tools, the practical paper will be conducted at the individual level. Every student will have his or her equipment.

Teaching and Learning Resources

Materials needed for successful teaching and learning activities

The successful execution of ICT lessons will require learners to have computers which are the standard equipment for this subject. Together with computers, other ICT tools and application software have been identified in the syllabus and where they will be needed. Various resources for the teaching and learning of the ICT competence-based curriculum are as follows:

- **Computer laboratory:** At least two learners for one computer. Mobile lab(laptops) is highly recommended where possible.
- **Printer and scanner**
- **Telephony systems**
- **Broadcasting technology:** Television and radios per school.
- **Projectors:** Presentation is a key element of the competence-based curriculum where learners work. Teaching materials will be mostly displayed using a projector for both ICT as a subject, and for other subjects using ICT as a tool. To assist

- learning and teaching ICT as well as integration of ICT in all subjects five(5) projectors are required per school.
- **Laptop per teacher:** Teachers needs to prepare learning and teaching materials and organise content so as to use the classroom time effectively. One laptop per teacher is required.
 - **Internet connectivity.**
 - **Network devices:** Switch, router, wireless access point, server, and crimping tools.
 - **Software:** In most cases skills expected from this competence-based curriculum do not rely on any version of the Operating System or any version of application software. However, the latest version of most software at the time of implementation will be used.
 - ✓ **Operating system:** A licensed copy of the Windows Operating System. Linux distributions are to be used if all applications reflected in the syllabus are supported. For portable devices most recent operating system is recommended.
 - ✓ **Word processing, spreadsheets and presentation:** A licensed copy of latest version of Microsoft Office.
 - ✓ **ArcGIS software** for spatial data manipulation.
 - ✓ **Graphics and multimedia:** A digital camera, Photoshop, Microsoft Picture Manager, and Movie Maker.
 - ✓ **Tux typing:** This is for enhancing typing skills and speed for learners.
 - ✓ **Browsers:** Chrome, Mozilla Firefox, Epiphany, and Opera.
 - ✓ **Social media:** Twitter, Facebook, Skype, Flickr, Instagram, IM (Instant Messaging) applications, Google+ and LinkedIn.
 - **Financial Transactions**
 - ✓ **ATM:** ATM Simulators for experimenting with the process of accessing, depositing and checking balances of an account using a debit/credit card. Organised visit is recommended if any ATM device is near the school.
 - ✓ **Telephones** for mobile banking and managing money.
 - ✓ **Billing machine or simulators**
 - ✓ **Programmable calculator**
 - **Interactive board:** Two interactive boards per school.

Human Resources

For a successful execution of the lessons, all educators at all levels of learning must get involved.

The following points are key:

- (i) Teachers who are directly involved with the learners will be expected to play their active role as discussed earlier. The teachers will be expected to utilize their Pedagogical Content Knowledge (PCK) and teaching experience to the fullest.
- (ii) The teacher in ICT will be expected to demonstrate a high level of understanding of ICT concepts. He or she should be qualified in ICT/Computer Science OR related fields. He or she must have a high moral standing; a role model for learners. He or she should be able to guide learners to make responsible and ethical decisions.
- (iii) School headteachers and directors of studies should be able to use the competence-based syllabus, and make a follow-up in all aspects of learning. They should also be able to assess the teaching and learning of ICT, and ensure that the methods and approaches applied in the school are adequate and effective.

The Skills and Attitudes Required for the ICT teacher

He or she should have the following skills, values, and qualities:

- (i) Show a high level of knowledge of the content.
- (ii) Inspire children and the community on the importance of learning and use of ICT.
- (iii) Be able to engage learners in variety of learning activities.
- (iv) Be able to use multiple teaching and assessment methods.
- (v) Be able to adjust instruction to the level of the learners.
- (vi) Be able to use creativity and innovation in the teaching and learning process.
- (vii) Be a good communicator and organiser.
- (viii) Be a guide/facilitator and a counsellor.
- (ix) Manifest passion and impartial love for learners in the teaching and learning process.
- (x) Relate the use of ICT with other subjects and real life situations.
- (xi) Have good classroom management skills.
- (xii) Exhibit a passion for teaching and interacting with children.

Content Structure

General presentation

The ICT subject is taught in the lower secondary education level, that is, S1, S2 and S3 respectively. At every level where it is taught, the ICT syllabus is structured into Topics, Subtopics and Units. Each unit is structured as follows:

1. The **number of periods** that are expected to be taught.

2. **Key unit competence:** Its achievement is pursued in all teaching and learning activities undertaken by both the teacher and the learners.
3. The key competency for each unit is broken down as follows:
 - (a) **Learning Objectives relating to Knowledge and Understanding** tend to use lower order thinking skills. They are considered to be prerequisites to the learning objectives relating to skills, attitudes and values.
 - (b) **Learning Objectives relating to Skills, Attitudes and Values** are also known as Higher Order Thinking Skills. These Learning Objectives are considered to be the ones targeted in a competence-based curriculum.
4. The **content** that is to be covered.
5. The **Learning Activities:** The teacher is to engage the learners in the learning process. The process must be participatory. Learners must be fully engaged.
6. Links to other subjects, assessment criteria and the materials (or resources) that are expected to be used in its teaching and learning.

Key Competencies at the End of Secondary Two

By the end of Secondary Two, the learner should be able to:

- (i) Use computers safely and securely to ensure that data is protected.
- (ii) Analyse and criticise the role and impact of computing tools in financial transactions.
- (iii) Use computing tools in financial transactions.
- (iv) Insert symbols, pictures, tables and objects in a document.
- (v) Fill a new empty map with data, use simple symbols, label features and attributes table, and navigate a map.
- (vi) Work with Spreadsheets and perform basic manipulation of cell contents using arithmetical operations.
- (vii) Manage a window, sorting and filtering data in a spreadsheet.
- (viii) Work with Spreadsheets by applying complex formulas and functions.
- (ix) Identify computer network devices, mediums, and peripherals and connect different computer devices to the network.
- (x) Use social media to exchange information on social life.
- (xi) Design a game, collect data in a table, and add game rules.

Distribution of the content by topic areas, subtopic areas, and the number of lessons allocated

Topic areas	Sub-topic areas	Number of periods (Period=40 minutes)				% Subtopic areas	% Topic areas
		S1	S2	S3	Total		
Introduction to ICT	ICT fundamental	18	10	4	32	15%	19%
	Safety and security	4	4	0	8	4%	
Application Software	Word Processing	20	8	14	46	19%	59%
	Spreadsheets	0	26	8	34	16%	
	Presentation	0	0	6	6	3%	
	GIS	12	8	10	28	14%	
	Graphics and multimedia	0	0	16	16	7%	
Computer network and Data communication		8	6	6	20	9%	9%
Programming for juniors(Scratch)		10	10	8	26	13%	13%
Total		72	72	72	216	100%	100%

A Sample of a Competence-Based Lesson Plan

Term	Date	Subject	Class	Unit N°	Lesson N°	Duration	Class size
1	23 May 2016	ICT	Senior 2	1 of 9	2 of 4	40 Min	45
Type of Special Educational Needs (SEN) and number of learners				<ul style="list-style-type: none"> • Learners with visual impairment are 3 • Learners with hearing impairment are 2 • Learners with motor impairment are 2 • Slow learners are 3 (Note: Total number of learners are of learners with special needs are 10 out of 45; Normal learners are 35)			
Unit Title		Data protection					
Key Unit Competence		Use computers safely and securely to ensure that data is protected.					
Title of the lesson		Protecting computers and data (using passwords)					
Instructional Objectives		By the end of this lesson, the learner should be able to: <ol style="list-style-type: none"> Create and use computer passwords. Describe the characteristics of a strong password. Appreciate the importance of using passwords in protecting computers and data. 					
Plan for this Class (Location: in /outside)		Inside the classroom/ Visit the school department where processes are automated, for example, the Accounts Office.					
Learning Materials (for all learners)		<ol style="list-style-type: none"> Rwandan National ICT Syllabus ICT Student's Book for Senior 2 Internet connectivity Computers 					
Reference Materials		The ICT for Senior 2 Student's Book, pages 6 to 8.					
Timing for each step		Description of teaching and learning activity				Generic Competencies and Cross-Cutting Issues to be addressed plus a short explanation	
		The teacher facilitates the learners in a discussion on data protection using passwords and the qualities of a good password. The learners create and use passwords in the provided computers.					

	Teacher's Activities	Learner's Activities	
Introduction: Review the previous lesson (If relevant). (5 minutes)	<ul style="list-style-type: none"> Use groups to review the previous lesson on user privileges in data protection. Possible Questions: <ul style="list-style-type: none"> What is data protection? What is user privilege? What are the possible threats to data? 	<ul style="list-style-type: none"> Let the learners respond to questions on data protection and user privileges. Possible Answers: <ul style="list-style-type: none"> Data protection is the process of safeguarding important information from corruption and/or loss. User privileges are the rights/permission given to the computer user. Some threats on data are virus attacks and access by unauthorised persons. 	Cooperation: <ul style="list-style-type: none"> Working in groups gives the students an opportunity to cooperate and work as a team. Peace Education: <p>Learners abide by the rule not to access the works of others without permission (user privileges).</p>
Development of the lesson 30 minutes	<p>(a) Ask learners to discuss in groups the importance of data protection.</p> <p>(b) Ask learners to explain the term password.</p> <p>(c) Discuss with students where passwords are used in real-life situations.</p> <p>(d) Let learners explain the characteristics of a strong password. Let the learners list down these characteristics</p>	<p>(a) Learners discuss in groups the importance of data protection. (Prevention of loss, corruption, theft of information, leaking of information.)</p> <p>(b) Learners explain the meaning of password. (Tip: secret words/codes)</p> <p>(c) Identify the use of passwords (in telephones as PIN, in computers, ATM, etc)</p> <p>(d) Learners to identify the characteristics of a strong password.</p>	Cooperation: <ul style="list-style-type: none"> Working in groups gives the students an opportunity to cooperate and work as a team. Gender balance: <ul style="list-style-type: none"> Groups should consist of both male and female students


<p>Development of the lesson (continued)</p>		<p>(e) Tips: Learners to note down their points. The characteristics of a strong password include the following:</p> <ul style="list-style-type: none"> ▶▶ Lower case letters ▶▶ Upper case letters ▶▶ Special character ▶▶ Numbers ▶▶ At least a minimum total of 8 characters 	<ul style="list-style-type: none"> • Financial education: Making learners aware of securing accounts with passwords for mobiles technologies, ATMs, and online transactions.
<p>Development of the lesson (continued)</p>	<p>(a) Let the learners create strong passwords. Every learner should get the opportunity to create a strong password.</p> <p>(b) Ask the learners to share with the class the passwords they have created and discuss the importance of changing one's password regularly.</p> <p>(c) Ask learners to discuss about setting computer passwords in personal and public computers.</p>	<p>(a) Create passwords and explain how they arrived at those passwords.</p> <p>(b) Share the passwords they have created and discuss the risk of forgetting passwords.</p> <p>(c) Discuss the use of passwords in personal and public computers. (Not to set a password on someone else's computer or in public computers. Share the passwords if the computer is used by other people.)</p>	<p>Creativity and Critical thinking: In creating strong passwords, creativity and critical thinking are developed.</p> <p>Communication: By making presentations and explaining what they are doing.</p> <p>Peace education: Make learners responsible for their skills. Ask them not to set passwords in public computers without permission. Make them aware of cybercrime.</p>

Conclusion Summary Assessment (5 minutes)	Conclusion <ul style="list-style-type: none"> • Summarise the lesson with students, by explaining the meaning of password, its application, qualities of a good password, and the steps of setting a password. • Ask questions to assess if all the learners have understood. Invite randomly two learners (a boy and a girl) to come in front of and set passwords to provided computers. • Give the learners homework to research on Internet or the library what can be done if a password is forgotten. 	<ul style="list-style-type: none"> • Summarise the key points of the lesson and note down the summary on using the password for data protection. • Respond to these questions: <ul style="list-style-type: none"> ▶▶ What are the characteristics of a strong password? ▶▶ What is the importance of using a password? • Set passwords on (projected) computers. • Research on what can be done if a person forgets his or her password. 	Gender balance: Giving a task of setting a password to both male and female students. Creativity and innovation: Learners will work independently to discover different strategies that can be used when a password is forgotten.
Assessment	<ul style="list-style-type: none"> • Formative assessment: Continuous Assessment Tests (CATs) and oral questions. • Summative evaluation: Revision Exercise and end-of-term examination. 		
Teacher Self-Evaluation	See the notes below on self-assessment.		

Self-Assessment

A good teacher will always assess him/herself. During assessment of each learner's progress, it is necessary to assess his/her teaching performance by asking him/herself the following questions:

- Were the learners interested in the topic he/she presented?
- Was the topic applicable in their day-to-day life? Did learners identify with the teaching and learning experience?
- For how long did teacher talk during the lesson? For how long did he/she allow the learners to talk?

- 
- Did teacher ask the learners relevant questions?
 - Did he/she listen keenly to their responses?
 - Did I use appropriate teaching aids?
 - Did the teaching aids arouse curiosity and stir interest in the learners?
 - What teaching and learning activities did I present to the learners?
 - Did the teaching and learning activities support multi-ability learning?
 - Were the activities varied?
 - What teaching and learning resources did I use? Were they relevant, affordable and familiar to the learners?
 - Did I take care of learners with special educational needs (SENs)?
 - Did I evaluate the learners appropriately and adequately?

Being critical of your performance will help you improve your teaching in the subsequent lessons.

Unit 1

Data Protection

Introduction

This topic introduces the learner to data protection in ICT. It is expected that at the end of the topic, the learner should be able to understand the importance of computers security and ensure that data is protected.

1.1 Content Map for the Unit

Topic	Data protection	
Topic Area	Introduction to ICT	
Subtopic Area	Safety and security	
Number of Periods	4	
Introduction	Data protection	
Classroom Organisation	Whole class orientation then work in groups. Individual activities.	
Equipment Required	Computers, CD/DVD, video player, projector, textbook, and digital materials.	
Activities	Practical activities, discussions, field trips.	
Competencies Practice	Team work, communication skills, and research.	
Language competencies and Practice	<ul style="list-style-type: none"> • Defining • Explaining • Writing 	<ul style="list-style-type: none"> • Communicating • Group discussions • Report
Additional vocabulary (Key terms to be explained to the student)	<ul style="list-style-type: none"> • Data Protection • Passwords • Worm • Trojan • Malware • Scan • Firewall • Antispyware 	<ul style="list-style-type: none"> • User privileges • Viruses • Spyware • Rootkit • Antivirus • Restore • Privacy • Backup

Numeracy	<ul style="list-style-type: none"> • Creating a user account which is password-protected. • Scanning computer for viruses. • Measures to prevent harmful programs. • Sources of viruses.
Study Skills (including language competencies)	<ul style="list-style-type: none"> • Note taking/ Writing • Organisation of ideas • Listening to audio lessons • Watching video lessons • Presentation/ Reporting skills • Observation skills
Revision	<ul style="list-style-type: none"> • Learning Activities and Revision Exercise in the ICT Senior 2 Student's Book
Assessment	<ul style="list-style-type: none"> • A formative assessment of the ability to work in groups, carrying out activities, assessing whether the objectives are met, Continuous Assessment Tests (CATs) and oral questions. • A summative evaluation at the end of the unit to examine the extent the intended learning objectives have been accomplished.
Learning outcomes	<p>The learner should be able to:</p> <ul style="list-style-type: none"> • Create a user account with password protection. • Create a strong password. • Determine the importance of computer protection in an organisation. • Identify different harmful programs. • Determine various measures to prevent harmful programs.

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher's Guide.

1.2 Subtopics/Content to be covered

Protect the computer (User Privileges)

- Setting password and user's privileges: (administrator and guest).

Harmful programs

- Define a harmful program and categories of harmful programs (virus, worms, spyware, trojan, rootkit, and malware, among others).

Sources of viruses

- The Internet.
- Secondary storage devices (media) such as flashdisks.

Measures to prevent harmful programs

- Install antivirus programs.
- Avoid connecting the computer to non-scanned storage devices and avoid connecting via the browser to non-secure websites.
- Apply common preventative procedures (antivirus scan, cleaning agent, spyware and anti-spyware, backup and restore, and compressing files).

1.3. Reference to the Student's Book for Senior 2

Refer to the ICT for Senior 1, Student's Book, pages 1 to 22.

1.4. Key Unit Competency

By the end of this unit, the learner should be able to use computers safely and securely to ensure that data is protected.

1.5. Learning Objectives

Knowledge and understanding

By the end of the unit, the learner should be able to:

- Describe computer user privileges.
- State and identify harmful programs.
- Identify the sources of computer viruses.
- Identify the role of antivirus and anti-spyware.

Skills to be imparted in this unit

By the end of the unit, the learner should be able to:

- Create and use computer user accounts.
- Distinguish different harmful programs.
- Scan external storage devices before connecting them to the computer.
- Use the appropriate computer user privileges to prevent the spread of computer viruses.

Attitudes and values to be developed in this unit

By the end of the unit, the learner should be able to:

- Appreciate the use of limited account (guest) to prevent the spreading of viruses and the use of the administrator account only for the installation of programs and altering settings.

- (ii) Be selective and careful of content on the Internet.
- (iii) Show concern for computer vulnerability.

1.6. Teacher Preparation

- (i) Plan and make notes for the lesson.
- (ii) Study and master the content to be taught. Refer to Unit 1 in the Student's Book for Senior 2.
- (iii) Practise how to scan storage devices and create user accounts. Ensure that all the required equipment and resources are in working order.

1.7 Key Concepts to be Covered

- **User privilege** is the permission given to a user to perform an action. It is used to regulate who can view or use the resources in a computer.
- A harmful **program** refers to software that interferes or poses security problems to computer hardware, software, data, and information. Harmful programs include viruses, worms, spyware, Trojan, and malware among others.
- A **virus** is a program that can make a copy of itself over and over again (replicate) in a computer.
- A **worm** is a malicious program that replicates itself and finally occupies the system memory of the storage media.
- **Spyware** is a program that monitors or tracks personal information or Internet activity and sends such information to someone else.
- A **Trojan** is a harmful program that disguises itself as legitimate software, tricking users into loading and executing it on their systems.
- A **rootkit** is a program designed to hide the fact that an operating system has been compromised and does so sometimes by replacing vital executable files.
- **Malware** are programs that are specifically designed to gain access or damage a computer without the user's knowledge.
- Antivirus is computer software that is used to scan and detect viruses, prevent virus spread, delete or remove viruses, and notify the user in case a virus is detected.

1.8. Additional Content for the Teacher

Computer protection

Data and software in the computers can be safeguarded in the following ways:

- **Locking the doors of the computer room when it is not in use:** Only those who are allowed access can be given the keys to the rooms.

- **Burglar proofing:** Measures to prevent forceful entry into the computer room such as fitting grills on windows, strong metallic door, and reinforcing the roof using concrete.
- **Fire-fighting and control equipment:** Smoke detectors and gaseous fire extinguishers can be used.
- **Stable power supply:** The use of Uninterruptible Power Supply (UPS) between the socket and the computers protects them from power surges, brown out, and spikes.
- **Proper room layout:** The computer rooms should be spacious enough for easy movement. The use of stable computer tables prevents accidental knocking down of the computers. Cables should also be laid away from the users' paths so that users do not accidentally stumble on them.
- **Electrical and power sockets security:** The cables and sockets must be well-insulated to avoid short circuits that may cause damage to the computers.
- **Installing the rooms with intrusion detection alarm systems:** The level of alertness against possible theft would be increased by fitting alarms, surveillance cameras, and also employing security guards.
- **Dump and dust control:** Use of air conditioning system that filters dust particles from entering computer rooms and dehumidifiers for controlling humidity or dampness protects the computers.
- **Avoid carrying foods and drinks to the computer room:** Food particles may fall on the moving parts of the computer such as the keyboard; liquids may pour on them causing damage to the computers.

1.9 Suggested Teaching and Learning Materials

- Computers.
- CDs/DVDs of documentaries on data protection in different organisations.
- Projector.
- The ICT for Senior 2 Student's Book.
- Connectivity to the Internet.
- Other relevant digital learning materials you may consider relevant.

1.10 Suggested Low-cost or No-cost Materials

- Free tutorials on identified websites but always establish the authenticity of the site.
- Visits to organisations to learn more on computer protection.
- Visit other institutions to learn the data protection methods they use.
- Free downloads of relevant materials from safe Internet websites.

Note: Always establish the authenticity of the website to avoid downloading infected files.

- Request for assistance in setting up a demonstration on the data protection.

1.11 Suggested Teaching Methods

(i) Question-and-answer method

The teacher can use this method when reviewing the previous lesson or when summarizing a lesson. This method will help the learners to recall information, emphasize facts, drill for retention of facts, and obtain some measure of achievement. For example, the teacher can ask the following questions to solicit for answers from the learners when summarizing the lesson:

- (a) What was the topic of today's lesson? (computer safety and security)
- (b) List two types of user accounts. (Administrator and Standard user or guest)
- (c) Computers can be protected from threats by assigning users _____ or _____. (privileges or passwords)
- (d) _____ is the process of safeguarding data from corruption, loss, or unauthorised access. (Data protection)

(ii) Discussion

In discussions, the teacher plays the role of the facilitator. A class discussion seeks and examines an issue by means of free flow of arguments. Follow these steps for a successful discussion:

- (a) Start the lesson with a motivating introduction and highlight the points for discussion.
- (b) Organise the learners into groups of four to five members. The size of the group depends on the items for discussion, as well as the size of the class.
- (c) Guide the members of each group to appoint a secretary and a chairperson. These roles should be rotational so that all pupils get the opportunity to develop their leadership, writing, and communication skills. The role of the secretary is to note down the contributions by the members.
- (d) Ensure that the seating arrangement is appropriate for effective discussions.
- (e) After the discussions, facilitate the presentation of the points by each group.
- (f) Allow other group members to make their contribution and then commend and correct the groups where necessary.

(iii) Educational Trip

A field trip is an organised learning experience carried outside the classroom. The experience helps a learner to achieve educational objectives. The trip could be within

the school or out of the school compound. The steps for preparing for a successful trip are as follows:

- (a) Identify the topic for study and the objectives to be achieved. For example:

Topic: Harmful computer programs

Objective: Identify types of harmful computer programs

- (b) With the help of the students, identify a site with relevant information that will help to achieve the set objectives.
- (c) Secure administrative and parental approval for the trip well in advance.
- (d) Obtain permission from the administration of the host institution.
- (e) Prepare a time schedule and itinerary for the entire trip.
- (f) Make arrangements for transport and lunch.
- (g) Prepare a list of names and addresses of those taking the trip and submit it to the administration for record purposes.
- (h) Discuss with learners the purpose of the trip. Provide the necessary safety precautions to be taken during the outing; for example, instruct them **NOT** to insert storage media in the computers of the host institution.
- (i) Assign learners into groups for discussion when they go out.
- (j) Inform the learners of departure time.

(iv) Practical Activities

- (a) Refer the learners to the Practice, Learning and Revision Activities in the Student's Book and guide them appropriately.
- (b) The learners should follow the instructions given in the Student's Book for each of the learning activities.
- (c) Assess the activities done by the students.

(v) Demonstration

You can use this method in the following scenarios: when teaching a new skill; when the facilities are not adequate for all learners; when content is complex to grasp; or when the equipment or materials are expensive or delicate. To perform a demonstration successfully, do the following:

- (a) Select the topic for demonstration; for example, creating an Administrator Account.
- (b) Try out the steps of the demonstration prior to the lesson to ensure they run as expected.
- (c) Ensure that the physical environment is well arranged so that the learners are able to observe and follow the demonstration.
- (d) Ensure that the facilities are available and in good working condition.

- (e) During the lesson, show the learners the procedure for creating an Administrator Account.
- (f) Demonstrate step by step the procedure for creating this account.
- (g) Asks the learners questions as you demonstrate.

(vi) *Listening to audio and watching video-recorded content*

Have links to video clips or audio recordings that discuss the various subtopics covered under data protection. These can be sourced from safe and free websites such as YouTube. Guide the students to watch and listen to the available resources.

1.12. Suggested Teaching and Learning Activities and Exercises to Support Delivery of Content and Development of Student Competencies

- Group discussions on the role of different accounts and passwords for private and school computers.
- Research on the types and source of viruses and their prevention.
- Class discussions on different data protection concepts.
- Educational visit to the institutional departments and neighbouring institutions to learn more on data protection.
- Group discussions on how to update antivirus and use it to scan the computer and storage devices.
- Explanation of the various concepts on data protection.

1.13 Cross-Cutting Issues to be integrated in Teaching and Learning Activities

- **Data security and cybercrime:** This chapter is in itself a cross-cutting issue.
- **Create short health breaks during the lesson.** The break could be as short as three to five minutes. Use the break to sensitise students on social issues such as environment, HIV/AIDS, dangers associated with premarital sex, and drug and substance abuse. You could download relevant short video clips and spend a few minutes to engage the students on the message.

1.14 Suggestions for Accommodating Special Education Needs (SEN)

Identify learners with special needs and help them to cope during the teaching and learning activities.

Type of impairment	Support for the learner
Sensory impairment (visual)	<ul style="list-style-type: none"> • Write legible letters on the board. • Allow learners with poor vision to sit next to those with good vision to be assisted where necessary.

Sensory impairment (hearing)	<ul style="list-style-type: none"> • Make an effort to project your voice to be audible to the learners. • Allow learners to sit close to the teacher.
Motor impairment	<ul style="list-style-type: none"> • Do the activities in one place to avoid unnecessary movement from place to place.
Gifted or talented learners	<ul style="list-style-type: none"> • Assign learners extra work. • Assign the learners more challenging work.

1.15 Suggestions for Supporting Multi-Ability Learning

Fast learners	<ul style="list-style-type: none"> • Request learners to sit next to slow learners to help them. • Give them extra tasks to perform.
Slow learners	<ul style="list-style-type: none"> • Arrange for remedial teaching. • Take time to go over the procedure and use the language that the learners will understand. • Request other learners to assist them do the task.

1.16 Support to Learning Activities

As individuals

- Research on creation of different accounts on the computer and setting of strong passwords.
- To attempt the questions under Practice and Revision Activities in the Senior 2 Students' Course Book. The instructions given are clear.

Pair Work

- Research on creation of different accounts on the computer and setting of passwords.
- Update the antivirus and use it to scan the computer and other secondary storage media such as flashdisks.

Group work

- Practise how to create administrator and guest accounts on the computer and set strong passwords.
- Discuss the role of different accounts and passwords for private and school computers.

Whole class work

- Visit some departments within the school that operate automated processes. The officers working in these departments could be requested to discuss how they

protect their data and their equipment. A visit to the ICT department could provide a learning experience on how to set user privileges in the computers.

- If the school does not have facilities that have automated processes, you could arrange a visit to a neighbouring institution where students can practise the skills they have learnt in this unit.

1.17 Support for the Development of Positive Skills, Values and Attitudes

- Some life skills to develop in the learner include decision making, effective communication, problem solving and creative thinking.
- Some values to be developed include responsibility, appreciation, respect, cooperation, and curiosity.
- Working in groups encourages development of attitudes such as cooperation and responsibility.
- Develop curiosity by letting the learners discover how to create a user account with password.
- Group work presentations help in developing effective communication skills and decision making.

1.18 Support to Formative and Summative Assessment

- Practice and Revision Activities, as well as the Revision Exercise at the end of the Unit in Senior 2 Student's Book.
- Oral questions.
- Continuous Assessment Tests (CATs) and Random Assessment Tests (RATs).
- Report writing

1.19 Links to Other Subjects

- **English:** Communication skills as they learn new ICT terms. One can also use ICTs to learn the English language. There are ICT applications (Apps) designed to assist learners to study English at basic and advanced levels.
- **Physics:** The maintenance of ICT equipment requires knowledge in physics.
- **Entrepreneurship:** Data protection in business organisations and institutions.

1.20 Additional Remedial, Consolidation, and Extension Activities

Give the following activities and exercises. Depending on your assessment of the individual learners, make an informed decision to give the activity as either a remedial, a consolidation, or an extension of the learning activities.

1. **Essay writing:** Let the learners work in pairs. Guide them to write an essay.
 - Instruct them to write an essay on the types and sources of viruses and their prevention. Guide them to make a presentation to the rest of the class.

- A representative from each group should give a short summary on the essay written.
 - Motivate the students by rewarding the winning team.
2. **Use of the Internet:** Refer the students to a secure website to get additional information on the topic.
 3. Learners to create Administrator and Guest accounts and set strong passwords.
 4. Learners to discuss various issues that come up in the media. For example, public officers who are alleged to have misappropriated public funds and give the excuse that their passwords to the computer system were stolen. Let the learners give different perspectives. Guide them appropriately.
 5. Learners to discuss any issues they may have read in the media about computer viruses and the damage the virus may have caused to the affected institution.
 6. Learners to update the antivirus in their computer systems.

1.21 Answers to the Learning Activities and Exercises in the Student's Book

Revision Activity 1.1 (Student's Book page 10)

Part A (Individual work)

1. Usernames and Passwords
2. User privilege
3. Password
4. Hacker
5. Eight

Part B (Pair work)

1. Data protection is the process of safeguarding data from corruption, loss, or unauthorised access.
2. (a) User privileges is the permission given to a user to perform an action.
(b) Password is a secret code used to deter unauthorised access to a computer, data, and software.
3. Administrator and Standard user (Guest).
4. The procedure for setting up a standard or administrator account is as follows:
 - (i) Create account.
 - (ii) Type password.
 - (iii) Re-enter the password.
 - (iv) Type a password hint.
 - (v) Choose the type of account.

Part C (Students to work in pairs)

- In pairs, learners to create and outline the procedure for creating new user accounts; one for the administrator and the other for a standard user. Let them refer to the discussion in the Student's Book. They should note that the

Administrator account has all the access privileges while a guest account has limited access privileges.

- Notes: There are two different accounts, namely the Administrator Account and the Standard user (Guest) in Windows Operating System.
 - ➔ **The Administrator Account:** The user has superior privileges. A user with this account can make changes that affect other users such as change security settings, install software and hardware, modify all files on the computer, as well as access other user accounts.
 - ➔ **Standard user (Guest):** It is a user account that allows people to have temporary settings that do not affect other users or the security of the computer. They, however, cannot install software or hardware or create passwords.
- Learners must ensure that the passwords for the two accounts are strong. The following are characteristics of a strong password:
 - (i) It should have at least 8 characters.
 - (ii) It should contain a combination of uppercase and lowercase and numbers and (symbols if they are allowed).

Revision Activity 1.2 (Student's Book page 13)

Part A (Pair work)

In pairs, learners to research on examples of malware. Guide them to present their findings in a table or any other desired format. Some examples include the Morris worm, the concept virus, CIH (also known as Chernobyl virus), the Anna Kournikova worm, ILOVEYOU, Melissa virus, the blaster worm, Netsky and Sasser, and the Storm worm among others.

Revision Activity 1.3 (Student's Book page 15)

Part A (Individual work)

1. Viruses, malware, and worms
2. Hoax
3. Malicious websites
4. Legitimate
5. Virus infection

Part B (Individual work as a Continuous Assessment Test)

1. A **harmful program** refers to software that interferes or poses security problems to computer hardware, software, data, and information.
2. Worms, spyware, trojan, and rootkit.
3. (a) **Symptoms of a virus-infected computer:**
 - (i) Computer system takes longer than usual to load programs and carry out other operations.

- (ii) Unfamiliar graphics appearing on a computer file.
 - (iii) Drive light of a non-referenced drive coming on without a reason.
 - (iv) The computer unexpectedly restarting without instruction.
 - (v) File size in the computer becomes unusually large.
 - (vi) The size of Random Access Memory (RAM) becomes unexpectedly smaller.
- (b) **Measures to protect a computer system from virus attacks**
- (i) Install an antivirus program.
 - (ii) Do **NOT** open email attachments unless you are sure of the source.
 - (iii) Always scan removable storage media for virus before use.
 - (iv) Use optical devices more often since they are more secure.
 - (v) Store files and folders in Google drive, skydrive, dropbox and any other virtual storage space which is more secure and convenient since it can be retrieved from anywhere as long as there is Internet connectivity.
 - (vi) Install and use Firewall security.
 - (vii) Avoid visiting insecure sites.
 - (viii) Block sites that you do not want the computer to connect to through the browser.
 - (ix) Avoid clicking on pop-up sites that appear when browsing the Internet.
 - (x) Use the browser's privacy settings.
 - (xi) Activate pop-up blocker in your web browser.

Revision Activity: 1.4 (Student's Book page 21)

Part A (Individual work)

- | | |
|----------------|---------------------------------------|
| 1. Quarantines | 2. Flashdisks and compact disks (CDs) |
| 3. Firewall | 4. Macfee, Avast, Kaspersky, Panda |

Part B (Pair work): Refer to the students's Book. The answers are also provided under Revision Activity 1.3, Part B, Question 3(b)

Part C (Pair work): Refer to the Student's Book pages 16 to 18.

Answers to Revision Exercise 1 (Student's Book page 22)

(Individual work: Treat it as a test. Students to hand in their complete work for marking.)

1. **Reasons why data protection is necessary in an organisation:**
 - **Confidentiality:** Sensitive data and information belonging to an organisation should not be disclosed to, or accessed by unauthorised persons.

- **Integrity:** When a person accidentally or with malicious intentions modifies important files, data loses integrity.
 - **Availability:** Data or information should only be accessible to those authorised to view or modify it.
2. **Difference between standard and administrator password accounts:**
An **Administrator Account** allows the user to make changes that can affect the other users. A **Guest or Standard User Account** allows people to have temporary settings that do not affect other users or the security of the computer. Administrator account have system privilege while a Guest or Standard User Account contains object privilege.
 3. **Ways in which an anti-virus software protects a computer system from attacks.**
 - Scans and detects viruses.
 - Quarantines infected files and programs to prevent virus spread.
 - Deletes or removes viruses and the infected files.
 - Notifies the user in case a virus is detected.
 4. **Difference between spyware and adware:**
 - Adware is information that is displayed on a pop-up window when a user is accessing the Internet. It is majorly used for advertisement.
 - Spyware is a program that monitors or tracks personal information or Internet activity and sends such information to someone else.
 5. Two sources of a computer virus are infected secondary storage devices and unsafe Internet websites.
 6. **Two characteristics of a strong password:**
 - (i) It should have at least 8 characters.
 - (ii) It should contain a combination of uppercase and lowercase letters, numbers, and symbols.
 7. **Preventive measures that can be taken to avoid virus infection:**
 - Install the latest version of antivirus software.
 - Frequently update the antivirus software.
 - Always scan the removable storage media for virus before using them.
 - Scan mail attachments for virus before opening or downloading them.
 - Avoid accessing unfamiliar sites on the Internet.
 8. It is used to prevent unauthorised access to a computer system.
 9. Activate pop-up blocker in your web browser.

1.22 Teacher Support on Assessment: Additional Questions

1. Identify four ways of safeguarding data and software in the computers.
2. Explain briefly the following terms: (i) Burglar proof (ii) UPS

Unit 2



ICT in Financial Transactions

Introduction

This topic introduces the learner to ICT in Financial transactions. It is expected that by the end of this topic, the learner should be able to analyse and criticize the role and impact of ICT in financial transactions.

2.1 Content Map for the Unit

Topic Area	Introduction to ICT
Unit Title	ICT Fundamentals
Subtopic Area	ICT in Financial Transactions
Number of periods	10
Introduction	ICT in Financial Transactions
Classroom Organisation	Whole class orientation; Groups; Pairs
Equipment Required	Computers, projector, textbook, Internet, ATM simulator, automated billing machine, credit cards, and debit cards.
Activities	Discussions, research, question-and-answers
Competencies Practice	Teamwork, communication skills, and research
Language Competencies Practice	<ul style="list-style-type: none">• Defining• Explaining• Writing• Communicating• Group discussions• Report
Additional Vocabulary (Key terms to be explained to the student)	<ul style="list-style-type: none">• Record keeping• Fraud• Credit cards• ATM• Stock exchange• E-commerce• Mobile banking• Automated billing
Numeracy	<ul style="list-style-type: none">• Using the ATM to withdraw and deposit money.• Knowledge on loading money in a mobile phone account.• Using e-commerce facilities to buy and sell products on the Internet.

Study skills (including language competencies)	<ul style="list-style-type: none"> • Note taking/ Writing • Presentation/ Reporting skills • Observation skills • Organisation of ideas
Revision	<ul style="list-style-type: none"> • Practice and Revision Activities, and the Revision Exercise in ICT Senior 2 Student's Book.
Assessment	<ul style="list-style-type: none"> • Practical activities, Continuous Assessment Tests (CATs), and oral questions. • A summative evaluation: A revision exercise has been given at the end of the unit.
Learning outcomes	<p>The learner should be able to:</p> <ul style="list-style-type: none"> • Determine the role of computer use in the society. • Identify different technologies and their use in financial transactions. • Determine the impact of technologies and their use in financial transactions. • Evaluate the role of different technologies in financial transactions. • State the different functionalities of an ATM. • Use telephone communication to manage money, pay, and buy items. • Use a billing machine to record items and generate bills for a given request.

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher's Guide.

2.2 Subtopics/Content to be covered

The role of computers in financial transactions

- Automated operations, record keeping, and the stock exchange.

Impact of financial technologies in society

Positive

- Quick service delivery.
- Security in transactions.
- Unlimited access to the user's bank account.
- Automated billing.
- Creation of job opportunities in technology-related areas.

- Communication networks.
- Security.
- Reduce payroll expenses.
- Increase revenue in the country.
- Solution to bank service problems such as long queues, limited time for customer servicing, transaction errors due to the bank personnel, and excessive bureaucracy among others.

Negative

- Fraud using computing tools.
- Unemployment in some fields (bank agents).
- Job losses as a result of automation of processes.

Technologies in financial transactions

- *E-commerce*: Process of buying and selling on the Internet (using credit cards in online shops).
- *ATM*: The process of accessing, depositing and checking the balance of an account using a debit card.
- *Mobile banking*: Process of loading money on a mobile phone account, making life easier, sending and receiving money, and the security of using mobile money.

2.3 Reference to the Student's Book: Senior 2, Student's Book, pages 23 to 42.

2.4 Key Unit Competencies

By the end of the unit, the learner should be able to:

- Analyse and criticize the role and impact of computing tools in financial transactions.
- Use computing tools in financial transactions.

2.5 Learning Objectives

Knowledge and understanding

By the end of the unit, the learner should be able to:

- Explain the importance of using computers in financial transactions.
- Know about the different technologies in financial transactions.
- State and understand the impact of different technologies in financial transactions.

Skills to be imparted in this unit

By the end of the unit, the learner should be able to:

- Explain the importance of computer in financial transactions.

- (ii) Evaluate the role of different technologies in financial transactions.
- (iii) Analyse and criticise the impact of different technologies in financial transactions.
- (iv) Use ATMs and telephones for financial transactions.

Attitudes and values to be developed in this unit

By the end of the unit, the learner should be able to:

- (i) Appreciate the importance of different technologies in financial transactions.
- (ii) Show concern for computer misuse.

2.6 Teacher Preparation

- Make notes and prepare a lesson plan for each topic.
- Obtain different resource materials to cater for the varied abilities of the learners.
- Organise the students into groups. Take care of those with special needs.
- Practise how to use different financial ICT tools.


2.7 Key Concepts to be Covered

- Record keeping is a systematic process of recording, creating, capturing, and maintaining transactions and events in an accounting system.
- Stock exchange is a market where securities (bonds, notes, shares) of publicly held companies are issued and governed by the forces of demand and supply.
- Fraud is an intentional act of deception involving financial dealings for personal gain.
- E-commerce is the process of buying and selling on the Internet (using credit cards in online shops).
- Agency banking is where commercial banks contract third parties to offer banking services.
- Deposit and withdrawal of money are examples of services offered in an ATM.
- Mobile banking makes use of telephone to make life easier when sending and receiving money.
- Mobile banking enables the customers to have unlimited access to their accounts.
- Unemployment is a situation where someone loses a job due to failure to meet eligibility requirements.

2.8 Additional Content for the Teacher

Disadvantages of mobile banking

- **Security:** Mobile users are vulnerable to money loss through a phishing-like scam called **smishing**. This happens when a mobile banking user receives a fake



text message asking for bank account details from a hacker posing as a financial institution representative. Many people have fallen for this trick and their money stolen through this scam.

- **Compatibility:** Mobile banking is not available on every mobile device. Some banks also do not offer mobile banking at all. Others require customers to use a custom mobile banking application only available on popular smart phones.
- **Cost:** The cost of mobile banking if a customer has a compatible device might not appear substantial, but a customer still needs to pay data and text messaging fees. Some financial institutions charge customers an extra fee for mobile banking service, and you may need to pay a fee for software. These extra charges quickly add up, especially if you access mobile banking often.

Biometrics in banking transactions

- **Biometrics** refers to the automatic identification of a person based on his or her physiological/behavioral characteristics such as fingerprints, iris, and DNA.
- Biometric systems can provide high identification accuracy and security since it is automated. It provides fast and accurate customer authentication. It is a reliable security tool that eliminates loopholes that could exist in a banking system. Such gaps are used by criminals to execute their fraudulent activities. Biometrics are, therefore, used to secure all financial transactions such as branch banking, Internet banking, mobile banking, and ATM networks.
- Use of biometrics for customer identification ensures that transactions are secure, leading to growth of the industry.

The following are some ways in which biometrics is used in the banks:

Biometrics System for ATMs: They are used to identify the person who is using a given card at the ATM. The biometrics system in this case uses a combination of card or PIN to provide strong authentication. They are automated and require customer self-authentication during the transaction process. The biometrics technology in the ATM ensures identification accuracy, thus improving the user experience and eradicating the security loopholes of using traditional passwords and personal identity numbers (PINs) to carry out a transaction.

Biometrics for Online Banking

- Online banking is convenient. It provides a suitable way to perform transactions from anywhere and at any time using devices such as laptops and smart phones.
- Online banking transactions are highly vulnerable to fraud because thieves are using advanced methods to gain access to user information such as passwords, PINs, and security questions.

- Online banking system will help protect a customer's identity and financial information. The system provides stronger authentication methods such as voice recognition, fingerprints, and scanning facial recognition since these features are unique for every individual.
- Devices such as laptops and smart phones are fitted with webcams and microphones. These features offer flexibility to banks for easy adoption of biometrics authentication for online banking services.

Biometrics in Banking Halls

- The use of biometric banking systems in the banking halls provides a convenient, quick, and accurate way for banks to authenticate each customer's identity.
- The customer's existing biometric data within the bank database is matched to the customer's authentication at the counter. This is done through the use of fingerprints and finger vein biometric scanners. Once this match is established, the customer is allowed to proceed with their banking transactions.
- This helps to maintain an audit trail which helps prevent fraudulent activities.

2.9 Suggested Teaching and Learning Materials

- Computers.
- CDs/DVDs and any other digital content on invention and evolution of computers, types and parts of a computer, how computers are used and computer connection.
- A projector or a smart board.
- Senior 2 Student's Book.
- Automated billing machines.
- Credit cards and debit cards.
- An ATM simulator: (Use this where you are not able to use a real ATM.)

2.10 Suggested Low-cost or No-cost Materials

- Free tutorials on identified websites. Always establish the authenticity of the site to prevent virus attacks.
- Visit neighbouring bank and request access to their ATM.
- Visit a mobile phone service provider to learn on mobile banking.
- Free YouTube downloads on various concepts in the unit.
- Ask the students to bring learning materials they would want to share.

2.11 Suggested Teaching Methods

- **Question-and-answer method:** The teacher asks questions and the students respond. The students should also be encouraged to ask questions either to the teacher or to the rest of the class.

- **Discussions:** These could be done as a class or in groups. Students should be encouraged to participate in the discussions to improve their communication skills.
- **Educational visit:** Make arrangements to take students to visit institutions where they can observe some of the processes they have learnt theoretically in class.
- **Practical activities:** A number of practice and learning activities have been provided in the Student's Book. Guide the learners to work in pairs, groups, or as a class. Observe how they carry out the activities and encourage every student to participate and give their contributions.
- **Demonstration:** Where appropriate, give demonstrations. This is especially an important method when the equipment you have is not adequate for the whole class, or when the resources to use are delicate and expensive.
- **Audio and video readings:** There are limitless audio and video resources online. Do research and give the students links to access these resources. Where the source allows downloading, or saving for offline viewing, download and save the clips on secondary media and avail them to the students.

2.12 Suggested Teaching and Learning Activities and Exercises to Support Delivery of Content and Development of Student Competencies

- Group discussions on the role of computer use in the society.
- Research on different technologies and their use in financial transactions.
- Group discussions on the impact of technology in financial transactions.
- Class discussions on different ICT concepts.
- Educational visit to a bank and a mobile phone service provider to access ATM and mobile banking facilities.
- Teacher explains the various uses of ICT in financial transactions.

2.13 Cross-Cutting Issues to be integrated in Teaching and Learning Activities

Address the following emerging issue: Tips on how to manage money

1. Preparing a budget

A budget is a plan to show how much money is available for expenditure and how it will be spent. When preparing a budget, there are important facts you need to have which include the following:

- (i) Amount of money to spend.
- (ii) Period of time to be covered.
- (iii) Item list.

2. Why Make a Budget

- It helps one to exhaustively list the required items and prioritise them.
- A budget helps one to know how much money is available for expenditure.

- It helps one to know how much money has been spent in given period.
- It helps in planning for saving for unforeseen expenses in the future.
- It helps one make decisions about money, both today and in future.

3. *Being Frugal*

- Being frugal means spending money carefully. To attain financial discipline, one needs to know the difference between wants and needs and be able to prioritise them.
- As a high school student, you know that the modern world does not favour frugality because of advertisements, latest technology and fashion among others.
- However, financial discipline enables one to live within their means and learn how to make the most of what one has and also get the best value on items that one purchases.

4. *Saving*

- Students may not understand the reason and value of saving money at a young age. Saving helps one to build a culture of proper financial management.
- The little savings act as a financial security in case of an emergency.

5. *Invest*

- It is important for students to understand the time value of money principle; that money available at the present time (today) is worth more than the same amount in the future. This is because of its potential earning capacity and inflation.
- It is important to begin saving and investing money as soon as possible so that it has more time to accrue interest.
- The earlier the students learn about personal finance management, the better prepared they will be in their future endeavours.

2.14 Suggestions for Accommodating Special Education Needs (SEN)

Identify learners with special needs and help them to cope during the lesson.

Sensory impairment (Visual)

- Group the learners with those who have good vision to assist them where necessary.
- Use large font size and legible font styles when projecting digital content.
- Provide more video or audio content than printed formats.
- Teacher to write legible letters on the board.
- Learners with poor vision to sit next to those with good vision to help where necessary.

Sensory impairment (Hearing)

- Project your voice to ensure you are audible to all the learners.
- Ask them questions to assess if they understand the concepts.
- Learners to sit close to the teacher.

Motor impairment

- Assign them computers near the door so that they do not have to walk a long distance before getting to their computers.
- Avoid undertaking tasks or exercises that involve a lot of movement.
- Do the activities in one place to avoid unnecessary movement from place to place.

Gifted or talented learners

- Assign learners extra work.
- Assign them more challenging tasks.
- Encourage them to do peer teaching.

2.15 Suggestions for Supporting Multi-Ability Learning

Fast learners

- Let them sit next to slow learners so that they can be assisted.
- Give them more exercises and extra tasks to perform.

Slow learners

- Remedial teaching.
- Take time to go over the procedure and use the terms the learners will understand.
- Use other learners to assist them to do the task.
- Use simple English that the students can understand.
- Avoid giving so many procedures to the students at the same time.
- Organise for remedial lessons.
- Group them with the fast learners and encourage peer teaching.
- Closely monitor their work and notes.

2.16 Support to Learning Activities

The following are some suggestions for learning activities: group work, project work, pair work, and individual work.

As individuals:

- Research on different technologies and their use in financial transactions.
- To attempt the practice and revision activities in Senior 2 Student's Book.

Pair Work:

- (i) Determine the role of computer use in society.
- (ii) Determine the impact of technologies and their use in financial transactions.

Group work:

- (i) Practise mobile banking.
- (ii) Observe the use of billing machines.

Whole class work:

- (i) Visit the nearest bank and ATM and a mobile phone service provider.
- (ii) Ask the students to conduct a library or Internet search on the use of ATM and mobile telephony

2.17 Support for the Development of Positive Skills, Values and Attitudes

- (i) Some life skills to develop in this unit include decision-making, effective communication, problem solving, and creative thinking.
- (ii) Some values to be developed include responsibility, appreciation, cooperation, and curiosity. They are developed in the following ways:
 - Working in groups encourages the development of attitudes such as cooperation and responsibility.
 - Develop curiosity by letting the learners discover how to pay and buy items using a mobile phone.
 - Group work presentations help in developing effective communication skills and decision-making.

2.18 Support to Suggested Formative and Summative Assessment

- Practice and Revision Activities, as well as the Revision Exercise in Senior 2 Student's Book
- Oral questions
- Project documentation
- Continuous Assessment Tests (CATs)
- Revision questions from past papers
- Report writing

2.19 Links to other Subjects: Economics and Entrepreneurship: Financial Transactions.**2.20 Additional Remedial, Consolidation and Extension Activities**

Give the following activities and exercises. Depending on your assessment of the individual learners, make an informed decision to give the activity as either a remedial, a consolidation, or an extension of the learning activities.

- (i) Learners to work in pairs. Let them write an essay on the positive impact of financial technology in the society.
- (ii) Learners to give short summary reports on the essay written.
- (iii) Reward the winning essay.
- (iv) **Using Automated Teller Machines (ATM):** Arrange a visit to the nearest bank. The teacher could also ask the students to conduct a library or Internet search on this topic. (See details in Practice Activity 2.3, Student's Book, page 31)
- (v) **Mobile Banking:** Arrange a visit to the nearest bank. You could also ask the students to conduct a library or Internet search on this topic. (See details in Practice Activity 2.4, Student's Book, page 32)

2.21 Answers to the Learning Activities and Exercises in the Student's Book

Revision Activity 2.1 (Student's Book, page 26)

Part A (Individual work)

1. Electronic Data Interchange
2. QuickBooks, Outright, and Fresh Books

Part B (Individual work)

A	T	D	R	F	G	K	O	H	D
T	R	A	D	I	N	G	G	U	P
F	A	P	Q	P	I	K	Z	R	D
K	S	T	O	C	K	T	M	W	S
G	A	M	G	C	B	J	A	E	X
A	C	C	O	U	N	T	I	N	G
H	T	X	C	I	D	J	L	B	Y
P	I	M	N	W	C	B	P	C	N
R	O	A	B	R	O	K	E	R	V
O	N	Z	G	X	L	Z	D	X	G


Revision Activity 2.2 (Student's Book, page 28): (Individual work)

1. **Defining the term record keeping:** It is a systematic process of recording, creating, capturing, and maintaining transactions and events in an accounting system.
2. **The role of computers in record keeping:** Record keeping software such as accounting software, databases and book-keeper provide ready-made reports, large storage space for files, backup of records, and security of files through the use of passwords among other functions.

3. **The advantages of using ICT in stock exchange:**
 - Computers ensure that stock trading is faster and more efficient.
 - To investors, it gives more up-to-date information.
 - It allows investors to buy or sell shares quickly.
 - It provides accurate market data which is important for investors to make informed choices.
4. **The role ICT in Automation:** Automation is the process of using machines and information technology to create products and services with minimal human intervention.
5. *Explaining automated accounting as used in financial technology:* It refers to the process of maintaining up-to-date accounting records using accounting software.

Revision Activity 2.3 (Student's Book, page 29): (Students to work in groups of five)

1. Let the students conduct research in groups. Each group should have a chairperson and a secretary. These roles should be rotational so that every student gets the chance to develop his or her leadership skills. They should compile their findings in a report. Guide them to make a class presentation. Assess the work done by each group on the areas highlighted in the questions. Some advantages of automated record systems include the following:
 - (i) It is easy to record business transactions, including income and expenses, and payments to workers.
 - (ii) It is easy to keep financial records.
 - (iii) It requires less storage space compared to the manual where physical space is required to store the files.
 - (iv) Easy to generate documents such as orders, invoices, debtor and creditor reports, and financial statements.
 - (v) It easily allows you to compare amounts and correct where necessary.
 - (vi) It can be upgraded to factor in new requirements in tax rates, tax laws and rulings.
 - (vii) Many automated systems have features for e-mailing documents to clients, suppliers, or the revenue authority.
 - (viii) Automated systems easily create backups for records and keep them safely in case of fire or theft.
2. Advise the groups accordingly where the information given is misleading. Let the learners work in small groups of three. Guide them to determine the role of computers in society. Some common terms at the stock exchange market are as follows:

- 
- (i) **Daily Trading Summary Schedule:** The schedule in which all transactions dealt are recorded.
 - (ii) **Dealer:** The person who buys, sells, deals, trades, underwrites or retails in securities.
 - (iii) **Deal in securities:** To make or offer a person, or influence him or her to enter into an agreement of dealing in securities with a view to making a profit.
 - (iv) **Dealing spread:** The allowed price margin within which a deal may go up or down during trading.
 - (v) **Issuer:** The company or other legal institution established legally under the laws of Rwanda that offers securities to the public.
 - (vi) **Listed:** Admitted to the official list of the Rwanda Stock Exchange market or any other recognized stock exchange.
 - (vii) **Material information:** Information that may affect the price of a company's securities or affect investment decisions, for example, a merger, purchase or sale of an asset, a new product released by the company, and a change of senior manager.
 - (viii) **Settlement:** refers to the conclusion of a payment by the buyer to the seller in a transaction on securities.
 - (ix) **Transaction number:** A unique number by which transactions are identified.
 - (x) **Trading floor:** The physical place where transactions in securities are carried out.
 - (xi) **Transaction across books:** A transaction where the same person represents both the buyer and the seller.
 - (xii) **Underselling:** A situation that arises where a trader stops a transaction that is about to be concluded; he or she then offers to sell at a price which is a lower than the given price.
 - (xiii) **Working day:** All weekdays except Saturday, Sunday and public holidays unless otherwise stated.

Revision Activity 2.4 (Student's Book, page 35): (Individual work)

1. E-commerce
2. Online shopping
3. Buy airtime, send money, check balance, withdraw cash, transfer funds, and get mini statements.

Revision Activity 2.5 (Student's Book, page 35): (Individual work)

1. *Defining the term online shops:* This is a form of electronic commerce which allows consumers to buy goods or services directly from the seller over the Internet.
2. *What is the negative impact of financial technology in the society?* Fraud
3. *Explain the term E-commerce:* It is the buying and selling of goods and services over the Internet using credit cards in online shops.
4. *The importance of mobile banking:*
 - (i) It makes life easier since customers can access their accounts at the comfort of their homes.
 - (ii) The customer is notified of any transaction done in his or her account.
 - (iii) Mobile banking applications are easy to use, thus user-friendly.
 - (iv) Use of mobile banking reduces cases of fraud.
 - (v) Transfer of funds from one account to another is easier.
 - (vi) Paying of bills is done faster, at the convenience of the customer.

Revision Activity 2.6 (Student's Book, page 35): (Students to work in groups of five)


1. In groups, learners to discuss the use of mobile banking in Rwanda and write summary notes in their books.
2. Learners to compare mobile banking and the use of ATMs.
3. In groups, learners to discuss the use of mobile banking in Rwanda.

Notes:

- Supervise the group discussions.
- Assess the work done by each group on the areas highlighted in the questions.
- Advise the groups accordingly where the information given is misleading.

Revision Activity 2.7 (Student's Book, page 41) (Individual work)

1. Password
2. Plastic Money
3.
 - (i) Short Message Service
 - (ii) Electronic Funds Transfer
 - (iii) Automated Teller Machine
 - (iv) Closed Circuit Television
4. Fraud
5. Biometrics
6. Remote Banking

- 
7. (i) Electronic Funds Transfer (EFT)
 - (ii) Mobile banking
 - (iii) Internet banking

Revision Activity 2.8 (Student's Book, page 42) (Individual work)

1. **Definition of automated billing:**

This is an action in which invoicing of goods and services occur without the need to prepare the invoice by hand.

2. **How financial technology has positively enhanced quick service delivery in society:**

- Passwords to secure transactions.
- Secure and quick electronic transactions.
- Signature retrieval facilities.
- Transacting from any location.

3. **Explain how fraud is carried out using computer tools.**

- Altering of data or programs.
- Modifying the activities of programs.
- Alter output which is used for personal gain.

4. **Ways in which users can unlimitedly access their accounts:**

- Agency Banking
- Plastic Money
- Remote Banking

5. **Explain how the problem of long queues in banks has been solved:**

- **Electronic Funds Transfer (EFT):** This is where customers can use debit cards, credit cards, and smart cards to transfer money without visiting the bank, either by use of ATM or Online Banking.
- **Mobile banking:** The customer is able to access banking facilities by the use of mobile phones and applications that support all services offered in the bank.
- **Internet banking:** This is made possible through online banking facilities available through Internet connectivity. Clients can carry out banking transactions without physically visiting the bank.

Revision Exercise 2 (Student's Book for Senior 2, page 42)

(Individual work: Treat it as a test. Students to hand in their complete work for marking.)

1. **The positive impact of financial technology in the society:**
 - Quick service delivery.
 - Security in transactions.
 - Unlimited access to the users' bank accounts.
 - Automated billing.
 - Creation of job opportunities.
 - Communication networks.
 - Security.
 - Reduce payroll expenses.
 - Increase revenue to country.
 - Solution to bank service problems (long queues, limited time for each customer).
2. **The advantages of mobile banking:**
 - Transacting at any time.
 - It saves a lot of time.
 - Mobile banking applications are easy to use, thus user-friendly.
 - Use of mobile banking reduces cases of fraud.
3. **How fraud can be carried out using computer tools:**
 - Fraud can be done using computer tools such as the Internet and remote computer systems.
 - Fraud may include hacking in which the criminal behind the activity uses sophisticated technological tools to remotely access a secure computer or Internet location.
 - Another common criminal activity involves illegally intercepting an electronic transmission not intended for the interceptor. This may result in accessing private information such as credit card information and passwords.
4. **The impact of mobile banking in the society:**
 - Transacting at any time.
 - It saves a lot of time.
 - Mobile banking applications are easy to use, thus user-friendly.
 - Use of mobile banking reduces cases of fraud.

The impact of agency banking in the society:

- Reduced transport costs for clients.

- Banking is brought closer to customers
- Creation of business opportunities

2.22 Teacher Support on Assessment: Additional Questions and Answers

(a) Define the term biometrics.

This is an authentication method used to measure unique physical characteristics of a person, such as voice pattern, the iris or retina pattern of the eye, or finger-print patterns.

b) Explain briefly three ways in which biometrics can be used in banks.

Biometric System for ATMs

- ATMs are automated and require customer self-authentication during the transaction process.
- The use of biometric technology in ATMs ensures identification accuracy. This improves the user experience and eradicates the security loopholes of using traditional passwords and PINs to perform a transaction.

Biometrics for Online Banking

- Online banking is now very popular among customers because it provides a suitable way to perform transactions from anywhere and at any time using devices such as laptops, desktop computers, and even smart phones.
- Online banking transactions are highly vulnerable to fraud because thieves are using advanced methods to gain access to user information such as passwords, PINs, and security questions.
- Online banking system will help protect customer's identity and financial information by providing stronger authentication methods such as voice recognition, use of fingerprints, and scanning the facial features.
- Devices such as computers, laptops, and even smartphones have webcams and microphones. These features offer flexibility to the banks for easy adoption of the biometric authentication for online banking services.

Biometrics in Banking Halls

Biometric banking system in banking halls will provide a fast, convenient, and accurate way for banks to authorise customer identities. The customer's existing biometric template within the bank database is matched to the customer's authentication data provided at the counter. After successful authentication, the customer is allowed to proceed with their banking transactions. This helps to maintain an audit trail which helps prevent fraudulent activities.

Unit 3

Objects in a Document

Introduction

Word processors contain features that can be used to insert, format, and edit objects in a document. The user is, therefore, able to insert standard shapes such as circles, rectangles, triangles, callouts, textboxes, and tables, as well as equations and symbols.

3.1 Content Map for the Unit

Unit Title	Objects in a document
Topic Area	Application Software
Subtopic Area	Word Processing
Number of Periods	12
Introduction	Objects in a document
Classroom Organisation	<ul style="list-style-type: none"> • Whole class orientation then work in groups. • Individual activities.
Equipment Required	Computers, projector, textbook, and data.
Activities	Practical activities, discussions, research.
Competencies Practice	Teamwork, communication skills, practical work, and research.
Language Competencies and Practise	<ul style="list-style-type: none"> • Defining concepts and terms such as text box. • Communicating: In class presentations and in group activities. • Explaining concepts in discussions.
Vocabulary Acquisition (Key terms to be introduced and explained to the student)	<ul style="list-style-type: none"> • Shapes • Equations • Text boxes • Tables • Merge cells • Symbols • Split cells
Numeracy	<ul style="list-style-type: none"> • Write mathematical equations. • Add figures in tables. • Perform calculations in a document.

Study skills (including language competencies)	<ul style="list-style-type: none"> • Writing skills in compiling reports and writing essays in documents. • Communication skills developed during class presentations. • Typing skills in keying in data in documents.
Revision	Learning activities, practice activities, and revision activities in ICT Senior 2 Student's Book.
Assessment	<ul style="list-style-type: none"> • Continuous Assessment Tests (CATs), self assessment exercises, and oral questions. • Revision Exercise at the end of the unit and the end-of-term examination.
Learning outcomes	<p>The learner should be able to:</p> <ul style="list-style-type: none"> • Write equations in a document. • Insert symbols in a document. • Add, edit, and format a shape. • Add various tables in a document.

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher's Guide.

3.2 Subtopics/Content to be Covered

Objects: Insert and format text boxes

- Insert a text box
- Format a text box
- Modify colours and lines
- Apply fill effects

Adding Shapes

- Insert shapes
- Format shapes
- Add text in shapes
- Use drawing tools

Insert picture and WordArt objects

- Insert a picture from Clipart Gallery and from file
- Insert a WordArt object

Equations and symbols

- Insert symbols and special characters
- Write equations

Tables

- Inserting a table, a column, and a row
- Deleting a row, a table and a column
- Merging and splitting cells
- Drawing a table, table auto format, and formulas
- Writing in a table, and text direction
- Table properties, layout and design, and borders and shading

3.3 Reference: ICT for Senior 2, Student's Book, pages 43 to 94.

3.4 Key Unit Competency

By the end of this unit, the learner should be able to:

Insert symbols, pictures, tables, and objects into a document.

3.5 Learning Objectives

Knowledge and understanding

By the end of the unit, the learner should be able to:

Identify how to insert different objects, watermarks, symbols, and special characters into a document.

Skills to be imparted in this unit

By the end of the unit, the learner should be able to:

- (i) Illustrate information with different objects in a document.
- (ii) Use equations to write mathematical information.
- (iii) Use tables to manipulate lists with different attributes.

Attitudes and values to be developed in this unit

By the end of the unit, the learner should be able to:

- (i) Appreciate the importance of adding objects in a document.
- (ii) Recognise the use of tables in a document.

3.6 Teacher Preparation

- Make notes and prepare a lesson plan before each lesson.
- Prepare presentation slides before the lesson.

- Attempt the learning activities before presenting them to the student.
- Ensure that all computers are in good working condition before every practical class.
- Read and master the content to be taught. Refer to Unit 3 in the Student’s Book for Senior 2.

3.7 Key Concepts to be Covered

- A text box is an object created to contain text.
- Insert a text box.
- Format a text box by creating a link, editing shape, modifying colours, and changing text direction.
- Adding shapes.
- Formatting a shape by rotation, changing shape, grouping and applying various shape effects.
- Insert pictures and WordArt objects.
- Insert symbols and special characters.
- Write a simple equation.
- Symbols are non-alphabetical signs that have specific meaning when used in a particular context.
- An equation is a mathematical statement that has two expressions, usually separated by equals sign.
- Insert a table.
- A table is a feature that is used to present information in an organised layout and consists of rows and columns intersecting to form cells where data is entered and manipulated.
- Merging and splitting cells.
- Applying table auto format and formulas.
- Formulae are used in order to perform calculations in a table.

3.8 Additional Content for the Teacher

Drawing Tools

Position objects: This feature is used to choose where the selected object will appear on the page. Text will be automatically wrapped around the object so that it is still easy to read. The default position is **In Line with Text**. To apply this feature, do the following:

- (i) Highlight the shape.
- (ii) Click on **Format** tab under **Drawing Tools** tab in the menu bar.

- (iii) Select **Position** icon under **Arrange** group. A dropdown menu appears as shown in figure 3.1.
- (iv) Click on the desired position to automatically apply it.

Wrap text: It is used to choose how text in a document wraps around a selected object. To wrap text, do the following:

- (i) Highlight the text.
- (ii) Click on **Arrange** under **Page Layout** tab in the menu bar.
- (iii) Select **Wrap Text** icon under Arrange group. A dropdown menu appears as shown in figure 3.2.
- (iv) Click on the desired wrap text option.

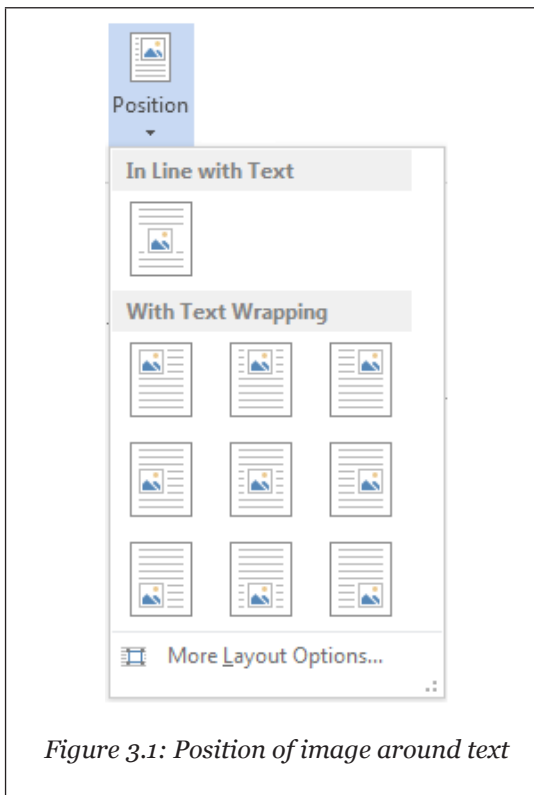


Figure 3.1: Position of image around text

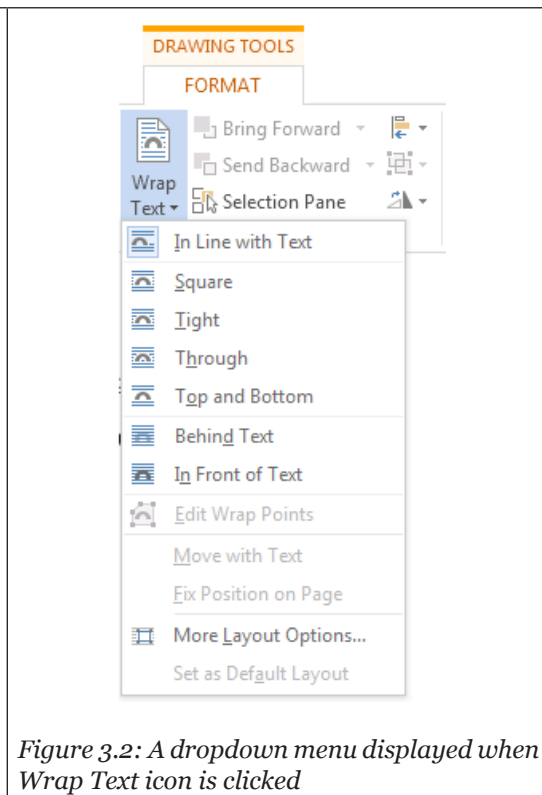


Figure 3.2: A dropdown menu displayed when Wrap Text icon is clicked

Table

Convert to text

Convert the table to regular text. The user can choose the text character to use to separate the columns.

To convert a table to text, do the following:

- (i) Place the cursor in any cell within the table.
- (ii) Click on **Layout** tab in the menu bar.
- (iii) Click **Convert to Text** icon in the **Data** group. A dialog box appears as shown in Figure 3.3.
- (iv) Select how the text is to be separated from the **Separate text with** option.
- (v) Click **OK** to apply.

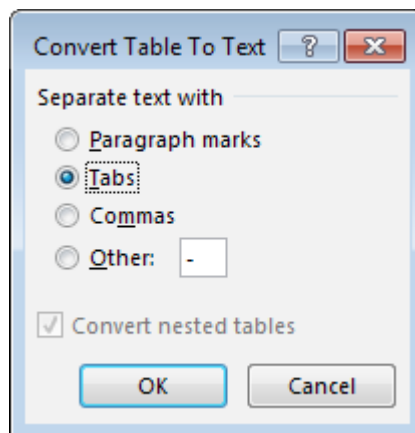


Figure 3.3: Convert table to text dialog box

Eraser

Table eraser is used to remove specific borders in a table in order to create merged cells.

- (i) Place the cursor in any cell within the table.
- (ii) Click **Layout** tab.
- (iii) Select **Eraser** icon in the **Draw** group. The pointer automatically changes to an eraser.
- (iv) Use it to click on a border line. The border line is automatically deleted.

SmartArt

Illustrations and graphics help audiences understand and recall information better than text.

A **SmartArt graphic** is a visual representation of information and ideas. It ranges from graphical lists and process diagram to more complex graphics such as Venn diagrams and organisation charts.

To insert a SmartArt graphic, do the following:

- (i) Position the cursor where the graphic is to be inserted.
- (ii) Click **Insert tab** from the menu bar.
- (iii) Select **SmartArt** icon in the **Illustration** group. A dialog box appears as shown in figure 3.4.

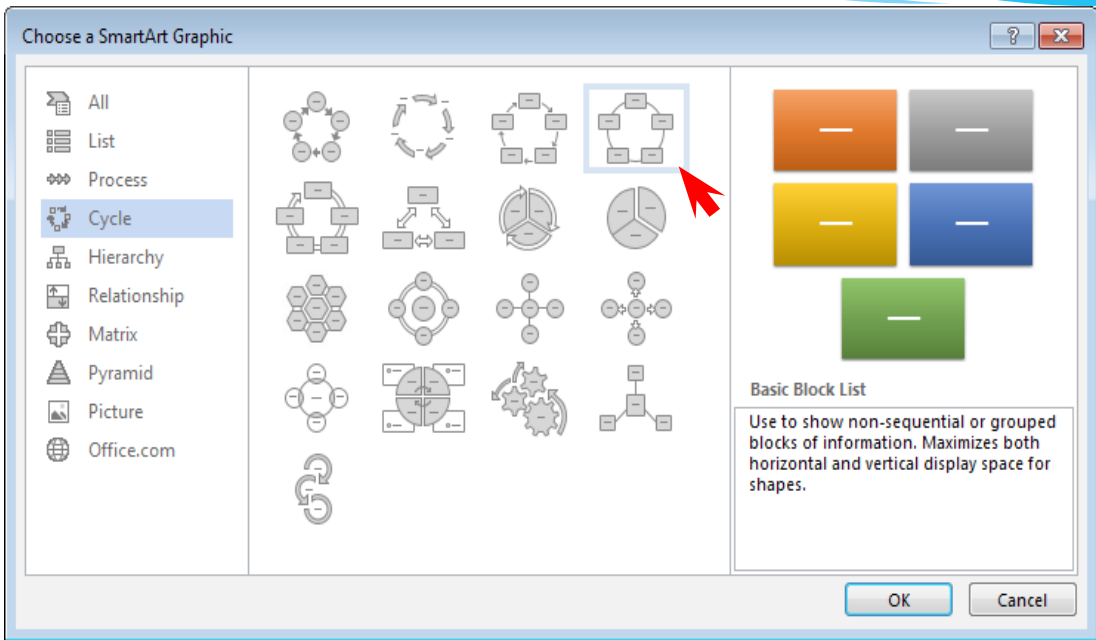


Figure 3.4: SmartArt Graphic dialog box

- (iv) Choose a **SmartArt Graphic** from the left pane; then choose the desired layout from the right pane.
- (v) Click **OK** to apply. The diagram is created as shown in Figure 3.5.

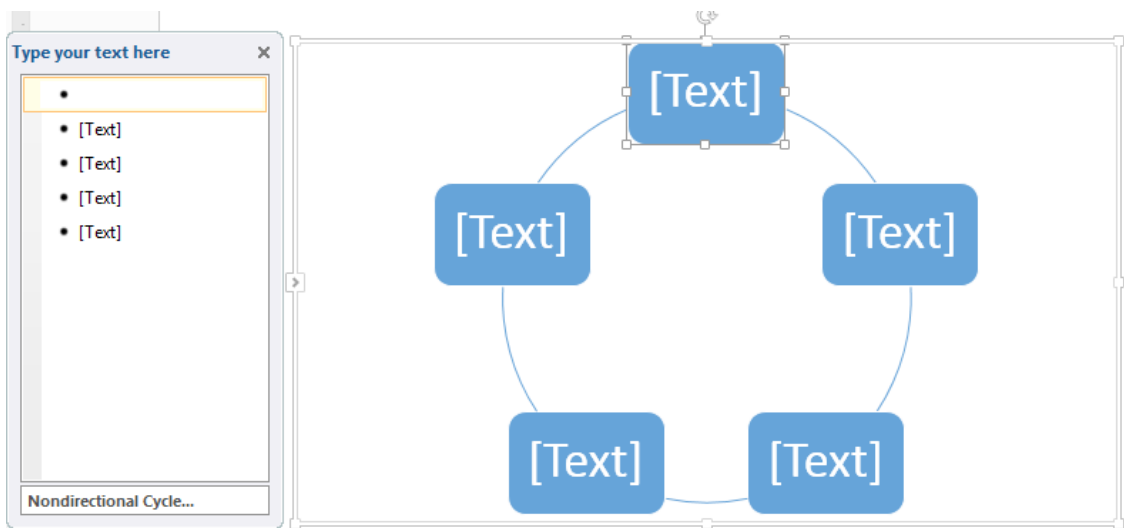



Figure 3.5: A cycle SmartArt graphic

- (vi) Depending on the layout chosen, each bullet in the Text pane is represented in the SmartArt graphic as either a new shape or a bullet inside a shape.

- 
- (vii) To create a new line of bulleted text in the **Text** pane, press **ENTER**.
 - (viii) To indent a line in the **Text** pane, select the line to be indented, and then under **SmartArt Tools**, click on the **Design** tab, in the **Create Graphic** group then select **Demote**.
 - (ix) To negatively indent a line, click **Promote**.

3.9 Suggested Teaching and Learning Materials

- Computers installed with Microsoft Office.
- CDs/DVDs of documentaries on working with Microsoft Word.
- A projector or a smart board.
- Senior 2 Student's Book.
- Other relevant digital learning materials such as laptops, soft documents, and their hardcopies.

3.10 Suggested Low-cost or No-cost Materials

- Press F1 key to access Microsoft Word free tutorial.
- Free tutorials on identified websites such as Microsoft website.
- Ask the students to bring learning materials they would want to share.

3.11 Suggested Teaching Methods

- **Explanation:** Give clear details about concepts by describing them or revealing the relevant facts.
- **Question-and-answer method:** The teacher asks questions and the students respond. The students should also be encouraged to ask questions directed to the teacher or to the rest of the class.
- **Discussions:** These could be done as a class or in groups. Students should be encouraged to participate in the discussions to improve their communication skills.
- **Educational visit:** Make arrangements to take students to visit institutions where they can observe some of the processes they have learnt theoretically in class.
- **Practical activities:** A number of practice and learning activities have been provided in the Student's Book. Guide the learners to work in pairs, groups, or as a class. Observe how they carry out the activities and encourage every student to participate.
- **Demonstration:** Where appropriate give demonstrations. This is especially an important method when the equipment you have is not adequate for the whole class, or when the resources to use are delicate and expensive.

- **Audio and video:** There are limitless audio and video resources online. Do research and give the students links to access these resources. Where the source allows downloading, or saving for offline viewing, download and save the clips on secondary media and avail them to the students.

3.12 Suggested Teaching and Learning Activities and Exercises to Support Delivery of Content and Development of Student Competencies

- Teacher explains key concepts in the chapter.
- Teacher demonstrates to the learners on the procedure for applying the various features using a projector.
- Discussion and exploration of different objects in a document.
- Learners to write equations.
- Learners apply arithmetical operations on numerical data.
- Teacher asks the students oral questions during demonstrations or explanation as the students provide answers.
- Teacher assesses the practical activities being done by the students and provides guidance where necessary.

3.13 Cross-Cutting Issues to be Integrated in Teaching and Learning Activities

There are several cross-cutting issues covered in the examples given in the Student's Book. Examples are working hard, determination, and taking studies seriously. Sensitise students on these issues. Provoke discussions and allow the students to contribute openly.

Example: On Gender Equality

- Rwanda has made a great deal of progress in promoting gender equality due to very strong government commitment.
- As a matter of fact, Rwanda has set aside a ministry for gender and family promotion, a gender monitoring office, a commitment to gender-based budgeting, and a strong emphasis on fighting gender-based violence.
- Rwanda was the first country in the world to have more than 50% female members of parliament.
- There is an education policy and implementation plan in place for the girl child.
- Both girls and boys are given an equal opportunity to attend school.
- Women have the same rights to inherit land as men. However, a gender gap still remains. Discuss how you can be part of the change. Ask the learners to create a document and type their findings on this issue.

3.14 Suggestions for Accommodating Special Education Needs (SEN)

The teacher should identify learners with special needs and help them to cope during the teaching and learning activities.

Type of impairment	Support for the learner
Sensory impairment (visual)	<ul style="list-style-type: none">• Use large font size and legible font styles to prepare slides for projecting digital content.• Allow learners with poor vision to sit next to those with good vision to help where necessary.• Arrange with the administration to provide Braille keyboard, speech input devices, or speakers for the affected learners.
Sensory impairment (hearing)	<ul style="list-style-type: none">• Make an effort to project your voice to be audible to the learners.• Allow the affected learners to sit close to the teacher.
Motor impairment	<ul style="list-style-type: none">• Arrange with the administration to provide the necessary support for these learners.• Assign these students computers near the door so that they do not have to walk long distances before getting to their computers.
Gifted or talented learners	<ul style="list-style-type: none">• Assign these learners extra work.• Assign the learners more challenging work.

3.15 Suggestions for Supporting Multi-Ability Learning

Fast learners

- Let them sit next to slow learners so that they can assist them.
- Give them involving activities.

Slow learners

- Avoid giving so many procedures at the same time.
- Organise remedial lessons.
- Group these students with the fast learners and encourage peer teaching.
- Closely monitor the practical activities being done by these students.

3.16 Support to Learning Activities

The following are some suggestions for assignments to be administered as group work, pair work, and individual work.

Group

- Practise on the procedures for inserting, formatting, and editing objects.
- Give the students the revision activities included in the Student's Book to discuss.

Pairs: Attempt the practice and revision activities in the Student's Book.

As individual: Attempt the revision exercise provided at the end of Unit 3 in the ICT Senior 2 Student's Book.

3.17 Support for the Development of Positive Skills, Values, and Attitudes

- (i) Some life skills to be developed in this unit are: critical and creative thinking, effective communication and problem solving.
- (ii) Values and attitudes to be developed include responsibility, appreciation, cooperation, and curiosity. They are developed in the following ways:
 - Working in groups encourages the development of attitude of cooperation.
 - Curiosity can be developed by letting the learners explore the software and search for an alternative way of performing a procedure.
 - Responsibility can be developed by assigning every group a leader and an activity to allow participation of each student in the group.

3.18 Suggested Formative and Summative Assessment

- During discussions in class, the teacher could use oral questions to gauge the learner's progress.
- There are Practice Activities given within the Unit. Guide learners to work as individuals, groups, or as a class depending on the instructions given in the Student's Book.
- There are Revision Activities within the Unit. Guide the learners to do them and assess them accordingly.
- There are Revision Questions given at the end of the Unit. Administer these questions as a summative examination. Mark and award the students their deserved scores.

3.19 Links to other Subjects

Mathematics: symbols and equations. The student is expected to learn how to enter mathematical symbols and equations in a word processing document.

3.20 Additional Remedial, Consolidation, and Extension Activities

Give the following activities and exercises. Depending on the assessment of the individual learners, make an informed decision to give the activity as either a remedial, a consolidation, or an extension of the learning activities.

1. Ask learners to create documents that tell a story. It could also be a cross-cutting issue such as genocide studies, gender, peace and values, and comprehensive sexuality education, including HIV/AIDS. The created documents should contain pictures, clip art, shapes, and text boxes among other objects.
2. Ask students to write equations. Give them different equations. See an example in Practice Activity 3.12 on page 75 of the Student's Book.
3. Let the learners draw and format various tables containing information about students, teachers, courses, and the timetable.
4. Give them questions such as the following:
 - (i) State **one** purpose of SmartArt.
 - (ii) How is the table eraser used in Ms-Word 2013.
 - (iii) Differentiate between **Position** and **Wrap text** features in Ms-Word 2013.
 - (iv) A student created a document that is to include an organisational chart represented in a hierarchical format. The student did not know how to insert the graph. Advise the student on the easier and faster option that can be used.

3.21 Answers to the Learning Activities and Exercises in the Student's Book

Revision Activity 3.1 (Student's Book page 56)

Part A (Individual work)

1. (i) ESDSAH Dashes (ii) RTUXETE Texture
(iii) NDIEARGT Gradient

Part B (Individual work)

2. The term graphics refers to anything in form of **images** or **pictures**.
3. A **text box** is an object created to contain text.
4. Two text boxes can be connected to allow **text flow** from one to another.
5. The direction of text in a text box could be changed to the desired **orientation**.

Part C (Individual work)

1. **Definition of the term text box:** A text box is an object created to contain text.
2. **Ways in which a text box can be used:**
 - (i) Drawing attention.

- (ii) Enhancing the layout of a document.
 - (iii) Inserting a label on an object or a margin.
3. **Ways in which a text box can be added in a document:**
- (i) From the **Insert** menu, click on the **Shapes** icon then select **Text box** icon in the **Illustration** group.
 - (ii) **Long press ALT**, press **N** then **X** and finally **D** to insert a customized text box or use the arrow keys to select the desired option.
 - (iii) From the **Insert** menu, click on the **Text box** icon, then in the **Text** group.
4. **Keyboard shortcuts for performing the following activities:**
- (i) **Activating the shape outline dropdown menu:** Long press **ALT** then **JD** and finally **SO** after selecting the shape.
 - (ii) **Changing the text direction:** Long press **ALT**, press **JD** then **AX**.
5. A student inserted a text box in a document. The student, however, did not want the border lines of the text box to appear. Advise the student on how to remove the text border.
- (i) Click on the text box.
 - (ii) Click on **Format** tab under **Drawing Tools** tab in the menu bar.
 - (iii) Select **Shape Outline** in the **Shape Styles** group.
 - (iv) Click on **No Outline**.

Part D (Students to work in pairs)

Assess if the following activities have been done in the document:

1. A new document is created and three text boxes inserted.
2. A link between the second and the third text box is created.
3. The following sentence has been typed and that text overflows to the third text box: "Ships don't sink because of the water around them. Ships sink because of the water that gets in them. Don't let what's happening around you get inside you and weigh you down."
4. Borders in the second and third text boxes are removed.
5. The student's first name has been typed in the first text box
6. Document saved as **Object 1**.
7. Appearance of the first text box enhanced in the following ways:
 - (i) Border colour changed to blue.
 - (ii) Line weight increased to 6pts and changed to suitable dashes.
 - (iii) All text rotated to 270°.

Revision Activity 3.2 (Student's Book page 67)

Part A (Individual work)

1. The letters below can be re-arranged to form formatting features in a shape. Give the feature in each case:
 - (i) OPUGR (**Group**)
 - (ii) RETOAT (**Rotate**)
 - (iii) VELBE (**Bevel**)
2. More than one shape can be **grouped** in one so that they are moved or formatted as a unit.
3. **Arrange Group** feature is used when arranging text and shapes in a document.
4. A **canvas** is automatically inserted around all the shapes.
5. Shadow, reflection, glow, soft edges, bevel, and 3-D rotation are examples of **Shape Effects**.

Part B (Pair work)

1. **The procedure for inserting a parallelogram in a document:**
 - (i) Click on **Insert** tab from the menu bar, select **Shapes** icon from **Illustration** group.
 - (ii) Click on parallelogram, the pointer changes to a plus sign.
 - (iii) Position the pointer at the desired area of the document and drag it to the desired direction to draw the parallelogram.
2. **Some formatting features that can be applied in a shape:**
 - Change Shape
 - Rotating
 - Grouping
 - Applying shape effects
3. **Differentiating between the function of rotating handle and adjustment handle found with a shape place holder:**
 - The rotating handle is used to flip or rotate an image to a given degree while the adjustment handle is used to change the shape or the size.
 - The adjustment handle is normally a yellow diamond while the rotating handle is a green circle.
4. **Examples of shape effects available in Microsoft Word 2013:**
 - Shadow
 - Reflection
 - Glow
 - Soft edges
 - Bevel
 - 3-D rotation
5. *The purpose of grouping objects:*

It enables the user to move or format the objects as a unit.

Part C (Students to work in groups of five)

Assess if the students have done the following:

1. A new document has been created. A speech bubble, a round corner rectangle, and a 16-sided star have been inserted.
2. Document saved as **Shapes**.
3. The speech bubble has been rotated to 180°.
4. The Star is formatted to have a relaxed inset bevel.
5. The three images have been grouped to form one large image.
6. The round corner rectangle has been changed to a circle. Changes have been saved as **Shapes 1**.
7. The the following message has been typed in the speech bubble: “Do not litter. Always keep your environment clean” .
8. The following message has been typed in the speech bubble: “Life is an echo, what you send comes back. What you sow you reap.”
9. Changes have been saved as **Shapes 2**.

Revision Activity 3.3 (Student’s Book page 71)

Part A (Pair work)

1. Insert tab
2. WordArt
3. Insert tab
4. Illustrations
5. Textbox

Extra Assignment: Ask learners to create a document on time management.

1. The new document to be saved as Time.
2. Ensure that the spelling of words are typed correctly in the document.
3. Let them obtain an image and insert it in the document. The image can be obtained from the Internet.
4. The image should be inserted in the correct position.
5. Let them apply the **Text Wrap** features.
6. The document should be saved as **Time**.

Revision Activity 3.4 (Student’s Book page 74)

Part A (Individual work)

1. Symbol
2. Equation
3. Radical
4. Structures
5. Insert

Revision Activity 3.5 (Student's Book page 81)

Part A (Individual work)

1. (i) ERMGE (Merge) (ii) LTISP (Split) (iii) REINST (Insert)
2. A table is a feature that consists of **rows** and **columns**.
3. A box formed by the intersection of a row and column in a table is known as a **cell**.
4. Delete columns command is used to erase an **entire column**.
5. The **Merge Cell** command is used to combine more than one cell to appear as one large cell.

Part B (Students to work in groups of five)

Examination Analysis					
Name	Class	House	History	Business	English
Habimana	2a	Muhanga	67	77	74
Muteteli	2b	Huye	89	56	87
Sebahire	2a	Rubavu	98	34	65
Nyamahoro	2b	Gatsibo			

Assess if the following have been done:

1. A new document has been created.
2. A table with three columns and five rows is inserted in the document.
3. Three columns have been added to the right of the column containing *house*.
4. Two rows have been added after the row containing Nyamahoro's details.
5. A row is added on top and the title "Examination Analysis" typed.
6. Document saved as **Table 2**.
7. The row containing Nyamahoro's details has been deleted.
8. The following details are added in the three columns that were inserted:
 - a. Column 1(History, 67, 89, 98), Column 2 (Business, 77, 56, 34) and column 3 (English, 74, 87, 65).
9. Cells containing the title are merged.
10. Cell containing the name Habimana is split into two.
11. Document is saved as **Table 3**.

Table 3 with formulas

Habimana	2a	Muhanga	67	77	74	=Sum(left)	=Count(D3:F3)
Muteteli	2b	Huye	89	56	87	=Sum(left)	=Count(D4:F4)
Sebahire	2a	Rubavu	98	34	65	=Sum(left)	=Count(D5:F5)
			=Average(above)	=Average(Above)	=Average(Above)		

Table 4 with values

Habimana	2a	Muhanga	67	77	74	218	3
Muteteli	2b	Huye	89	56	87	232	3
Sebahire	2a	Rubavu	98	34	65	197	3
			84.67	55.67	75.33		

Revision Activity 3.6 (Student's Book page 87)

Part A (Individual work)

1. A table option that provides in-built formats is known as **Auto Format**.
2. **Formulas** are used in order to perform calculations in a table.
3. Microsoft Word will not total the entire column or row if it contains any **blank** cells.
4. **=SUMLEFT** adds the numbers in the row to the left of the current cell.
5. The **Paste Function** contains inbuilt functions in Microsoft Word.

Part B (Individual work: Treat it as a test. Students to hand in their complete work for marking.)

1. **Definition of the term symbols as used in word processing:**
Symbols are non-alphabetical signs that have specific meaning when used in a particular context.
2. **Three ways in which a table can be created:**
 - Using Draw Table
 - Using Insert Table
 - Using Graphic Grid
3. **Definition of the term equation as used in word processing:**
An equation is a mathematical statement that has two expressions, usually separated by an equals sign.
4. **Differentiating between a row and a column:**
 - Columns are labelled using letters while rows are labelled using numbers.
 - A row contains a record while a column contains a field.
 - A row is horizontal while a column is vertical.
5. **Definition of a table:**
A table is a feature consisting of rows and columns intersecting to form cells that are used to present information in an organised layout.

Part C (Students to work in groups of five)

Assess if the following are done:

1. **Table 3** has been opened.
2. A column has been added to the far right and labelled as **Total**.
3. A formula has been written to calculate total marks for each student.
4. A row has been added after the last record.
5. Formula to calculate average has been added.
6. A column has been added to the far right and labelled as **Number**.
7. A formula to calculate the number of subjects done by each student is written.
8. Text direction of the row containing labels changed to vertical.
9. Changes in the table saved as **Table 4**.

Revision Activity 3.7 (Student's Book page 91)

P	A	S	T	E	W	F	U	N	C	T	I	O	N	E	S
I	L	H	J	A	J	K	O	B	O	R	D	A	R	Y	H
C	Y	A	X	D	B	N	Q	R	E	Q	U	E	M	T	A
T	O	D	O	W	T	L	S	P	M	I	G	B	I	A	P
U	U	I	R	S	H	A	E	X	V	U	O	A	T	B	E
R	T	N	B	A	T	U	O	Y	A	L	L	T	O	L	S
E	Z	G	I	P	I	C	T	C	P	E	S	A	R	Y	N
B	O	R	D	E	R	F	E	Q	U	A	T	I	O	N	S

Answers to Revision Exercise 3 (Student's Book page 94)

(Individual work: Treat it as a test. Students to hand in their complete work for marking.)

1. Differentiating between merge cells and split cells:

Merge cells command is used to combine more than one cell to appear as one large cell while **split cells** command is used to divide a cell into more than one section hence appearing as many different cells.

2. The Table below contains details of students. Use it to answer the questions that follow:

Name	ICT	General	Total Marks
Hakizimana	78	81	159
Dukuzumuremyi	90	65	155
Kamali	68	54	122

(i) Calculate the total marks for Hakizimana =Sum(Left)

(ii) The mean for ICT =Average(Above)

(iii) Give the name of the cell containing ICT marks for Dukuzumuremyi given that A1 is the cell containing Name. B3 and C3

3. What is the purpose of writing formulas? It is used for performing calculations in a table.

4. **What is a cell as used with tables?** A cell is the intersection of a row and a column.
5. **State the purpose of creating links between text boxes.**
It is used to allow text flow from one text box to another.
6. A student wrote a formula in Word 2013. However, the result was not displayed.
 - (i) **Give a reason why this happened.**
All the cells contained letters not numeric values.
 - (ii) **State a solution to the problem.**
Change the text in the cells to numeric values.
7. **Differentiating between an equation and a symbol:**
An equation is written to perform certain mathematical calculations while a symbol is a sign which is not used for performing mathematical calculations.
8. **Two ways in which a picture can be inserted in a document:**
 - From file
 - From the Internet

3.22 Teacher Support on Assessment: Additional Questions and Answers

1. *State one purpose of SmartArt:*
It is used to help audiences understand and recall information better.
2. *How is table eraser used in Ms-Word 2013?*
It is used to remove specific borders in a table in order to create merged cells.
3. *Differentiate between Position and Wrap text features in Ms-Word 2013:*
Wrap text is used for choosing how text in a document wraps around a selected object. The position feature is used to choose where the selected object will appear on the page.
4. A student created a document that is to include an organisational chart which is represented in a hierarchical format. The student did not know how to insert the graph. Advise the student on the easier and faster option that can be used.
To Use SmartArt:
 - (i) Position the cursor where the graphic is to be inserted.
 - (ii) Click **Insert** tab from the menu bar and select **SmartArt** icon. A dialog box appears.
 - (iii) Choose a **Hierarchy** from the left pane then choose a layout from the right pane.
 - (iv) Click **OK** to apply.

Unit 4

Spreadsheet Basics

Introduction

Spreadsheets are programs that are mainly used for accounting, statistical and data analysis among others. The learner is expected to perform basic mathematical operations, format a cell and the data in it, and manipulate data in a spreadsheet.

4.1 Content Map for the Unit

Unit Title	Spreadsheet Basics
Topic Area	Application Software
Subtopic Area	Spreadsheets
Number of Periods	8
Introduction	Spreadsheet Basics
Classroom Organisation	Whole class orientation then work in groups or in pairs. Individual activities.
Equipment Required	Computers installed with Microsoft Excel; ICT Studies, Student's Book for Senior 2 and Teacher's Guide for Senior 2; and samples of data to input in working out the examples and the learning activities in the Student's Book
Activities	Practical activities and discussions.
Competencies Practised	Team work, leadership skills, communication skills, practical skills, and research
Language Competencies Practice	<ul style="list-style-type: none"> • Defining concepts. • Communicating: In class presentations. • Explaining concepts in discussions. • Participating in group discussions. • Leadership skills to play the role of chairperson in a groups. • Writing skills for the role of secretary in a group. • Typing skills to input data in a spreadsheet.

Vocabulary Acquisition (Key terms to be introduced and explained to the student)	<ul style="list-style-type: none"> • Cell • Rows • Fill • Columns • Wrap text • Merge cells • Formula bar • Worksheet
Numeracy	<ul style="list-style-type: none"> • Perform calculations. • Apply various functions in a spreadsheet.
Study skills (including language competencies)	<ul style="list-style-type: none"> • Writing skills in compiling reports. • Communication skills developed during class presentations. • Typing skills in keying in data in spreadsheets.
Revision	<ul style="list-style-type: none"> • Revision and Practice Activities in the ICT Senior 2 Student's Book. • Revision Questions in the ICT Senior 2 Student's Book. • Past examination questions.
Assessment	<ul style="list-style-type: none"> • Learning Activities, Revision Activities, Continuous Assessment Tests (CATs), Random Assessment Tests (RATs) and oral questions. • A summative evaluation at the end of the unit. A revision exercise has been given at the end of the unit.
Learning outcomes	<p>The learner should be able to:</p> <ul style="list-style-type: none"> • Delete, move, and enter data using various methods. • Format a spreadsheet by changing the row height and column width, wrap text, and merge cells. • Perform basic mathematical operations. • Describe the various sections of a spreadsheet environment.

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher's Guide.

4.2 Subtopics/Content to be Covered

Introduction

- Definition and role of a spreadsheet.
- Create, save, and open a workbook.

Spreadsheet Environment

- Title bar, menus, tool bar, scroll bar, formula bar, status bar, cell, active cell, name box, formula bar, column and row headings.

Cell, row and column basics

- Definition, cell content, enter, select, copy and paste, cut and paste cell data.
- Change row height, column width, wrap text, and merge cells.
- Insert, delete, move and hide rows and columns.

Formatting a cell

- Font
- Text alignment and orientation
- Cell borders and fill colours
- Formatting numbers and text

Worksheet basics

- Insert, delete, rename, copy, move, group and ungroup worksheets.

Mathematical operators

- Addition, subtraction, multiplication, division, and percentages.

4.3 Reference

ICT for Senior 2, Student's Book, pages 95 to 128.

4.4 Key Unit Competency

By the end of this unit, the learner should be able to:

- Work with a spreadsheet and apply basic manipulation of cell content using arithmetical operations.

4.5 Learning Objectives

Knowledge and understanding


By the end of the unit, the learner should be able to:

- (i) Explain the role of a spreadsheet.
- (ii) Identify the basic features of a spreadsheet.
- (iii) State how to manipulate cell contents.

Skills to be imparted in this unit

By the end of the unit, the learner should be able to:

- (i) Apply various methods to move, delete, and enter data from and into cells.

- 
- (ii) Manipulate a worksheet and interconnect different worksheets.
 - (iii) Use arithmetic operations to manipulate cell data.

Attitudes and Values to be developed in this unit

By the end of the unit, the learner should be able to:

- (i) Appreciate the functions and effectiveness of a spreadsheet and its use in different sectors of work.
- (ii) Develop confidence when using a spreadsheet.

4.6 Teacher Preparation

- Attempt the learning activities before presenting them to the students.
- Ensure that all computers are in good working condition before every practical class.
- Make notes and prepare a lesson plan before each lesson.
- Prepare presentation slides before the lesson.
- Obtain different resource materials to cater for the varied abilities of the learners.

4.7 Key Concepts to be Covered

- Spreadsheet is application software that is made up of rows and columns used to present and analyse data.
- Spreadsheets enable the user to enter data, edit and perform calculations, as well as present data in charts among others.
- The spreadsheets environment consists of title bar, menus, tool bar, scroll bar, formula bar, status bar, cell, active cell, name box, formula bar, column and row headings.
- Changing of row height and column width.
- Wrap text feature enables a cell to contain content that is larger than its size and all the content is displayed.
- Merging cells involves combining two or more adjacent cells to become one larger cell.
- Formatting of cells is applied when changing font, aligning text, designing cell borders, and filling colours.
- The following are basics that can be done on a worksheet: Insert, delete, rename, copy, move, group, and ungroup worksheets.
- Perform the following mathematical operators: addition, subtraction, multiplication, division, and percentages.

4.8 Additional Content for the Teacher

Format a cell: Using the icons on the Ribbon

Alignment: To format text alignment, do the following:

- (i) Select the cells to apply the format.
- (ii) From **Home** tab, under the **Alignment** group click on the desired alignment style to apply it. The available options are displayed in figure 4.1 and they include:
 - **Align top:** Align text to the top.
 - **Middle align:** Align text for it to be centred between the top and bottom of a cell.
 - **Bottom align:** Align text to the bottom of the cell.
 - **Align left:** Align text to the left of the cell.
 - **Centre:** Align text to the centre.
 - **Align right:** Align text to the right.

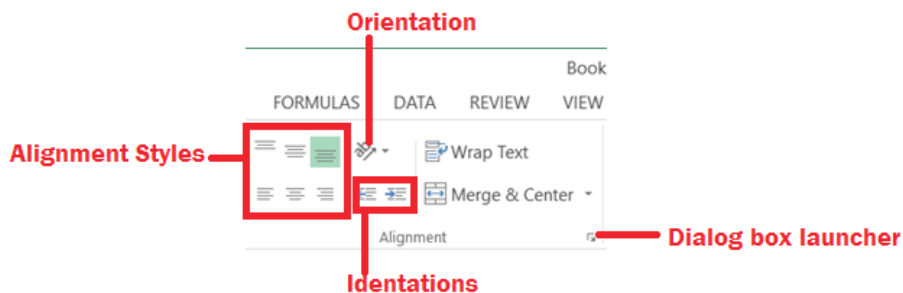


Figure 4.1: Options available in the alignment group

Font

- (i) Select the cells in which to apply the format.
- (ii) From **Home** tab, under the **Font** group, click on the desired font style to apply it. The following are the options available:

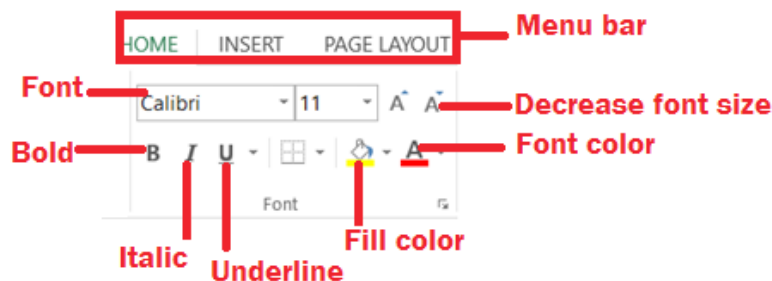


Figure 4.2: Options available in the font group

Number

- (i) Select the cells in which to apply the format.
- (ii) From **Home** tab, under the **Number** group click on the desired number format to apply it.

The following are the options available:

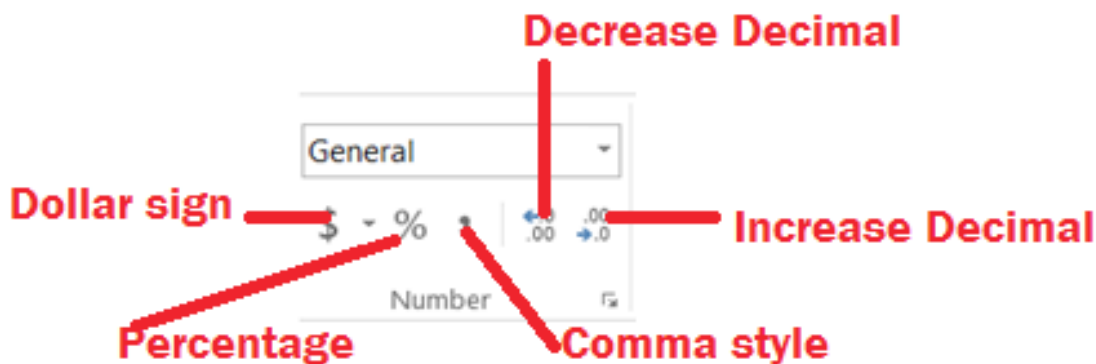


Figure 4.3: Options available in the alignment group

Insert

This option is used to add a row, a column, or another worksheet in the workbook. To use this option, do the following:

- (i) Select the cells to apply the format.
- (ii) From **Home** tab, under the **Cells** group, click on the arrow in the **Insert** icon. A dialog box appears as shown in Figure 4.4.
- (iii) Click on the desired option.

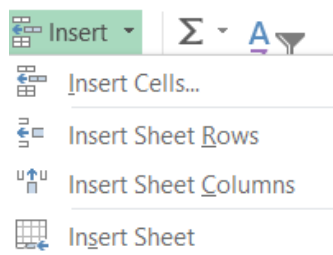


Figure 4.4: Options available when the Insert icon is clicked on the Cell group.

4.9 Suggested Teaching and Learning Materials

- Computers with Microsoft Office 2013.
- CDs/DVDs of documentaries on working with Microsoft Excel 2013.
- Projector or smart board.
- Senior 2 Student's Book.
- Other relevant digital learning materials such as laptops, soft documents, and their hard copies.

4.10 Suggested Low-cost or No-cost Materials

- Press F1 key to access Microsoft Excel free tutorial.
- Free tutorials on identified websites.
- Ask learners to bring relevant learning materials they would want to share.

4.11 Suggested Teaching Methods

- **Explanation:** Give clear details about concepts by describing them or revealing the relevant facts.
- **Question-and-answer method:** The teacher asks questions and the students respond. The students should also be encouraged to ask questions, either to the teacher or to the rest of the class.
- **Discussions:** These could be done as a class or in groups. Students should be encouraged to participate in the discussions to improve their communication skills.
- **Educational visit:** Make arrangements to take students to visit institutions where they can observe some of the processes they have learnt theoretically in class.
- **Practical activities:** A number of practice and learning activities have been provided in the Student's Book. Guide the learners to work in pairs, groups, or as a class. Observe how they carry out the activities and encourage all students to participate and give their contributions.
- **Demonstration:** Where appropriate give demonstrations. This is especially an important method when the equipment you have are not adequate for the whole class, or when the resources to use are delicate and expensive.
- **Audio and video:** There are limitless audio and video resources online. Do research and give the students links to access these resources. Where the source allows downloading, or saving for offline viewing, download and save the clips on secondary media and avail them to the students.

4.12 Suggested Teaching and Learning Activities and Exercises to Support Delivery of Content and Development of Student Competencies

- Teacher explains the key concepts in the chapter.
- Teacher to use a projector to demonstrate to the learners the procedures for applying the various formatting and editing features.
- Discussion and exploration of basic features of a spreadsheets environment.
- Learners to write sample data in cells and apply indicated manipulation guided by the teacher or the available electronic content.
- Learners to link different worksheets by updating data through grouping of worksheets.
- Learners to apply arithmetical operations on numerical data.

- Teacher asks the students oral questions during demonstrations or explanation as the students provide answers.
- Teacher to assess the practical activities being done by the students and provide guidance where necessary.

4.13 Cross-cutting Issues to be Integrated in the Teaching and Learning Activities

- Address the following cross-cutting issues that will help students to relate with others well and live in peace and harmony:

Nurturing Ambassadors of Peace

Human beings are social beings and therefore they need to relate with one another. Good inter-personal relationships result in harmonious and peaceful co-existence. The following are some factors that can improve good inter-personal relationships:

- Respect:** It enables a person to recognise and appreciate other people's rights, status, and circumstances.
- Co-operation:** It is the ability of a person to co-work together with others for a common goal. People in a relationship can only move in the same direction if they work together and agree with one another.
- Love:** It is the affection for or devotion to someone. It is an important ingredient in interpersonal relationships, since it makes relationships strong and long-lasting.
- Tolerance:** It is the ability to put up with other people's weaknesses. It enables a person to bear with difficult people.
- Honesty:** It is being truthful and dealing fairly with other people. An honest person is reliable, trustworthy, and faithful.

Create short health breaks during the lesson. The break could be as short as three to five minutes. Use the break to sensitise students on the cross-cutting issue. Divide the students into groups of three and let them discuss the importance of nurturing cordial interpersonal relationships.

4.14 Suggestions for Accommodating Special Education Needs (SEN)

Identify learners with special needs and help them to cope during the lesson. The following are some of the possible types of impairment that could be encountered:

Type of Impairment and Support for the learner

Sensory impairment (Visual)

- Group these learners with those who have good vision to assist them where necessary.
- Use large font size and legible font styles to prepare slides for projecting digital content.

- Arrange with the administration to provide a Braille keyboard, speech input devices, and speakers for these learners.

Sensory impairment (Hearing)

- Project your voice to ensure you are clearly audible to all the learners.
- Ask the learners questions to assess if they understand the concepts.
- Ensure these learners sit close to the teacher.

Motor impairment

- Assign these students computers near the door so that they do not have to walk a long distance before getting to their computer stations.
- Pair them with the other students.

Gifted or talented learners

- Assign a more challenging exercise.
- Give extra practical questions.
- Encourage peer teaching.

4.15 Suggestions for Supporting Multi-Ability Learning

Fast learners

- Let them sit next to slow learners so that they can assist them.
- Give them involving activities.

Slow learners

- Use simple English for the students to easily understand the concept.
- Avoid giving so many procedures at the same time.
- Organise for remedial lessons.
- Group these students with the fast learners and encourage peer teaching.
- Closely monitor the practical activities being done by these students.

4.16 Support to Learning Activities

The following are some suggestions for assignments: group work, pair work, and individual work.

Group

- Give the students past papers on spreadsheets to compute.
- Give the students revision questions at the end of the unit in the Student's Book to do as a test. Mark and award scores.

Pairs

- Guide learners to work in pairs. They should attempt the learning activities in the ICT Senior 2 Student's Book. The instructions are given in the course book.

As individuals

- Where students are required to work as individuals, guide them accordingly. Mark their work and give them feedback on their performance.

4.17 Support for the Development of Positive Skills, Values and Attitudes

The following are some life skills to be developed in this unit: critical and creative thinking, effective communication, and problem solving.

Values and attitudes to be developed include responsibility, appreciation, cooperation, and curiosity. They are developed in the following ways:

- (i) Working in groups encourages the attitude of cooperation.
- (ii) Curiosity can be developed by letting the learners explore the software and search for an alternative way of performing a procedure.
- (iii) Creative and critical thinking competencies are developed by giving them a project.
- (iv) Responsibility can be developed by assigning every group a leader. The role of leadership should be rotational so that every student in the group gets the opportunity to hone their leadership skills.

4.18 Suggested Formative and Summative Assessment

- Learning Activities and the Revision Exercise in Senior 2 Student's Book.
- Oral questions.
- Practical questions.
- Revision questions from past papers.

4.19 Links to other Subjects: Mathematics: arithmetic operations.

4.20 Additional Remedial, Consolidation and Extension Activities

Give the following activities and exercises. Depending on your assessment of the individual learners, make an informed decision to give the activity as either a remedial, a consolidation, or an extension of the learning activities.

1. Let the learners work in groups of five. Let them discuss and explore the basic features of a spreadsheet environment.
2. Guide learners to input sample data in cells and apply some of the following formatting:
 - Copy and paste data in cells

- Cut and paste data in cells
 - Change row height, column width, wrap text and merge cells
 - Insert, delete, move and hide rows and columns.
3. Guide learners to apply arithmetical operations on numerical data.
 4. What is the function of the **B** icon?
 5. Outline the procedure for inserting a worksheet using the ribbon.
 6. Identify three icons available in the number group of the Home menu.

4.21 Answers to the Learning Activities and Exercises in the Student's Book

Revision Activity 4.1 (Student's Book page 99)

Part A (Individual Work)

1. The default name of the first sheet in a workbook is **Sheet1**.
2. **CTRL + S** is the keyboard shortcut for saving data.
3. A ribbon consists of **icons** of commands organised in groups.
4. The intersection of a row and a column where data is entered is known as a **cell**.
5. **The minimize button** reduces the Microsoft Excel window to an icon in the task bar.

Part B (Individual Work)

1. **Define the term spreadsheet:** Spreadsheet is an application software that is made up of rows and columns used to present and analyse data.
2. **State two roles of a spreadsheet program.**
 - To enable the user to enter and edit data.
 - To perform calculations.
 - To present data in graphic charts.
3. **Give three features of a spreadsheet program.**
 - They consist of workbooks and worksheets.
 - Every worksheet consists of a cell where data is entered.
 - Every individual cell has a unique cell address used for identification.
 - It contains inbuilt formulas known as **functions** that enable the user to quickly perform calculations.
 - It allows presentation of information using charts.
4. **Outline two possible ways of starting the Microsoft Excel program.**
 - Click the **START** button, select **All Apps**, then Click on **Microsoft Office** to display a list of programs contained in the Office Suite. Click on **Excel 2013**.

- Type the word **RUN** in the **Search** the web and Windows box next to the start button then press the **Enter** key. Type **Excel** in the dialog box that appears and click **OK**, or Press **ENTER** on the keyboard.
 - Click the **START** button then select **Microsoft Excel 2013** if it has been pinned on the **START** menu.
 - Click **Microsoft Excel 2013** icon if it has been pinned on the task bar.
5. Write the keyboard shortcut for performing the following actions:
- (i) Open a worksheet (**CTRL + O**)
 - (ii) Close a workbook (**ALT + F4**)

Part C

- | | |
|-------------------------|------------------------|
| 1. Quick Access Toolbar | 2. Title bar |
| 3. Maximize/Restore | 4. Formula bar |
| 5. Column heading | 6. Vertical scroll bar |
| 7. Status bar | 8. Ribbon |
| 9. Name box | 10. Active cell |
| 11. Row heading | 12. Sheet tab |

Revision Activity 4.2 (Student's Book page 115)

Part A (Individual Work)

1.
 - (i) Cell
 - (ii) Column
 - (iii) Selecting
2. **Merge Cell** is a feature that combines two or more cells to one large cell.
3. A feature used to decrease the apparent size of font characters so that all data in a selected cell fits within the column is called **Shrink to fit**.
4. **CTRL + A** is the keyboard shortcut used for selecting contents in an entire worksheet.
5. Values are **numeric** data that can be manipulated mathematically.

Part B (Individual Work)

1. **Differentiate between a row and column.**
A row is a range of horizontal cells having a unique number while a column is a range of vertical cells labelled using a unique letter.
2. **Define the term label.**
It is text or alphanumeric characters that are entered in a cell which cannot be manipulated mathematically.

3. **Differentiate between a function and a formula.**

Formulas are mathematical expressions created by the user while functions are inbuilt formulas that the user can quickly apply in a cell to perform mathematical calculations.

4. **A student created a spreadsheet document for analysis. The student wanted a duplicate of the same file in another location. Outline the procedure the student could have used.**

(i) Select or highlight the data.

(ii) Use one of the following options:

- Right-click on the highlighted data then select **Copy** from the pop-up menu.
- Press **Ctrl + C** on the keyboard.
- From **Home** tab, click **Copy** icon under the **Clipboard** group.

5. **An organisation had a large spreadsheet document. The data in the cells were so many that some of it could not be displayed. Advise the organisation of the feature they could use to ensure that all the data is visible in the cell.**

They can activate the text wrap feature.

Part C (Students to work in groups of five)

1. (i) Value (ii) Label
(iii) Label (iv) Formula

Assess if the following have been done:

2. **A workbook is created and data correctly entered in the worksheet.**

<input type="checkbox"/> Name	<input type="checkbox"/> Maths	<input type="checkbox"/> Science	<input type="checkbox"/> English
<input type="checkbox"/> Umutoni	<input type="checkbox"/> 56	<input type="checkbox"/> 64	<input type="checkbox"/> 93
<input type="checkbox"/> Rwema	<input type="checkbox"/> 78	<input type="checkbox"/> 76	<input type="checkbox"/> 45
<input type="checkbox"/> Kamali	<input type="checkbox"/> 90	<input type="checkbox"/> 88	<input type="checkbox"/> 90
<input type="checkbox"/> Mulisa	<input type="checkbox"/> 45	<input type="checkbox"/> 34	<input type="checkbox"/> 46
<input type="checkbox"/> Mwiza	<input type="checkbox"/> 67	<input type="checkbox"/> 78	<input type="checkbox"/> 77

3. Two rows inserted on top and the title **Final Analysis** typed on the second row.
4. Cells containing the title merged.
5. The column labelled **No.** hidden.
6. The document has been saved as **Analysis**.

Revision Activity 4.3 (Student's Book page 126)

Part A (Individual Work)

O	R	I	E	N	T	A	T	I	O	N	A	M
M	E	W	Y	O	Y	T	E	N	N	I	P	E
E	N	V	T	P	I	Q	X	S	O	A	U	R
R	A	U	O	A	T	A	T	E	D	F	O	E
G	M	C	R	M	E	B	O	R	D	E	R	S
E	E	T	E	L	E	D	A	T	I	O	G	N

Part B (Individual Work)

Let the students work in pairs. Assess if the following have been done:

1. Two columns have been added to the right of the column labelled English and the first column has been labelled **Total**.
2. The total marks for each student have been calculated.
3. The content of the worksheet has been copied to another worksheet.
4. The column labelled No is hidden.
5. The second worksheet has been named **Final**.
6. The Orientation of the text in the first row has been changed to 90°.
7. A border has been added on the worksheet data.
8. The first worksheet has been renamed **Class**.
9. The two worksheets have been grouped.
10. The font size has been changed to 14 and the font type to Arial Black.

Revision Activity 4.4 (Student's Book page 127)

1. $=60+50+50$. Value displayed is 160
2. $=60-50$. Value displayed is 10.
3. $=60*5$. Value displayed is 300.
4. $=160/5$. Value displayed is 32.
5. $=60\%$ and 60% is the displayed.

Answers to Revision Exercise 4 (Student's Book page 128)

(Individual work: Treat it as a test. Students to hand in their complete work for marking.)

- 1. Define the term active cell.**
It is a rectangular box highlighting the cell being worked on and where data is being entered.
- 2. Differentiate between a workbook and a worksheet.**
A workbook is a file that can contain one or more worksheets used to organise different kinds of related data. A worksheet is a collection of cells organised in rows and columns.
- 3. Differentiate between Save and Save As command.**
Save is used when updating data already existing in a given location while **Save As** command is used to save data for the first time in a given location.
- 4. State the function of the paste command.**
It is used for inserting the current clipboard content to a new location.
- 5. Define the term label as used in a spreadsheet.**
It refers to alphanumeric data that cannot be manipulated mathematically.
- 6. List three types of mathematical operators that can be used in calculations.**
 - Addition
 - Subtraction
 - Division
 - Multiplication
- 7. Differentiate between a label and a value.**
A label cannot be manipulated mathematically while a value can be manipulated mathematically.
- 8. (i) Hold down the Control (CTRL) key as you click on the desired cells.
(ii) Click on the cell.**
- 9. Differentiate between Merge cells and Wrap text commands.**
The command **Merge cells** combines several cells to form one large cell to enable large data to be displayed. The command **Wrap text** automatically ensures that data fits in a single cell.
- 10. State three components that must be contained in a formula.**
 - (i) Begin with an equal sign (=).
 - (ii) Contain mathematical operation such as +, -, / and *.
 - (iii) Cell addresses that contain values.



4.22 Teacher Support on Assessment: Additional Questions and Answers

1. What is the function of the **B** icon? To format text in bold type.
2. Outline the procedure for inserting a worksheet using the ribbon.
 - Select the cells to apply the format.
 - From **Home** tab, under the **Cells** group click on the arrow in the **Insert** icon.
 - Select **Insert Sheet** option.
3. Identify three icons available in the number group of the Home menu.
 - Increase decimal
 - Decrease decimal
 - Percentage
 - Comma style

Unit 5

Worksheet Data Presentation

Introduction

When information in a worksheet is too large that it cannot fit on one screen, the user will often scroll through the content to view the ones that are not visible. This topic introduces the learner to various methods of managing large information in a worksheet. Teacher is expected to guide the students on how to sort, filter, and freeze pane among others.

5.1 Content Map for the Unit

Unit Title	Worksheet data presentation
Topic Area	Application Software
Subtopic Area	Spreadsheets
Number of periods	6
Introduction	Worksheet data presentation
Classroom Organisation	<ul style="list-style-type: none">• Whole class orientation then work in groups.• Individual activities.
Equipment Required	Computer, projector, and textbooks.
Activities	Practical activities and discussions.
Competencies Practice	Teamwork, leadership skills, communication skills, and practical skills.
Language Competencies Practice	<ul style="list-style-type: none">• Defining: The learners will be able to give precise meanings of MS Excel words or expression.• Communicating: The learners will practise on transmitting or revealing a thought by speech, writing, or gesture so that it is clearly understood when they answer questions during the lessons.• Explaining: The learners will be able to explain the procedure for executing different commands in Excel with enough clarity. For example, procedure for sorting data in a worksheet.

	<ul style="list-style-type: none"> • Group discussion: The learners will be able to exchange ideas and reach a conclusion on a certain topic during the lesson. • Writing: When the learners are organising the items discussed in respective groups, they will be applying their writing skills. • Reporting: After every discussion during a lesson, the learners will be able to make a formal statement about the key points discussed in their respective groups.
Vocabulary acquisition (Key terms to be introduced and explained to the student)	<ul style="list-style-type: none"> • Freeze Pane • Filter • Page break view • Custom view • Sort • Normal view • Page layout • Split worksheet
Numeracy	<ul style="list-style-type: none"> • Identify different worksheet views. • Identify frozen rows in a worksheet. • Differentiate between data sorted in ascending and descending order. • State whether filtered data meets the stated criteria.
Study skills (including language competencies)	<ul style="list-style-type: none"> • Writing skills in compiling reports • Communication skills developed during class presentations. • Typing skills in keying in data in worksheets.
Revision	<ul style="list-style-type: none"> • Learning Activities in ICT Senior 2 Student's Book. • Revision Questions in ICT Senior 2 Student's Book. • Past examination questions.
Assessment	<ul style="list-style-type: none"> • A formative assessment of the ability to work in teams, carrying out activities, assessing whether the objectives are met, Continuous Assessment Tests (CATs) and oral questions. • A summative evaluation at the end of the unit to examine the extent to which the intended learning objectives have been accomplished.

Learning outcomes	<p>The learner should be able to:</p> <ul style="list-style-type: none"> • Freeze the top row and first column of a worksheet. • Apply the sorting and filtering commands in a worksheet. • Apply different workbook views to display data.
--------------------------	--

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher’s Guide.

5.2 Subtopics/Content to be Covered

Freeze panes

- Freeze top row.
- Freeze first column.
- Workbook view
- Normal, page break preview, page layout, custom view, and split the worksheet.

Sort and filter

- Custom sort: A to Z (ascending order), and Z to A (descending order)
- Filter by colour, text, number, and custom filter
- Grouping and ungrouping worksheets

5.3 Reference: ICT for Senior 2, Student’s Book, pages 129 to 149.

5.4 Key Unit Competency

By the end of this unit, the learner should be able to manage a window, sort and filter data in a spreadsheet.

5.5 Learning Objectives

Knowledge and understanding

By the end of the unit, the learner should be able to:

- Identify techniques to freeze columns and rows.
- Explain the difference between sorting and filtering.
- Describe the impact that sorting can have on data.

Skills to be imparted in this unit

By the end of the unit, the learner should be able to:

- Apply freeze panes, sort and filter skills in a datasheet.
- Filter the data in a spreadsheet.

Attitudes and values to be developed in this unit

By the end of the unit, the learner should be able to:

- Appreciate the importance of freezing columns or rows, and filtering and sorting data.

5.6 Teacher Preparation

- Create a lesson plan based on schemes of work.
- Make notes and demonstration materials before each lesson.
- Attempt the learning activities in Student's Book in advance.
- Avail different resource materials to cater for the varied abilities of learners.

5.7 Key Concepts to be Covered

- The freeze pane command is used to permanently display selected rows or columns.
- Ms Excel provides the following views: Normal, Page Break Preview, Page Layout and Custom View.
- Splitting a worksheet is necessary when all the information in it cannot be displayed in one view.
- Sorting is the process of arranging data in a predefined order.
- Filtering is done to display records that meet a certain criteria.

5.8 Additional Content for the Teacher

Filter dates or times

In addition to filtering data by number, text or colour, it is possible to filter by date and time if the column contains date or time. To filter by date or time, do the following:

- (a) Select a range of cells containing numeric data.
- (b) On the **Data** tab, in the **Sort & Filter** group, click **Filter**. Make sure that the active cell is in a worksheet column that contains dates or times. The keyboard shortcut is: **Long press ALT**, then **A** and finally press **T**.

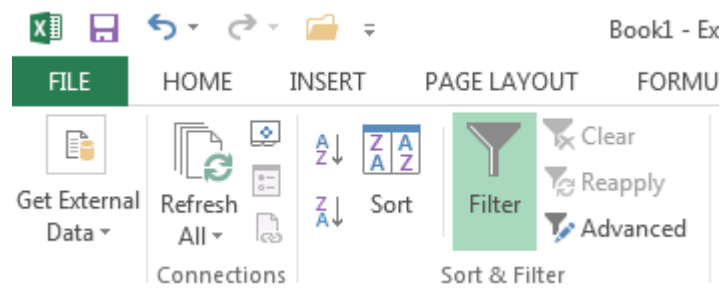


Figure 5.1: Filtering data

- (c) Click the filtering control in the column header and select **Date Filters**. Figure 5.2 shows the menu that will appear.

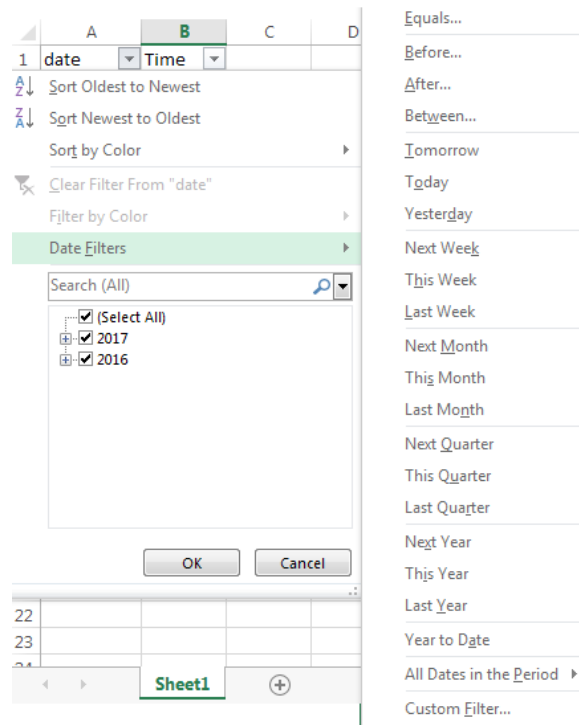


Figure 5.2: The date filter options

Do one of the following:

(a) Select from a list of dates or times

In the list of dates or times, select or deselect one or more dates or times to filter by. By default, all dates or times in the range of cells are categorised by a hierarchy of years, months, and days.

Selecting or deselecting a higher level in the hierarchy will automatically select or deselect all nested dates below that level. For example, if you select 2016, months are listed below that year, and days are listed below each month.

The list of values can go up to 10,000. If the list of values is large, click on **Select All** at the top, and then select the values to filter by.

(b) Create criteria

- (i) Select **Date Filters** and then do one of the following:
- (ii) Click one of the comparison operator commands (**Equals**, **Before**, **After**, or **Between**) or click **Custom Filter**. The **Custom AutoFilter** dialog box appears as shown in Figure 5.3.

On the right side, enter a date or time by either selecting from the list or typing on the box, or click the **Calendar** button to find and enter a date.

(iii) Click **OK** to apply.

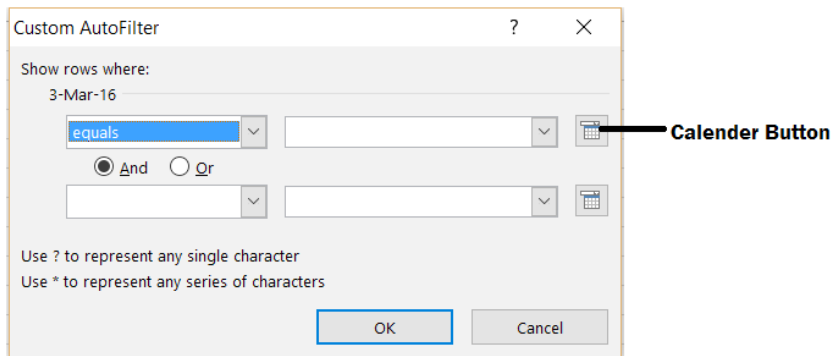


Figure 5.3: Custom filter dialog box

For example, to filter by an earlier date of “5/1/2016” and a later date of “8/29/2016,” enter, “5/1/2016” and “8/29/2016”.

(c) Dynamic filter

A dynamic filter is one where the criteria can change when you reapply the filter. Click one of the pre-defined date commands. For example, to filter all dates by the current date, select **Next Year**, or by the end of **This week**.

5.9 Suggested Teaching and Learning Materials

- Computer
- Projector
- The Internet
- The Senior 2 Student’s Book

5.10 Suggested Low-cost or No-cost Materials

- Access free tutorials on identified websites but always establish the authenticity of the website to avoid downloading infected files.
- Ask learners to bring any learning materials they would want to share, for example, data in hard copy which is unsorted.
- Visit the school offices and request access to the list of students.

5.11 Suggested Teaching Methods

(a) Discussion

In a discussion, the teacher plays a facilitative role. A class discussion seeks and examines an issue by allowing free flow of arguments.

The teacher can follow these steps for a successful discussion:

- (a) Start by highlighting the main points in a discussion.
- (b) Organise the learners into groups of four or five members depending on the size of the class.
- (c) Guide each group to appoint a chairperson to moderate the discussion, and a secretary to note down the contributions of the members. These roles should be rotational. Every learner must get an opportunity to play these roles in order to develop and hone their leadership skills.
- (d) Ensure that the seating arrangement is appropriate for organised conversations.
- (e) After the discussion, guide the learners to make their presentations to the rest of the class.
- (f) Allow other group members to make their contributions.
- (g) Commend and correct the groups appropriately.

(b) Practical Activities

- (a) Refer to the Learning and Revision activities in the Students' Course book for Senior 2.
- (b) Encourage all the learners to participate in the group activities.
- (c) Assess the activities as they are being carried out. You could assess by observation.

(c) Demonstration

The teacher can use this method when teaching a new skill, or when facilities are not enough for all the learners. The teacher could also use it when the equipment or materials to use are expensive or delicate. To perform a demonstration successfully, do the following:

- (a) Select the topic for demonstration. The teacher could inform the learners in advance to prepare them psychologically.
- (b) Try out the steps of the demonstration prior to the lesson to ensure smooth running.
- (c) Ensure that the physical environment is well arranged so that learners observe and follow.
- (d) Ensure that the facilities are available and in good working condition.
- (e) During the lesson, show the learners the procedures to follow in the activity.
- (f) Demonstrate the process, step by step. Encourage learners to ask questions or seek clarification.
- (g) Ask questions as you demonstrate.
- (h) Give the learners the chance to try out the procedure as you supervise.

(d) **Question-and-answer method**

The teacher can use this method when reviewing the previous lesson or when summarising a lesson to help the learners to recall information, emphasise facts, drill for retention of facts, and obtain some measure of achievement.

5.12 Suggested Teaching and Learning Activities and Exercises to Support Delivery of Content and Development of Student Competencies

- Class discussion on freeze pane, worksheet views, sort and filter commands.
- Group discussion on freeze pane, worksheet views, sort and filter commands.
- Students to share their experiences on application of sort and filter commands.
- Practical exercise on freeze pane, worksheet views, sort and filter.

5.13 Cross-Cutting Issues to be integrated in Teaching and Learning Activities

Impact of errors in Spreadsheets

- An error is termed as something unintentionally done wrong. Errors are thought to be common in spreadsheets. In some instances, errors cost organisations large amounts of money.
- When errors go unnoticed, they can have very negative impact to the organisation. Decisions made on erroneous information can impact negatively on the lives of people. Therefore, it is important to take necessary precautions when using spreadsheet formulas by confirming the answers to ensure that they are accurate.

5.14 Suggestions for Accommodating Special Education Needs (SEN)

The teacher should identify learners with special needs and help them to cope during the teaching learning activities.

<i>Type of impairment</i>	<i>Support for the learner</i>
Sensory impairment (visual)	<ul style="list-style-type: none">• You should write large legible letters on the board.• Learners with impairment should sit next to learners with good vision to be helped where necessary.
Sensory impairment (hearing)	<ul style="list-style-type: none">• Speak loudly to be audible to the learner.• Allow learners to sit close to the teacher.
Motor impairment (Movement)	<ul style="list-style-type: none">• Do the activities in one place to avoid situations that require learners to move from place to place.
Gifted or talented learners	<ul style="list-style-type: none">• Assign learners extra and more challenging work.• Encourage fast learners to assist the slow learners.

5.15 Suggestions for Supporting Multi-Ability Learning

Fast learners	<ul style="list-style-type: none">• Request learners to sit next to slow learners to help them.• Give them extra tasks to perform.
Slow learners	<ul style="list-style-type: none">• Remedial teaching.• Take time to go over the procedure and use the language the learners will understand.• Use other learners to assist them to do the task.

5.16 Support to Learning Activities

Individual work, pair work, group work, and whole class work.

Group work:

- In groups, learners to attempt the Practice and Learning Activities given in the Students' Course Book. Clear instructions have been provided. Depending on the size of the class, you could group the learners into groups of fours or fives.

As individuals:

- Guide the learners to do the questions provided in the various learning activities. They should also do the revision exercise at the end of the unit. Administer this exercise as a summative test. Mark and award each student a grade.

5.17 Support for the Development of Positive Skills, Values, and Attitudes

Some life skills to develop include problem-solving, decision-making, effective communication, and creative thinking. Some values to be developed include responsibility, appreciation, respect, cooperation, and curiosity.

- Cooperation is developed through working in groups.
- Develop curiosity by letting the learners discover other ways of sorting, filtering, and freezing rows or columns.
- Develop responsibility by showing care of the computer resources.

5.18 : Suggested Formative and Summative Assessment

- Revision activities and exercises in Senior 2 Student's Book.
- Oral questions.
- Practical questions.
- Continuous Assessment Tests (CAT).

5.19: Links to other subjects: English: Development of new ICT vocabulary, for example, in English they define the word sort theoretically and in ICT they are exposed to the practical part of it.

5.20: Additional Remedial, Consolidation and Extension Activities

Give the following activities and exercises. Depending on your assessment of the individual learners, make an informed decision to give the activity as either a remedial, a consolidation, or an extension of the learning activities.

- An essay writing competition on the use of spreadsheet software in the school.
 - Reward the winning essay with an ICT accessory such as a flashdisk.
1. Define the term dynamic filter as used in spreadsheets.
 2. The table below shows a list of children who were born in 2016. Use it to answer the questions that follow.

	A	B	C
1	Child's name	Date of birth	Hospital
2	Irudukunda	1/1/2016	Muhima
3	Mutegaraba	2/12/2016	Kigali central
4	Mukambanguza	4/29/2016	La Croix du Sud
5	Nazou	5/30/2016	Muhima
6	Habimana	6/17/2016	Kigali central
7	Muteteli	7/3/2016	La Croix du Sud
8	Sentwali	8/23/2016	Muhima

- (a) Open MS Excel and type the list as it appears. Save it as **Birthday** on the computer desktop.
- (b) Using the filter command, display all the children whose birth date is between 4/29/2016 and 7/3/2016.

Expected Answers

1. Dynamic filter is one where the criteria can change when the filter is reapplied.
2. (b)

Irakuda	1/1/2016	Muhima
Nazou	5/30/2016	Muhima
Habimana	6/17/2016	Kigali Central

5.21 Answers to the Learning Activities and Exercises in the Student's Book

Revision Activity 5.1 (Student's Book page 137)

Part A (Individual work)

1. Freeze
2. Normal
3. Custom Views
4. Split Worksheet
5. Page layout

Part B (Individual work)

1. Explain the use of the freeze command.
It is used to permanently display selected rows or columns.
2. Outline three examples of worksheet views.
 - (a) **Normal:** This option displays the document in normal view.
 - (b) **Page Layout:** This option views the document as it will appear on the printed page.
 - (c) **Page Break Preview:** This option is used to view a preview of where pages in a document will break when being printed.
 - (d) **Custom View:** This is a flexible tool that can be used to view the same data in different ways which is faster than manually changing the settings.
3. Differentiate between worksheet freeze and worksheet Split.

Freeze	Split
<ul style="list-style-type: none">• The freeze command is used to permanently display selected rows or columns.	<ul style="list-style-type: none">• This option divides the worksheet into 4 sections.
<ul style="list-style-type: none">• Displays consecutive rows on the screen apart from the ones which are frozen.	<ul style="list-style-type: none">• Displays different parts of a worksheet on different sections on the same screen.

4. Outline the steps followed when creating a custom view in an Ms Excel worksheet.
 - (a) Select the **Custom Views** option from the **Workbook Views** group.
 - (b) Click **Add...** command.
 - (c) Type the name of the view in the **Name** text box then click **Ok**.
5. Describe three freeze pane options.
 - (a) **Freeze Panes:** Keeps a given block of rows and columns visible while the rest of the worksheet scrolls.
 - (b) **Freeze Top Row:** Keeps the top row visible while scrolling through the rest of the worksheet.

- (c) **Freeze First Column:** Keeps the left column visible while scrolling through the rest of the worksheet.
 - (d) **Unfreeze Panes:** Unlocks all rows and columns to scroll through the entire worksheet.
6. **Explain the importance of the page layout view.**
This option helps the user to view a document as it will appear on the printed page.

Part C (Students to work in groups of five)

Assess if:

1. (i) Worksheet 1 is created in page break view.
(ii) Worksheet 2 is created in page layout view.
2. “Integrity is key to success” is inserted as a header;
3. Worksheet 2 has been split from cell C10.
4. Changes made on the worksheet saved as **Exercise 1**.

Revision Activity 5.2 (Student’s Book page 146)

Part A (Pair work)

1. **Sorting** is the process of arranging data in a predefined order.
2. Records in a worksheet can be arranged either in **ascending** order or **descending** order.
3. The process of displaying records that meet a certain criteria in a worksheet is known as **filtering**.
4. The part labelled (1) is Filtering Control.
5. **Text only**.

Part B (Pair work)

1. **Explain the importance of sorting data in a worksheet.**
It helps in arranging data in a given order to speed up access.
2. **Outline the steps followed when sorting data in a worksheet.**
 - (a) Select the cell range containing the data to be sorted.
 - (b) Click on **Data** tab from the menu bar then select one sort option from the **Sort & Filter** group.
 - (c) To sort in ascending order, select the **A to Z** icon. To sort in descending order, select the **Z to A** icon.

3. **Outline the steps followed when filtering data in a worksheet.**
 - (a) Select the cell range containing the data.
 - (b) Click on **Data** tab from the menu bar then select **Filter** command from the **Sort & Filter** group. Filtering can be done by number, text or colour. Choose the desired option.
 - (c) Click **Ok**.
4. **Outline three filter options.** Filtering by: Number, Text, and Colour.
5. **State the function of the Filter command.**

It is used to display records that meet a certain criteria only.


Part C (Students to work in pairs): Assess if:

- (i) Worksheet 1 is created; correct data entered; document saved as **Championships**.
- (ii) Data in Sheet 1 is copied to Sheets 2 and 3.
- (iii) Records in Sheet 2 are filtered correctly by text.
- (iv) Records in Sheet 3 are correctly filtered by colour.
- (v) Changes have been saved as **Filtered List**.

Answers to Revision Exercise 5 (Student's Book page 149)

(Individual work: Treat it as a test. Students to hand in their work for marking.)

1. (i) Custom (ii) Normal
2. Custom view, Normal view, Page break preview and page layout view.
3. It keeps the top row visible while scrolling through the rest of the worksheet.
4. Filtering manages large data in a worksheet by displaying only those that meet given criteria while sorting arranges the data in a given order to speed up access.
5. Filtering data in a worksheet so that it only displays values greater than 50:
 - Select the cell range containing the data to be sorted.
 - Click on **Data** tab from the menu bar then select **Filter** command from the **Sort & Filter** group.
 - Click on the filter control and select **Number Filters** option.
 - From the resulting side kick menu, click on **Greater than** option.
 - Type 50 at the cursor position in the **Custom Autofilter** dialog box.
 - Click **OK**.
6. **Outline a circumstance under which each of the following features would be applied in Ms Excel:**
 - (a) **Sort:** When ranking, especially to arrange in ascending order to show the best out of a list of items.

- 
- (b) **Filter:** When you want to view a certain category of records that meet a certain criteria.
7. **Outline the steps followed when splitting a worksheet.**
- Position the cursor at the cell where the worksheet is to be split into panes.
 - Click on the **View** tab in the menu bar then select **Split** command on the ribbon from the **Windows** group.
8. **A command to view column labels and the last row in the worksheet at the same time:** Use the freeze pane command to permanently display the first row and the last row.
9. **Outline the steps followed when sorting a list of data in descending order in a worksheet.**
- Select the cell range containing the data to be sorted.
 - Click on **Data** tab from the menu bar.
 - Select the **Z to A** icon from the **Sort & Filter** group to sort in descending order.
10. **Mwiza would like to insert a footer on a worksheet. State a worksheet view that she would use to achieve her objective.**

Page Layout View: It enables the user to view a document as it will appear on the printed page showing all the footers as well as the header.

5.22 Teacher Support on Assessment: Additional Questions and Answers

1. **Outline any three comparison operators used when filtering by date.**
- Equals
 - Before
 - After
 - Between
2. **Describe a dynamic filter as used in spreadsheets.**
- A dynamic filter is one where the criteria can change when you reapply the filter.
3. **Outline the steps that would be followed to display all records whose date is after 3/3/2015 and before 3/3/2016 using the filter feature.**
- (i) Select **Date Filters**.
 - (ii) Click on **Custom Filter**. A **Custom AutoFilter** dialog box, on the right side of the box either enter 3/3/2015, select it from the list, or click the **Calendar** button to find it.
 - (iii) Click on **And** button then enter 3/3/2016 on the box just below the one containing 3/3/2015.
 - (iv) Click **OK**.

Unit 6

ArcGIS

Introduction

ArcGIS equips the learners with skills that enable them to add data to a map, work with data in a maps and be able to query a map.

The learner should be able to open ArcMap and browse, save and close an existing map. Individually or in groups, learners should create layers.

It is also expected that the learners should be able to query a map using identify measure, Go To XY, and hyperlink tools.

6.1 Content Map for the Unit

Unit Title	ArcGIS
Topic Area	Application Software
Subtopic Area	GIS
Number of Periods	8
Introduction	Creation of Maps
Classroom Organisation	<ul style="list-style-type: none"> • Whole class orientation then work in groups. • Individual activities.
Equipment Required	Computers installed with ArcGIS software, projector, text book and digital materials such as like Evernote, Google Education, Diigo, and Google earth among others.
Activities	Practical activities, discussions, demonstrations.
Competencies Practice	<ul style="list-style-type: none"> • Team work • Leadership skills • Research • Communication skills

Language Competencies Practice	<ul style="list-style-type: none"> • Defining concepts and terms • Communicating: In class presentations • Explaining concepts in discussions • Participating in group discussions • Leadership skills to play the role of chairperson in a group • Writing skills to take up the role of secretary in a group • Typing skills to input data
Vocabulary Acquisition (Key terms to be introduced and explained to the student)	<ul style="list-style-type: none"> • Legends • Geospatial Data • Graduated Colours • Attribute Table • Geodatabase • Georeferencing • Personal Geodatabase • Database • Symbology • Layers • Rectify • Attribute • Feature Class • Feature Dataset
Study Skills (including language competencies)	<ul style="list-style-type: none"> • Note taking • Organisation of ideas • Reporting skills • Observation skills
Revision	<ul style="list-style-type: none"> • Learning Activities and Revision Exercise in the ICT Senior 2 Student’s Book. • Past papers covering ArcGIS
Assessment	<ul style="list-style-type: none"> • A formative assessment of the ability to work in teams, carrying out activities, experiment and recording of observation, Continuous Assessment Tests (CATs) and oral questions.
Learning Outcomes	<p>The learner should be able to:</p> <ul style="list-style-type: none"> • Create Maps and insert features. • Display layers and show where the data has been stored. • Open Attribute table sort, and freeze columns. • Query a map using measure, Identify, and Go TO XY tools.

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher’s Guide.

6.2 Subtopics/Content to Be Covered

Creation of Maps :Open a new empty map.

Add data to the map

- Display of a layer
- Symbolise layer using one single symbol per layer.
- Add/Remove labels of a layer.

Layer properties and discuss the tabs in layer properties dialog box.

- Attribute Table
- Open an attribute table
- Sort data in ascending and descending order.

Freeze and unfreeze columns

- Query methods
- Measure
- Go to XY
- Identify
- Hyperlink

Select features

- Spatial Thinking Techniques

6.3 Reference: Senior 2, Student's Book, pages 150 to 185.

6.4 Key Unit Competencies

By the end of this unit, the learner should be able to:

- (i) Fill a new empty map with data.
- (ii) Use simple symbols.
- (iii) Label features and attribute tables.
- (iv) Navigate a map.

6.5 Learning Objectives

Knowledge and understanding

By the end of the unit, the learner should be able to:

- (i) Create maps in ArcGIS.
- (ii) Use navigation tools in ArcGIS.

Skills to be imparted in this unit

By the end of the unit, the learner should be able to:

- (i) Add data to a map.
- (ii) Work with data in a map.
- (iii) Apply simple symbology techniques.
- (iv) Use an attribute table.
- (v) Query a map using measure, go to XY, and hyperlink methods.

Attitudes and values to be developed in this unit

By the end of the unit, the learner should be able to appreciate the importance of GIS.

6.6 Teacher Preparation

- (i) Practise how to open ArcMap and ArcCatalog, browse, save, and close an existing map.
- (ii) Practise how to create layers.
- (iii) Practise how to use the navigation tools to explore a map.
- (iv) Practise how to query maps using measure, go to XY, and identify tools.
- (v) Practise how to apply hyperlink.
- (vi) Read and master the content to be taught.
- (vii) Plan and make notes for the lesson.

6.7 Key Concepts to Be Covered

Creation of maps

- Maps have to be created in ArcMap from a new blank map. It will be important to create layers and add features to the layers. Creation of layers includes saving the data in ArcCatalog in a folder; creating personal geodatabase; creating feature classes; and creating feature dataset and adding features.
- Display of a Layer: Different types of symbols are usually used with the data features in a layer, for example, Single Symbols, Unique Values, Graduated Colours, Graduated Symbols, and Dot Density Symbols among others.
- Layers can be added or removed by clicking on the check box and de-activating it.
- Each layer has its unique properties. One can right-click on the layer, and from the dropdown menu, display the layer properties dialog box. The dialog box has several tabs including Source Tab, Symbology, and Selection Fields among others.
- Attribute Table: Open an attribute, add fields to the table, and add data to the fields. Use the sort tool to sort data in ascending/descending order. Freeze and unfreeze a column.

Query Methods

- Use the **Go to XY** and **Identify** tools to query maps.
- Use the **Measure** tool to calculate distances and area of locations on a map.
- Apply **Hyperlink** to layers in a map.
- Use feature selection tools.

6.8 Additional Content for the Teacher

Spatial Thinking Techniques

Spatial thinking includes our thought and understanding processes. A spatial thinker is able to visualise relations and perceive an object from various angles. He or she is able to remember images seen in varied locations.

Spatial thinking enables us to create representations such as maps. The contexts in which space thinkers operate include the following:

- Life space:** This is four-dimensional and helps relate oneself and the physical environment. Life space involves thinking about our existence in Planet Earth.
- Physical space:** This emphasises the scientific understanding of nature. Physical space involves thinking how the world works. This relates to how we come up with conclusions.
- Intellectual space:** This relates to concepts and objects that are not necessarily spatial, for example, a concept such as nurturing peace between nations and communities.

6.9 Suggested Teaching and Learning Materials

- Computers with appropriate software
- CDs/DVDs of world maps
- A video player and a projector
- The ICT Student's Book for Senior 2
- An interactive board
- ArcGIS desktop
- Other relevant digital learning materials such as radio, television, laptops, phones, tablets, billing machines, projector.

6.10 Suggested Low-cost or No-cost Materials

- Free downloads from the Internet. Always establish the authenticity of the website to avoid downloading infected files.
- Free tutorials on identified websites.

- Ask learners to bring any learning materials they would want to share.
- Visit neighbouring schools and request access to their resources.

6.11 Suggested Teaching Methods

Some of the teaching methods that can be applied in this chapter include the following:

- Question-and-answer method
- Explanation
- Practical activities
- Discussions

6.12 Suggested Teaching and Learning Activities and Exercises to Support Delivery Of Content And Development Of Student Competencies

- Class discussions on concepts of ArcGIS.
- Group discussions on the relationship between ArcMap and ArcCatalog.
- Question and answers on varied concepts.
- Students to share any knowledge they may have.
- Video clips on GIS and maps.

6.13 Cross-Cutting Issues to Be Integrated in Teaching and Learning Activities

(a) GIS in Disaster Management

- GIS is important in disaster management. It is used to identify emergency management needs to be identified prior to an incident.
- Disaster events, for example, floods, oil spills, earthquakes, epidemics, wildfires, and tsunami can be modeled and displayed in GIS.
- Disaster management programs are based on data.
- Disaster management programs are developed through the analysis of data and information. The information is spatial and can be mapped using GIS.
- After information is mapped and data is linked to the map, disaster management can then be done.
- The environmental factors can be identified and be linked to likely disasters. The disaster needs and preparedness can then be included in mitigation programs.
- The appropriate data is gathered, organized, analysed and presented in order to determine the appropriate management programs to put in place.

(b) GIS in the Police Department

- Crime patterns in the country can be studied and mapped. This will help the authorities to gather intelligence information and deploy security enforcement officers hence improving the country's security.

- A police dispatcher team can find the fastest route to an emergency spot using GIS.

Other areas where GIS is used include the following:

- **Ministry of Lands:** The government prepares maps on land use for planning purposes.
- **Transport:** The department uses GIS to monitor the condition of roads and bridges and produces planning maps for natural disasters. The department can also produce maps of bicycle and footpaths for commuters.
- **Infrastructure and utility lines:** The Rwanda Energy Corporation (REC) and water and Sanitation Corporation (WASAC) can use GIS to find the shortest and cheapest routes for laying new lines to a desired destination.
- **Telecommunication:** A telecommunication company studies the terrain to find locations for new cell phone masts.

6.14 Suggestions for Accommodating Special Education Needs (SEN)

The teacher should identify learners with special needs and help them to cope during the teaching learning activities.

Type of impairment	Support for the learner
Sensory impairment (visual)	<ul style="list-style-type: none"> • Learners could sit next to learners with good vision to get help where necessary. • Teacher to write large letters on the board.
Sensory impairment (hearing)	<ul style="list-style-type: none"> • Teacher should make an effort to speak loudly to be audible to the affected learners. • Allow learners to sit close to the teacher.
Motor impairment	<ul style="list-style-type: none"> • Do the activities in one place to avoid situations requiring learners to move from place to place.
Gifted or talented learners	<ul style="list-style-type: none"> • Assign the learners extra work. • Assign the learners more challenging work.

6.15 Suggestions For Supporting Multi-Ability Learning

Fast learners	<ul style="list-style-type: none"> • Request learners to sit next to slow learners to help them. • Give them extra tasks to perform.
Slow learners	<ul style="list-style-type: none"> • Take time to go over the procedure and use the language the learners will understand. • Remedial teaching. • Use other learners to assist them to do the task.

6.16 Support to Learning Activities

Group work, pair work, project work, individual work, and whole class work.

As a group:

- In groups, open the **ArcCatalog**, browse, save, and close an existing map. Open the same map in ArcMap.
- Use the navigation tools to explore maps.

As individuals:

- Query a map using the map of Africa. Use the **identify tool**.
- Create a Hyperlink on a layer on the Map and save the data.

6.17 Support for the Development of Positive Skills, Values and Attitudes

- Some life skills to develop include critical thinking, effective communication, problem-solving, and creative thinking. Some values to be developed include responsibility, appreciation, cooperation, and curiosity.
- Working in groups encourages development the attitude of cooperation.
- Develop curiosity by letting the learners discover the various tools in ArcMap.
- Have the desire to explore the environment and find out more on what they have learnt.
- Creativity can be encouraged by letting the students open different types of maps.

6.18 Support to Suggested Formative And Summative Assessment

- Practice and Revision Activities, as well as the Revision Exercise in the ICT Student's Book for Senior 2
- Oral questions
- Continuous Assessment Tests (CATs)
- Random Assessment Tests (RATs)

6.19 Links to Other Subjects

- Mathematics: Measurements and coordinates.
- Geography: Physical geography, maps, and spatial data manipulation.

6.20 Remedial, Consolidation and Extension Activities

Give the following activities and exercises. Depending on your assessment of the individual learners, make an informed decision to give the activity as either a remedial, a consolidation, or an extension of the learning activities.

- Let the students try and create several layers on a certain new map. They should be as creative as possible in the design. Guide them appropriately.

- Let the learners practise how to open an existing map, turn on and off layers, and order and rename layers. Give them the necessary guidance.
- Guide the learners to perform exercises on how to open a new empty map, add data, and save a new map. Guide them through the steps.
- Encourage the learners to explore and change symbols by right- or left-clicking on the symbol. Encourage them to ask questions.
- Guide the learners to explore the presentation of labels of a layer. They could work in pairs.
- Guide the learners to open and arrange attribute tables. Help them to use a query using methods such as measure, go to XY, identify, hyperlink, and select features.

6.21: Additional Assignment

Arrange an educational visit to an institution that uses ArcMap. Have a resource person to take the learners through the software. Encourage them to ask questions and seek clarifications.

6.22 Answers to the Learning Activities and Exercises in the Student's Book

Revision Activity 6.1 (Refer to the Student's Book, page 166)

Part A: This part could be done as individual work

1. Layers define how a set of geographic features will be drawn when they are added to a map.
2. There are two ways of adding data; Click **Add Data** button to add data which is stored in a folder, or the Arc Catalog window is opened side by side to the ArcMap window and then the data to be added is dragged from the ArcCatalog Tree menu to the display area of the ArcMap window.
3. Single symbol
4. The **General Tab** allows the recording of layer properties such as layer name, its description, set credits, and specifies scale-dependent drawing properties.
5. Line, colour, and width.

Part B: This part could be done as individual work. Give this as a CAT. Mark and review it in class.

1. Generally, making maps in ArcMap takes the following steps:
 - (i) Load Geospatial data into ArcMap.
 - (ii) Identify the features and attributes to present.
 - (iii) Define how to show the data.

- (iv) Add map components.
 - (v) Export the map.
2. Symbology is a set of conventions, rules, or encoding systems that defines how geographic information is represented with signs on a map.
 3. Graduated colours use a range of colours to show qualitative differences in feature values while Graduated symbols show qualitative differences in feature values with varying symbol sizes.
 4. To remove the label of a layer, uncheck the dialogue box, next to the label. To add the layer for the cities, just check the Checkbox against the layer and the feature appears in the map.
 - 5.

Symbol Type	Basic Property
Line	Line colour, width.
Polygon	Colour, Outline colour, Outline width.
Point	Colour, Size, Angle, Angle alignment, in the context of a 2D map only.

Part C: This part could be done in groups of five

Guide the learners to perform the given tasks. Emphasise the difference between data in ArcCatalog and ArcMap. They should practise turning the layers on and off. They should be able to change the shapes and colour of symbols used to represent different features.



Revision Activity 6.2 (Refer to the Student’s Book, page 183)

Part A: This part could be done as individual work. Give the exercise as a test. Mark and review it in class.

1. A field is a column in an attribute table that contains information for each feature.
2. Freezing a column helps in showing how attributes for the same feature are related with respect to one or more key fields (that are frozen).
3. The Measure Tool allows distances, areas, and feature locations on a map or scene to be measured.
4. Hyperlinks allow access to documents or web pages related to a certain feature.
5. Spatial queries.

Part B: This part could be done as individual work

Give this as a CAT. Mark and review it in class.

1. To add hyperlink using the Identify tool;
 - (i) Click the **Identify** tool  on the **Tools** bar.
 - (ii) Click the feature for which you want to define a hyperlink.
 - (iii) Right-click the feature in the **Identify** window and click **Add Hyperlink**.
 - (iv) Specify the desired hyperlink target
2. The three types of hyperlinks are:
 - (i) **Document**: Clicking a feature with the Hyperlink tool opens a document or file using its appropriate application (such as Microsoft Excel).
 - (ii) **URL**: On clicking a feature with the Hyperlink tool, a web page is launched in the web browser.
 - (iii) **Script**: On clicking a feature with the **Hyperlink** tool, a feature value is sent to a script.
3. On the tools toolbar, click the **Go To XY** button  to open the **Go To XY** dialog box, key in the X and Y coordinates, and click the **Add** call-out button. A call-out will be inserted in the position represented by the coordinates.
4. To sort records:
 - (i) Click the heading of the field column whose values are to be sorted.
 - (ii) Right-click the selected field's heading and click **Sort Ascending**.
5. Types of data in a field include:

(i) Integers (short or long)	(ii) Decimal numbers (floats or doubles)
(iii) Text	(iv) Date
(v) Binary Large Objects (BLOB)	(vi) Global ID's (GUID)

Part C: This part could be done in groups of five

Provide the learners with the relevant data and a new map. Ensure it has well marked Eastings and Northings. Guide them to perform Georeferencing, and creation of personal geodatabase, feature dataset, and feature classes.




Part D: This part could be done in pairs


Guide the learners appropriately through steps (a) to (d). Encourage them to ask questions

Revision Exercise 6 (Refer to the Student's Book, page 185)

Administer this Revision Exercise as a Test. Mark and review it in class.

1. **The steps followed when creating a map are:**
 - (i) Load Geospatial data into ArcMap.
 - (ii) Identify the features and attributes to present.

- (iii) Define how to show the data.
 - (iv) Add map components.
 - (v) Export the map.
2. **To add data:** Use the Add Data button; and drag data from the ARcCatalog Tree.
 3. **To perform Georeferencing:**
 - The coordinates for the map are set.
 - Any point within the map should have an X (Easting) coordinate value, and a Y (northing) coordinate value.
 - Georeferencing starts by setting the coordinates of at least four farthest corner points in the map.
 - Using the **Add** control points tool, the X and Y coordinates for each of the four points are set.
 - Have a regular pattern for setting the four points, for instance, one can follow the clockwise direction.
 - The next step is to rectify the map, which is the application of a mathematical transformation to the map so that all the points on the map have coordinates.
 4. **To add features to a feature class:**
 - (i)  Click the layer to add features, then click on the **Create features** tool on the tool bar.
 - (ii) The **Create** feature dialog box appears.
 - (iii) If a river is to be created, click on **Rivers feature** class. Click inside the map to create a line along the course of the river. To create towns, a point  is used. Forests are represented by a polygon.
 - (iv) Click on the **Attributes** tool,  to open and modify the attribute values of the features being edited. The **Attributes** dialog box opens. Type the name of the feature, e.g., type the name of the river and press **Enter**.
 5. **To display the name on the feature:**
 - Right-click on the layer and select **Label feature**.
 - If the name of the feature is not being displayed, right-click on the layer and open the **Layer Properties** dialog box.
 - From the drop down menu of the **Display Expressions**, change to **Names**. The name of the feature should appear on the map.
 6. **Graduated symbols: Show qualitative differences in feature values with varying symbol sizes.**
 - (i) **Single symbol:** All features are represented in the map with a common symbol.

- (ii) **Unique values:** A different symbol is applied to each category of feature within the layer.
 - (iii) **Graduated colours:** Range of colours are used to show qualitative differences in feature values.
 - (iv) **Graduated symbols:** Show qualitative differences in feature values with varying symbol sizes.
7. **Explain the function of the Source tab, Selection Tab, and Symbology Tab.**
- (i) **General:** This tab allows the recording of layer properties such as layer name, its description, set credits, and specifies scale-dependent drawing properties.
 - (ii) **Selection:** This tab allows the setting of how features in a specific layer are highlighted when they are selected. The symbol shape and colour can be changed in this tab.
 - (iii) **Symbology:** The various tools are listed on the left side of this window (Features, Categories, Quantities, Charts, and Multiple Attributes).
 - **Feature:** Used to draw all features using the same symbol.
 - **Categories:** Used for assigning symbols based on unique values, for example, state names.
 - **Quantities:** Used to set graduated colours, graduated symbols, or proportional symbols.
 - **Chart:** Used to create pie, bar or column charts, and stacked charts.
 - **Multiple attributes:** Used to show more than one attribute.
8. **To measure the area covered by Nyungwe Forest National Park:**
- (a) Click the **Measure**  tool.
 - (b) Choose a measuring tool and click the map to begin measuring. Click on along the boundaries of the park to draw a polygon shape. The area covered will be displayed in the measure dialog box.
9. **The Go To XY tool works with the following coordinate systems among others:**
- (i) Longitude-Latitude
 - (ii) Values in the map document's coordinate system
 - (iii) Military Grid Reference System (MGRS) coordinates
 - (iv) Universal Transverse Mercator (UTM) coordinate notation
10. Hyperlink for a certain feature can be defined in a layer using either field-based hyperlinks or by defining a dynamic hyperlink using the **Identify** tool.

Unit 7

Complex Formulae and Functions

Introduction

Spreadsheets are programmed in such a way that they can accept different formulae and functions. A formula may be a combination of actual values, cell references, functions, and mathematical operators. When the correct formula is typed on the formula bar, the result of the formula appears on the active cell at the current position.

7.1 Content Map for the Unit

Unit Title	Complex formulae and functions
Topic Area	Application Software
Sub topic Area	Spreadsheets
Number of periods	12
Introduction	Complex formulae and functions
Classroom organisation	Whole class orientation then work in groups. Individual activities.
Equipment Required	Computer, projector, excel applications and text books.
Activities	Practical activities, discussions, field trips.
Competencies Practice	Team work, leadership skills, communication skills and practical skills.
Language Competencies Practice	<ul style="list-style-type: none"> • Defining: The learners will be able to give precise meaning of terms and expressions used in Microsoft Excel. • Communicating: The learners will practise on sharing a thought by speech, writing, or gesture so that it is clearly understood when they answer questions during the lessons.

	<ul style="list-style-type: none"> • Explaining: The learners will be able to explain the procedure for executing different commands in Excel with enough clarity. For example, the procedure for applying a function on worksheet data.
	<ul style="list-style-type: none"> • Group discussion: The learners will be able to exchange ideas and reach a conclusion on a certain topic during the lesson. • Writing: When the learners are organising the items discussed in groups, they will be applying their writing skills. • Reporting: After every discussion during a lesson, the learners will be able to make a formal statement about the key points discussed in their respective groups.
Vocabulary Acquisition (Key terms to be introduced and explained to the student)	<ul style="list-style-type: none"> • Parenthesis • Function • Mixed reference • Absolute reference • Formula • Cell reference • Relative reference • Conditional formatting
Numeracy	<ul style="list-style-type: none"> • Perform calculations using complex formulas. • Perform calculations using functions. • Differentiate between different types of functions. • Apply logical functions to evaluate a condition and return one of the values in the formula. • Apply text functions to manipulate text strings.
Study skills (including language competencies)	<ul style="list-style-type: none"> • Writing skills in compiling reports. • Communication skills developed during class presentations. • Typing skills in keying in data in worksheets.
Revision	Learning activities and the Revision Exercise in the ICT Senior 2 Student's Book.

Assessment	<ul style="list-style-type: none"> • A formative assessment of their ability to work in teams and carry out activities. Assess whether the objectives are met. Use Continuous Assessment Tests (CATs) and oral questions. • A summative evaluation at the end of the unit to examine the extent to which the intended learning objectives have been accomplished.
Learning Outcomes	<p><i>The learner should be able to:</i></p> <ul style="list-style-type: none"> • Insert a complex formula in a worksheet. • Use different cell references on a worksheet. • Reference cells from different worksheets. • Apply sheet reference in a worksheet. • Write a formula in a worksheet using functions.

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher's Guide.

7.2 Subtopics/Content to be Covered

Formulas: Complex formula (many operators in one formula).

- **Cell references:** Relative, absolute, and mixed references.
- **Cell references of another worksheet:** Copy paste option and sheet reference.
- **Functions:** Definition of functions.
- **Mathematical:** SUM, AVERAGE, ODD, INT, ROUND, EXP, SQRT, POWER, MOD, MAX, and PRODUCT
- **Logical:** AND, NOT, OR, and IF.
- **Text:** COUNTA, COUNTBLANK, UPPER, LOWER, and REPLACE, AND SEARCH.

Conditional formatting

- Highlight cell rules (greater than, equal to, less than, etc.)
- Top bottom rules
- Data bars
- Colour scales
- Icon sets

7.3 Reference: Refer to the ICT for Senior 2, Student's Book, pages 186 to 228.

7.4 Key Unit Competencies

By the end of this unit, the learner should be able to:

- (i) Work with spreadsheets to apply complex formula and functions, recognising the order of operations.
- (ii) Apply conditional formatting to the content of a worksheet.
- (iii) Use absolute and relative referencing.

7.5 Learning Objectives

Knowledge and understanding

By the end of the unit, the learner should be able to:

- (i) Identify the order of operations to evaluate a formula involving more than one operator.
- (ii) Identify the importance of referencing a cell.
- (iii) Explain the roles of formula and predefined functions.
- (iv) State the importance of visualising specific content in a sheet.

Skills to be imparted in this unit

By the end of the unit, the learner should be able to:

- (i) Use formula involving more than one operator to manipulate the content of cells.
- (ii) Apply cell referencing in formulas.
- (iii) Use functions to manipulate data in worksheets.
- (iv) Highlight the content in a worksheet fulfilling a given condition.

Attitudes and values to be developed in this unit

By the end of the unit, the learner should be able to:

- (i) Appreciate the complexity of worked worksheets.
- (ii) Understand others views on well-formatted tables.

7.6 Teacher Preparation

- Create a lesson plan based on schemes of work.
- Prepare notes and demonstration materials before each lesson.
- Attempt the learning activities in Senior 2 Student's Book before assigning them to the students.
- Avail different resource materials to cater for the varied abilities of learners.

7.7 Key Concepts to be covered

- **Complex formulas** are written using more than one operator.
- A **cell address** consists of a column letter and a row number.
- **Relative cell reference** automatically changes the cell addresses of a formula relative to the position of a cell where it is copied.
- An **absolute cell reference** remains the same regardless of where it is copied. To make a cell absolute, type the dollar sign (\$) before the column letter and the row number.
- **Mixed cell reference** combines both relative and absolute cell reference. To apply this reference, the dollar sign (\$) appears on the column letter or row number in the cell reference but not on both.
- Copying a formula within the same worksheet and in other worksheets.
- Functions are inbuilt formulae that the user can quickly use to perform calculations automatically.
- Mathematical functions are used to perform common mathematical operations such as **SUM**, **AVERAGE**, **ODD**, **INT**, **ROUND**, **EXP**, **SQRT**, **POWER**, **MOD**, **MAX**, and **PRODUCT**.
- Logical functions return either the logical **TRUE** or logical **FALSE** when their functions are evaluated they include **AND**, **NOT**, **OR**, and **IF**.
- Text functions are used in manipulating text strings and are referred to as text functions.
- The following are some of the text functions used in Excel: **COUNTA**, **COUNTBLANK**, **UPPER**, **LOWER**, **REPLACE**, and **SEARCH**.
- Conditional formatting enables the user to answer specific questions about the data in a worksheet.

7.8 Additional Content for the Teacher

Logical functions

- (i) **SUMIF**: Adds the values of cells within a specified block or range of cells that meets a given condition or criteria and returns a result. The general syntax is: **=SUMIF(Range, "Condition")**. For example: Suppose cells B4 to H4 contain the values 90, 30, 80, 40, 50, 9, and 20. To sum all values greater than 50, the function would be: **=SUMIF(B4:H4, ">50")**. The result displayed would be 260.
- (ii) **COUNTIF**: Counts the number of cells within a specified block or range of cells that meet given conditions or criteria and displays the result. The general syntax

is: =COUNTIF(Range, "Condition"). Suppose B4 to H4 contain the values 90, 30, 80, 40, 50, 90, and 20. To count all values greater than 50, the function would be: =COUNTIF(B4:H4, ">60"). The result displayed would be 3.

- (iii) **LOG:** It is used to return the logarithm of a number to the base specified. The general syntax is LOG(number, base). For example, the Logarithm of 2 base 10 would be =LOG(2,10).
- (iv) **QUOTIENT:** It is used to return the integer portion of a division. The general syntax is QUOTIENT(numerator, denominator). For example, the Quotient of 10/3 would be =Quotient(10,3). The result would be 3.
- (v) **LEN:** It is used to return the number of character in text string. The general syntax is =LEN(text). For example, to count the number of characters in the String "Rwanda," =LEN(A4) assuming that "Rwanda" is found in cell A4. The result would be 6.

7.9 Suggested Teaching and Learning Materials

- Computers with Microsoft Office 2013.
- CDs/DVDs of documentaries on working with Microsoft Excel 2013.
- Projector or smart board.
- Senior 2 Student's Book.
- Other relevant digital learning materials.

7.10 Suggested Low-cost or No-cost Materials

- Press F1 key to access Microsoft Excel free tutorial.
- Free tutorials on identified websites but always establish the authenticity of the website to avoid downloading infected files.
- Ask learners to bring any learning materials they would want to share, for example, data in hard copy that requires calculations.
- Visit the school offices and request for a copy of the list of students.

7.11 Suggested Teaching Methods

(I) Discussion

In a discussion, the teacher plays the facilitative role. He or she guides learners to examine an issue; and allows free flow of arguments. The steps to a successful discussion are as follows:

- (a) Start with a motivating introduction on the importance of using cell reference in formulas. Highlight the group rules to be followed.
- (b) Organise the learners into groups of fours or fives depending on the size of the class.

- (c) Guide the group members to appoint a secretary to be noting down the contributions of the discussion group.
- (d) Ensure that the seating arrangement is appropriate for an organised conversation.
- (e) After the discussion, facilitate class presentations.
- (f) Allow other group members to make their contributions. Commend and correct the group members where necessary.

(ii) Educational visit

A field visit is an organised learning experience carried outside the classroom that helps a learner to achieve educational objectives. It may be within the school or out of the school compound. The following are steps for preparing for a successful visit:

- (a) Identify the topic for study and the objectives to be achieved. For example:
Topic: Explain the roles of formulas and predefined functions.
Objective: Application of formulas and functions.
- (b) With the help of the students, identify a site that will help achieve the set objectives.
- (c) Secure administrative and parental approval for the trip before the due date.
- (d) Obtain permission from the hosting institution.
- (e) Prepare the time schedule for the entire period of trip.
- (f) Make arrangements for transport and lunch.
- (g) Prepare a list of names and addresses of those going on trip and submit a copy to the administration.
- (h) Discuss with learners the purpose of the visit, and the safety precautions to be taken when out. For example: Not to insert secondary storage media in the computers of the organisation being visited.
- (i) Put learners into groups for discussion when they go out.
- (j) Inform the learners of the departure time.

(c) Practical Activities

- (a) There are Practice and Learning Activities provided in the Student's Book for Senior 2. The instructions given are clear. Guide the students accordingly.
- (b) Encourage all the learners to participate in the activities.
- (c) Assess the students as they do the activities and provide any guidance required.

(d) Demonstration

You can use this method when teaching a new skill, or when the facilities are not enough for all learners. You could also use it when the equipment to use or materials are expensive or delicate.

(e) **Question-and-answer method**

You can use this method when reviewing the previous lesson or when summarising a lesson to help the learners to recall information, emphasise facts, drill for retention of facts, and obtain some measure of achievement.

7.12 Suggested Teaching and Learning Activities and Exercises to Support Delivery of Content and Development of Student Competencies

- Teacher explains the key concepts in the unit.
- Teacher demonstrates to the learners on the procedures of creating complex formula using a projector.
- Discussion on creation of complex formula.
- Learners to write the formula.
- Learners to apply formula on data in a worksheet.
- Teacher asks the students oral questions during demonstrations or explanations.
- Students to provide the answers.
- Teacher assess the practical being done by the students and provide guidance where necessary.

7.13 Cross-cutting Issues to be integrated in Teaching and Learning Activities

- **Gender equality:** Both boys and girls can achieve excellence in life. Always use gender sensitive language when speaking and writing. Encourage learners to also use gender-sensitive language in discussions; for example, instead of chairmen, use chairperson; instead of business man, use business executive or business person.

7.14 Suggestions for Accommodating Special Education Needs (SEN)

The teacher should identify learners with special needs and help them to cope during the teaching learning activities.

Type of impairment	Support for the learner
Sensory impairment (visual)	<ul style="list-style-type: none">• Write in large legible letters on the board.• Learners with impairment should sit next to learners with good vision to get help where necessary.
Sensory impairment (hearing)	<ul style="list-style-type: none">• Speak loudly to be audible to the learner.• Allow learners to sit close to the teacher.
Motor impairment (Movement)	<ul style="list-style-type: none">• Do the activities in one place to avoid situations requiring the affected learners to move from place to place.

Type of impairment	Support for the learner
Gifted or talented learners	<ul style="list-style-type: none"> • Assign learners extra and more challenging work. • Encourage fast learners to assist the slow learners.

7.15 Suggestions for Supporting Multi-Ability Learning

Fast learners

- Request these learners to sit next to slow learners to help them.
- Give them extra tasks to perform.

Slow learners

- Remedial teaching.
- Take time to go over the procedure and use the language the learners will understand.
- Use other learners to assist them to do the task.

7.16 Support to Learning Activities

The following are some suggestions of assignments: group work, pair work, and individual work.

Group:

- In groups, learners to attempt the learning and practice activities.
- The learners to discuss other materials availed by the teacher.

Pairs: Attempt the practice and learning activities in ICT Senior 2 Student's Book.

As individuals: Guide the students to do the activities in ICT Senior 2 Student's Book. Instructions for individual work are clearly given.

7.17 Support for the Development of Positive Skills, Values, and Attitudes

Some life skills to develop include problem-solving, decision-making, effective communication, and creative thinking. Some values to be developed include responsibility, appreciation, respect, cooperation, and curiosity.

- Attitude of cooperation is developed through working in groups.
- Develop curiosity by letting the learners discover other ways of performing calculations.
- Have the desire to explore the safety, secure, and ethical precautions taken in other laboratories in the school.
- Develop responsibility by demonstrating caring for computer resources.

7.18 Suggested Formative and Summative Assessment

- Questions in Senior 2 Student's Book.
- Oral questions.
- Continuous Assessment Tests (CATs).

7.19: Links to other Subjects

- Mathematics: Arithmetic operations, functions, equations, matrix, and logic.
- Economics: Econometrics.
- Entrepreneurship: Financial modelling.

7.20: Additional Remedial, Consolidation, and Extension Activities

Additional questions

1. Outline the purpose of **SUMIF** function.
2. The formula **=COUNTIF(A3:A10,"<40")** was applied on cells containing the following data: 40, 30, 20, 10, 50, 70.
3. Determine the result once the function is executed.
4. Differentiate between **COUNTIF** and **SUMIF**.
5. State the use of the **LOG** function.
6. Compute the output from the formula **=QUOTIENT(14,4)**.

7.21 Answers to the Learning Activities and Exercises in the Student's Book ICT

Revision Activity 7.1 (Student's Book page 196)

Part A (Individual Work)

1. The **equals** sign is used at the beginning of a formula.
2. **Complex formulas** contain more than one operator.
3. The parts labelled 1 and 2 are known as a **Active cell** and **Enter Button** respectively.
4. A cell address is also known as a **cell reference**.
5. State the type of cell references used in each of the following cells:
 - (a) A\$2 - **Mixed cell reference**
 - (b) \$X10 - **Mixed cell reference**
 - (c) \$Y\$25 - **Absolute cell reference**
6. Cell referencing.

Part B (Individual Work)

1. The equals sign (=) is used to begin a formula. **TRUE**
2. All formulas must be enclosed within parenthesis. **FALSE**
3. Formulas created using cell references cannot be copied. **FALSE**
4. A function is a part of a formula. **TRUE**

Part C (Individual Work)

1. Examples of symbols that are used in formulas: (Learners to give any of these:)

Name	Symbol
Percentage	%
Parenthesis/brackets	(
Closing parenthesis)
Colon	:
Dollar sign	\$

Name	Symbol
Comma	,
Equal Sign	=
Quotation marks	“ ”
Exponential	^
At sign	@

2. Differentiate between simple formulas and complex formulas.

Simple formulas are written using one operator whereas complex formulas are written using more than one operator.

3. Differentiate between mixed cell reference and absolute cell reference.

A **mixed cell reference** is a type of reference that combines both relative and absolute cell reference. An **absolute cell reference** is a type of reference where the formula remains the same regardless of where it is copied.

4. Describe relative cell reference.

This type of reference automatically changes the cell addresses of a formula relative to the position of a cell where it is copied. For example, if the formula =A1+B1+C1 is written in cell D1 then copied to cell F1, the formula becomes =C1+D1+E1.

5. Kamali would like to create three worksheets to enter budgets for different departments in an office. Identify one advantage he would gain from referencing data from one worksheet to another in the workbook.

When the content of one worksheet changes, the other worksheets referencing will also be updated.

Part D (Students to work in groups of five)

Assess if the following have been done in the worksheet:

- Text has been entered in the worksheet.
 - Total for Rukundo has been computed and copied to the other respective cells.
 - The changes have been saved.
- Data has been entered in the worksheet and saved on the desktop.
 - Students have used cell references to compute the VAT using the rate in cell D6.

- (ii) The formula entered in cell E2 has been copied to cells E3 and E5.
 - (iii) The cost of cement in cell F2 has been computed.
 - (iv) The formula entered in cell F2 has been copied to cells F3 to F5.
3. Ensure that the following have been done:
- (a) Entering data in three separate worksheets.
 - (b) Calculating the total from each ministry.
 - (c) Entering the data in worksheet 4.
 - (d) Referencing the totals in other sheets to Sheet4.
 - (e) Calculating the totals for all the ministries in Sheet4.
 - (f) Changing the cost of the seedlings.
 - (g) Ascertain that the changes have been reflected in worksheet 4.
 - (h) The changes have been saved.

Revision Activity 7.2 (Student's Book page 218)

Part A (Individual Work)

1. A **function** is an inbuilt formulae that the user can quickly use to perform calculations automatically.
2. The **fx** is known as the **paste** function.
3. **SUM** function adds all the values in a specified range of cells.
4. **ODD** function returns a value rounded up to the nearest odd integer.
5. The formula **=ODD(1.7)** rounds 1.7 up to the nearest odd integer which is 3.
6. Examples of logical functions include: **IF**, **AND**, **OR**, and **NOT**.
7. The syntax of the command that counts the number of nonblank cells in the range A1 through to H1 is **COUNTA(A1:H1)**.
8. The **UPPER** function is used to change text from small letters to capital letters.
9. The syntax of the **REPLACE** function is **=REPLACE(Old_Text, start_num, num_chars, New_Text)**.

Part B (Individual Work)

10. The figure given shows a section of Ms Excel worksheet:
 - (a) **Members of Parliament** is the result when the formula **=LOWER(A2)** is applied.
 - (b) **2** is the result when the formula **= COUNTBLANK (A2:E2)** is applied.

Part C (Students to work in groups of five)

Assess if the following have been done in the worksheet:

- (a) Typing of the data in the worksheet.

- (b) Mark for Gahigi have been computed through the use of a function.
- (c) The empty cells have been counted using the count function.
- (d) The formula created in (c) has been copied to the respective cells.
- (e) Maximum, Minimum, Average, and Mode have been computed.
- (f) The grade for Gahigi has been computed using the IF logical function.
- (g) The formula created in (f) has been copied to the respective cells.
- (h) Correct formula used =IF(AND(B5>80,D5>80),“Technologist”, “Decide”)
- (i) The formula created in (h) has been copied to the respective cells.
- (j) The workbook has been saved with the changes.

Part D (Individual work)

1. **Define the term function as used in spreadsheets.**
Functions are inbuilt formulae that the user can quickly use to perform calculations automatically.
2. (a) = Average (A1:D1) (b) = Round (A2,2) (c) = Max (A1:D1)
3. AND, NOT, OR, and IF
4. (a) **COUNTA:** This function counts the number of cells that are not empty in a specified range (range: Two or more cells on a sheet. The cells in a range can be adjacent or nonadjacent).
- (b) **SEARCH:** This function locate one text string within a second text string then return the number of the starting position of the first text string from the first character of the second text string.
- (c) **LOWER:** This function converts all uppercase letters in a text string to lowercase.
- (d) **REPLACE:** It is used to substitute part of a text string based on the number of characters specified, with a different text string.
5. **Name the function that rounds a positive number down to the nearest integer number. INT**
6. **Under what circumstance would the ODD function be used?**
When the result returned should be a value rounded up to the nearest odd integer.

Revision Activity 7.3 (Student’s Book page 226)

Part A (Individual Work)

1. Greater Than, Less Than, Between, Equal To, Text That contains, A date Occurring, Duplicate values.

2. Top 10 Items, Top 10%, Bottom 10 Items, Bottom 10%, Above Average, Below Average are examples conditional rules
3. Home, Styles
4. Gradient, Solid
5. Directional, Shapes, Indicators, Ratings.

Part B (Individual Work)

1. **List three types of conditional formatting used in Ms Excel.**
Highlight cells rules, Top/Bottom rules, Data bars, Colour scales, Icon sets
2. **Outline the steps followed to apply colour on data in a worksheet.**
 - (a) Select the data where the colour scales is to be applied.
 - (b) Click on the **Home** tab, in the **Styles** group, click on **Conditional Formatting** icon then point to **Colour Scales**.
 - (c) Select the desired colour scales option. The format is automatically implemented.
3. **State the use of the Between option in conditional formatting.**
Used to separate dates being used in the criteria.
4. **Outline the steps followed to apply icons on data in a worksheet.**
 - (a) Select the data where the icon sets is to be applied.
 - (b) Click on the **Home** tab, in the **Styles** group, click on **Conditional Formatting** icon then point to **Icon Sets**.
 - (c) Select the desired icon sets option. The format is automatically implemented on the cells containing values.
5. **State the advantage of using conditional formatting in Ms Excel.**
It can be used to format large amount data uniformly.

Part C (Students to work in groups of five)

Assess if the following have been done on the worksheet:

- (a) Red border has been applied to all cells with data greater than 50
- (b) Light Red fill has been applied to all cells with data equal to 32.
- (c) Gradient fill has been applied to the cell with data.
- (d) A colour scale has been applied to the data.

Answers to Revision Exercise 7 (Student's Book page 228)

Administer this Revision Exercise as a Test. Mark and review it in class.

1. **List three examples of operators used in spreadsheets.**
Plus(+), Multiplication(*), Subtraction(-), Division (\div)

2. **Differentiate between a relative cell reference and a mixed cell reference.**
A relative cell reference automatically changes the cell addresses of a formula relative to the position of a cell where it is copied. A mixed cell reference combines both relative and absolute cell reference.
3. **Explain the advantage of referencing data from different worksheet.**
When changes are made they are shown on all the worksheet.
4. **Outline the steps followed when copying formulas.**
 - (a) Highlight the data to be copied.
 - (b) Click **Home** tab, select **Copy** command from the **Clipboard** group.
 - (c) Click on the name of the sheet where the data is to be copied, for example, **Sheet2**.
 - (d) Click on the position where the cell is to be copied.
 - (e) Click **Home** tab, select **Paste** command from the **Clipboard** group.
5. **Explain the use of each of the following spreadsheet functions:**
 - (a) **Average**; it is used to calculate the mean of values specified in a selected range of cells
 - (b) **Odd**; it returns a value rounded up to the nearest odd integer. The general syntax is =ODD(number) where number is the value to be rounded.
 - (c) **Round**; it rounds off a number to a specified number of digits.
 - (d) **Max**; the term Max refers to the function used for obtaining the maximum or largest value in a selected range of cells.
6. **Musabe created a document in Ms Excel showing the list of students in a class. She would like to assign a pass or a fail to a student given that a score of 40 and above attracts a pass remark, otherwise a fail. Given that the score is in cell A14 write a formula in Cell A15 using the IF function that would be used to assign a pass or fail remark to a student.**
=If(A14>40,"Pass," "Fail").
7. **Outline the function of each of the following functions in spreadsheets:**
 - (a) **UPPER**: this function converts text to uppercase.
 - (b) **REPLACE**: it is used to substitute part of a text string based on the number of characters specified, with a different text string.
 - (c) **COUNTBLANK**: this function counts the number of empty cells in a specified range of cells.
8. **Explain a circumstance under which conditional formatting would be used in a worksheet.**
When formatting text using a given criteria.

9. Identify the errors in the following formula and write the correct formula:

=IF(AND,(B3>10:C3>2500)1/2*C3:1/4*C3)

Wrong use of colon and comma. The correct formula should be

=IF(AND(B3>10,C3>2500),1/2*C3,1/4*C3)

10. Use the figure given in the Student's Book (Figure 7.45) to answer the questions:

(a) Using a function and cell references only, write an Excel formula that would be used to:

(i) Calculate the total cover paid by Gahigi; =B3*C3.

(ii) Total cover collected; =SUM(C3:C9).

(iii) Bonus for Gahigi given that all clients who have more than 15 years in the insurance and pay more than 200,000 cover get 50% of the cover otherwise they get a 25% of the cover.

=IF(AND(B3>15,C3>200000),C3*50/100,C3*25/100).

(b) Calculate the total bonus. =SUM(E3:E9).

7.22 Teacher Support on Assessment: Additional Questions and Answers

1. Outline the function of SUMIF.

SUMIF: Adds the values of cells within a specified block or range of cells that meets a given condition or criterion and returns a result.

2. The formula COUNTIF(A3:A10,<40) was applied on cells containing the following data: 40, 30, 20, 10, 50, 70.

Determine the result once the function is executed.

3. Differentiate between COUNTIF and SUMIF.

COUNTIF is a function that returns the number of values within a given data range that meets certain criteria. SUMIF returns the result after the addition of values within a given data range that meets given criteria.

4. State the use of the LOG function.

It is used to return the algorithm of a number to the base specified.

Unit 8

Network Components and Social Media Applications

Introduction

This topic introduces the learner to network components and social media applications. It is expected that by the end of this topic, the learner should be able to identify computer network components and social media applications.

8.1 Content Map for the Unit

Unit Title	Network components and social media applications
Topic Area	Computer network and data communication
Number of Periods	6
Introduction	Network components and social media applications
Classroom Organisation	Whole class orientation then work in groups. Individual activities.
Equipment Required	Computers, servers, routers, switches, transmission data cables, projector and textbooks.
Activities	Practical activities, discussions, research, field trips.
Competencies Practice	Teamwork, communication skills, and Research.
Language Competencies and Practice	<ul style="list-style-type: none">• Defining• Explaining• Writing• Communicating• Group discussions• Report

<p>Vocabulary acquisition (Key terms to be introduced and explained to the student)</p>	<ul style="list-style-type: none"> • Smart phone • Coaxial cable • Twisted pair cable • Infrared • Hub • Router • Social media • Access point • Switch • Radio waves • Blue tooth • Fibre optic cable • WiFi • Protocol • Multifunctional device
<p>Numeracy</p>	<ul style="list-style-type: none"> • Using devices to connect to the network. • Knowledge on connecting cables to the devices. • Using connected devices to configure the network.
<p>Study Skills (including language competencies)</p>	<ul style="list-style-type: none"> • Note taking/ Writing • Presentation/ Reporting skills • Observation skills • Organisation of ideas
<p>Revision</p>	<ul style="list-style-type: none"> • Revision activity and Revision questions in ICT Senior 2 Student's Book.
<p>Assessment</p>	<ul style="list-style-type: none"> • A formative assessment of the ability to work in groups and carry out activities. • Assess whether the objectives are met. Continuous Assessment Tests (CATs) and oral questions. • A summative evaluation at the end of the unit to examine the extent the intended learning objectives have been achieved.
<p>Learning Outcomes</p>	<p>The learner should be able to:</p> <ul style="list-style-type: none"> • Connect devices to a network. • Explain computer network resources. • Differentiate between computer network media. • Identify computer network devices. • Share different network peripherals on the computer network.

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher's Guide.

8.2 Subtopics/Content to be Covered

- **Devices that can be connected to a network:** (Desktop, Laptop, Printers, Scanners, PDAs and Smart phone).
- **Connect different devices to the computer network.**
- **Network resources:** (Services, Storage space, Applications).
- **Network medium:**
 - ➔ **Cables** (Coaxial cable, Fibre optics, Twisted pair cable).
 - ➔ **Radio wave** (Infrared, Bluetooth, WiFi).
- **Computer network devices** (Switch, Hub, Access point, Router and Multifunction device).
- **Network peripherals** (Scanner and Printer)
- **Social media**
 - ➔ Value of social media.
 - ➔ Social media best practice.
 - ➔ Examples of social media (Facebook, Twitter, Google+, LinkedIn, YouTube, Blogging, Skype).

8.3. Reference : ICT for Senior 2, Student's Book, pages 230 to 256.

8.4. Key Unit Competencies

By the end of this unit, the learner should be able to:

- (i) Identify computer network devices, media, and peripherals.
- (ii) Connect different computer devices to the network.
- (iii) Use social media to exchange information on social life.

8.5. Learning Objectives

Knowledge and understanding

By the end of the unit, the learner should be able to:

- (i) Identify devices that can be connected to the network.
- (ii) Identify network resources.
- (iii) Identify different network mediums.
- (iv) Identify network devices and peripherals.
- (v) Know how to use social media appropriately.

Skills to be imparted in this unit

By the end of the unit, the learner should be able to:

- (i) Connect devices to the network.
- (ii) Explain computer network resources.
- (iii) Differentiate between computer network media.
- (iv) Differentiate computer network devices.
- (v) Share on the computer network different network peripherals.
- (vi) Create a profile.

Attitudes and values to be developed in this unit

By the end of the unit, the learner should be able to:

- (i) Appreciate the use of network devices, peripherals, network media, and shared resources.
- (ii) Show concern for the risks associated with social networking and overall Internet communication.

8.6. Teacher Preparation

- Plan and make notes for the lesson.
- Read and master the content to be taught. Refer to Unit 8 in the Student's Book for Senior 2.
- Practise how to use social media in communication.
- Practise how to connect devices to a network.

8.7 Key Concepts to be Covered

- The following are some devices that can be connected to a network: desktop, laptop, printers, scanners, PDAs, and smart phones.
- Some resources available in the network include: storage space services and applications.
- Devices can be connected to a network using cables or radio waves.
- Networking cables include: coaxial cable, twisted pair cable, fiber optic cable.
- Radio wave transmission can be in form of Bluetooth, infrared, and WIFI.
- Network peripherals are devices connected to a computer in the network through data interface cables or wireless media.
- Social media refer to Internet-based applications that enable users to create and exchange information.

8.8 Additional Content for the Teacher

Network Devices

Repeater

It is a network device used to expand the boundaries of a wired or wireless network. A repeater receives a signal, cleans it to remove any distortion, and amplifies or boosts the signal, then finally it sends the signal to another network segment.

Bridges

It is a communication device that connects one network segment to another that uses the same protocol. It keeps records of the type of network segments and addresses of all network nodes. A bridge uses these records to determine the destination of a message.

It is used to:

- (i) Extend a LAN beyond its length limit.
- (ii) Segment a LAN to reduce network traffic bottlenecks.
- (iii) Extend a LAN when the maximum connection limit has been reached.

Network Interface Card

It is a circuit board that is installed in a computer to enable network connection. It can be used in a wired or a wireless network.

Social media

Social media is today playing a vital role in that it allows online communication. People are able to create, share, and exchange information. However, although it is becoming widely used these days, there are also challenges that are associated with it.

Advantages of social media

- (i) Exchange of ideas and information at the click of a button.
- (ii) Business purposes for exchange of goods and services.
- (iii) Entertainment, for example, YouTube: one can watch videos, movies, and listen to music.
- (iv) Marketing and advertisement by organisations.
- (v) Catching up on missed news broadcasts and also missed program episodes.

Disadvantages of social media

- Decreases face to face conversation skills. This affects interpersonal relationships.
- Loss of valuable time. Individuals get addicted to spending countless hours on social media sites.

- Leaking of personal information on social media sites. This is because one's posts and data can easily be copied. Photographs can easily be downloaded and shared without one's knowledge.
- Crimes and exposure to activities that are illegal. Some bloggers may damage one's reputation by posting malicious and inaccurate information.

8.9 Suggested Teaching and Learning Materials

- Computers
- ICT for Senior 2 Student's Book
- Switches
- Projectors
- Servers
- Routers
- Transmission data cables

8.10 Suggested Low-cost or No-cost Materials

- Free tutorials on identified websites. Caution: Always establish the authenticity of the site.
- Visit neighbouring institutions to identify various computer networks.

8.11 Suggested Teaching Methods

- **Question-and-answer method:** The teacher asks questions and the students respond. The students should also be encouraged to direct their questions, either to the teacher or to the rest of the class.
- **Discussions:** These could be done as a class or in groups. Students should be encouraged to participate in the discussions to improve their communication skills.
- **Educational visit:** Make arrangements to take students to visit institutions where they can observe some of the processes they have learnt theoretically in class.
- **Practical activities:** A number of practice and learning activities have been provided in the Student's Book for Senior 2. Guide the learners to work in pairs, groups, or as a class. Observe how they carry out the activities and encourage all students to participate and give their contributions.
- **Demonstration:** Where appropriate give demonstrations. This is especially an important method when the set of equipment you have is not adequate for the whole class, or when the resources to use are delicate and expensive.
- **Audio and video:** There are limitless audio and video resources online. Do research and give the students links to access these resources. Where the source allows downloading, or saving for offline viewing, download and save the clips on secondary media and avail them to the students. Be cautious as some sites may contain malware.

8.12. Suggested Teaching and Learning Activities and Exercises to Support Delivery of Content and Development of Student Competencies

- Group discussions on different network peripherals.
- Research on different network media.
- Group discussions on the best practices of social media in the society.
- Class discussions on various types of devices that can be connected to a network.
- Educational visit to various rooms in the school and neighboring institutions to learn more about networking.
- Teacher explains the various concepts on networking.

8.13 Cross-Cutting Issues to be integrated in Teaching and Learning Activities

- Sensitise the students on the use of social media platforms. Let them appreciate both the positive and negative effects of these media.
- Remind them on the importance of proper use of social media so as to balance between their leisure and academic reading time.
- Sensitise them to be careful and not to over-indulge in social media at the expense of their academic responsibilities. Let them understand that sometimes social media may also lead to moral degradation, brainwashing, and trickery into joining dangerous groups hence corrupting their morals.

8.14 Suggestions for Accommodating Special Education Needs (SEN)

The teacher should identify learners with special needs and help them to cope during the teaching and learning activities.

Type of impairment	Support for the learner
Sensory impairment (visual)	<ul style="list-style-type: none">• Write legible letters on the board.• Learners with poor vision to sit next to those with good vision to help where necessary.
Sensory impairment (hearing)	<ul style="list-style-type: none">• Make an effort to project your voice to be audible to the learners.• Allow learners to sit close to the teacher.
Motor impairment	<ul style="list-style-type: none">• Do the activities in one place to avoid unnecessary movement from place to place.
Gifted or talented learners	<ul style="list-style-type: none">• Assign the learners extra work.• Assign the learners more challenging work.

8.15 Suggestions for Supporting Multi-Ability Learning

Fast learners	<ul style="list-style-type: none">• Request learners to sit next to slow learners to help them.• Give them extra tasks to perform.
Slow learners	<ul style="list-style-type: none">• Remedial teaching.• Take time to go over the procedure and use simple language that the learners will understand.• Use other learners to assist them to do the task.

8.16 Suggestions for Assignments

Individual work, pair work, group work, and whole class work.

As individual:

- Research on different computer network devices.
- Attempt the Learning Activities provided in the Student's Book for Senior 2.

Pair Work:

- Connect to a Bluetooth-enabled network and share files.

Group work:

- Connect to a wireless network using WiFi and access Internet.

Whole class work:

- Visit the nearest institution and observe how networking is applied.

8.17 Support for the Development of Positive Skills, Values and Attitudes

- Some life skills to develop in this unit include decision-making, effective communication, problem-solving, and creative thinking.
- Some values to be developed include responsibility, appreciation, cooperation, and curiosity.
- Working in groups encourages development of attitudes such as cooperation.
- Develop curiosity by letting the learners discover how to use social media in communication.
- Group work presentations help in developing effective communication skills and decision-making.

8.18 Suggested Formative and Summative Assessment

- Practice and Revision Activities, as well as the Revision Exercise in Senior 2 Student's Book.

- Oral Questions.
- Continuous Assessment Tests (CATs).
- Report Writing.

8.19 Links to Other Subjects

- History and Citizenship: Obtain newspapers that contain citizenship-related content such as the political life of the country.

8.20 Additional Remedial, Consolidation and Extension Activities

Give the following activities and exercises. Depending on your assessment of the individual learners, make an informed decision to give the activity as either a remedial, a consolidation, or an extension of the learning activities.

- Let the learners work in pairs. Let them discuss the requirements of networking.
- Let the learners work in groups of five. Let them discuss computer network devices, media, and peripherals.
- Let the learners work in groups. Let them describe different components of a computer network, resources, and devices.
- In groups guide the learners to discuss how best to use different types of social media. Let them identify some disadvantages or dangers associated with the use of social media platforms.

8.21 Answers to the Learning Activities and Exercises in the Student's Book ICT Senior 2.

Learning Activity: 8.1 (Student's Book page 237)

Part A (Individual Work)

1. A system or a group of interconnected objects or people is known as a **network**.
2. A **computer network** is a set of interconnected computing nodes that can exchange data or resources.
3. The set of rules that allow communication between two or more computing nodes are called **protocols**.
4. (i) Services
(ii) Applications

5.

Q	A	D	E	S	K	T	O	P	S	D
W	H	E	N	E	V	Y	N	R	C	R
E	M	T	E	O	U	P	A	I	A	E
R	H	E	S	G	T	R	E	N	T	N
L	A	P	T	O	P	O	W	T	E	N
T	O	P	A	L	D	E	S	E	T	A
Y	C	A	N	N	A	K	T	R	O	C
S	M	A	R	T	P	H	O	N	E	S

Part B (Pair Work)

1. Define the terms computer network.

A **computer network** is a set of interconnected computing nodes that are organised in such a way that they can exchange data, information, or resources through a transmission medium using a set of rules called protocols.

2. Differentiate between a laptop and a desktop computer.

A laptop is designed to be used while placed on the lap while a desktop is designed to be used while placed on the desk.

3. What is a computing node?

Computing node could be a fax machine, computer, printer, mobile phone or tablet that is within the network.

4. List three network services.

- User management
- Shared printing
- Central control
- File sharing

5. Give three types of devices that can be connected in a network.

- Printer
- Laptop
- Desktop
- PDA
- Smartphone

Part C (Students to work in groups of five)

1. Assess if the following have been done:

- The groups have connected to a network.
- They can share files and resources between the nodes in the network.

2. They are discussing on advantages of computer network. Possible answers are:
- Resource sharing
 - Remote communication
 - Cost effectiveness
 - Distributed processing

Revision Activity 8.2 (Student's Book page 244)

Part A (Individual Work)

1. (a) Wireless Fidelity (b) High Frequency
(c) Light Emitting Diodes (d) Unshielded Twisted Pair
2. An optical material that surrounds the core is known as **cladding**.
3. Radio waves is an example of **wireless** media.
4. (a) **Guided media** (b) **Unguided media**
5. STP is a type of **twisted pair** cable.

Part B (Pair Work)

1. **State two advantages of each of the following media:**
 - (a) **Twisted pair**
 - Easy to install.
 - Cost of installation is low as cables are readily available in the market.
 - (b) **Fibre optic cable**
 - It is immune to Electromagnetic Interference (EMI).
 - It does not generate electrical signals hence can be used in dangerous places such as high flammable areas.
 - It is smaller and lighter than copper cables hence suitable for situation where space is limited.
2. **Give three advantages of wireless communication.**
 - Allows users of the network to roam without losing access to the network.
 - It is easier to add and remove nodes.
 - It is ideal for use in networks that cover a wide geographical area.
 - Enables communication in remote areas where laying of cables is not possible.
3. (a) **Bluetooth** is a wireless protocol that connects electronic devices over a short distance of up to about 10 meters creating a Personal Area Network (PAN) with a high level of security.
(b) **Network media** are devices that facilitate interconnection of computers and other devices in a network by providing a pathway through which data and information is carried from one point to another.

4. **State two disadvantages of twisted pair cable.**

- Can carry only up to a maximum of 100Mbps (Megabits per second).
- Very sensitive to Electromagnetic Interference compared to other cables.

Part C (Students to work in groups of five)

1. Supervise the group discussion and provide guidance where necessary. Let them identify the various types of network connectivity.
2. Assess if the groups have connected to a Bluetooth-enabled network and have shared resources.

Practice Activity 8.1 (Student's Book page 248)

Guide the learners to implement a peer-to-peer network. Let them work in groups of five. The instructions given in the Student's Book are clear. A diagram has been provided to enhance understanding.

Revision Activity 8.3 (Student's Book page 249)

Part A (Individual Work)

1. Write the following abbreviations in full:
 - (a) DCE Data Circuit-terminating Equipment
 - (b) LED Light Emitting Diodes
 - (c) DTE Data Terminating Equipment
 - (d) AP Access Point
2. A network device that forwards data directly to its destination address without broadcasting is known as a **switch**.
3. A hub connect networks that have the same **protocol**.
4. Access points are devices used on a wireless network.
5. A **router** is a device that can connect a Local Area Network to a Wide Area Network.

Part B (Pair Work)

1. **Define the term multifunction media.**
These are devices that have multiple functions.
2. **State the function of a router.**
It performs the routing function by listening to the entire network to determine the best path to route a data signal based on the destination address and the source.
3. **Differentiate between a switch and a hub.**
A switch is a network device that forwards data directly to its destination address. A hub broadcasts data to all the other devices in the network.

4. **Explain the term routing:** Routing is the process of moving data signals across a network from the source node to the destination node.
5. **List two types of network peripherals:** Scanners, Printers and Smartphones

Part C (Students to work in pairs)

Guide the learners to connect two cell phones via bluetooth and share files; connect a laptop to a wireless hotspot; identify other devices in the environment that can be connected to a network.

Answers to the Revision Exercise (Student's Book page 256)

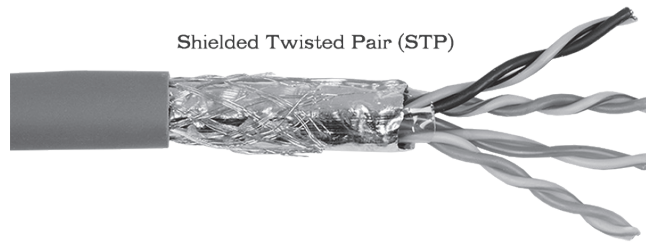
Administer this Revision Exercise as a Test. Mark and review it in class.

1. **Definition of terms:**
 - (a) A **computer network** is a set of interconnected computing nodes that are organised in such a way that they can exchange data, information, or resources through a transmission medium using a set of rules called protocols.
 - (b) **Network devices** are communication devices that are used in networking. They are used in between the DTE and transmission media to provide an interface or junction for the network to be fully operational.
2. **Some benefits that an institution would gain by installing a computer network.**
 - Resource sharing
 - Remote communication
 - Reduces cost of buying shared resources
 - Faster communication
 - Centralised control and administration
3. **Examples of twisted cables are:**
 - Unshielded Twisted Pair (UTP)
 - Shielded Twisted Pair (STP)
4. (a) The transmission media depicted by the given figure is a **Coaxial cable**.
(b) **The parts labelled A to D are:**

A. Plastic Insulator	B. Shield
C. Center Conductor	D. Outer Jacket
5. Apart from printers and scanners, give two other network peripheral devices.
 - Smartphone
 - PDA
6. **Describing various types of transmission media.**

(a) **Twisted pair :**

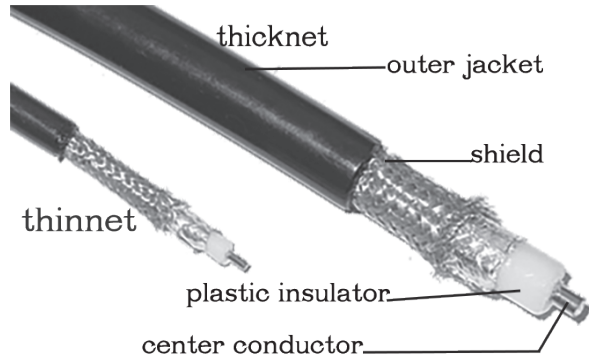
This cable is made up of pairs of insulated copper wires twisted along each other. The twists are done to protect the cable from Electromagnetic Interference (EMI) and cross-talk. They are usually packed as four sets of pairs in a cable.



(b) Coaxial cable

This type of cable contains two conductors, namely copper wire, which runs through the centre of the cable where the actual data travels and a shield made of wire mesh tube, metallic foil, or both.

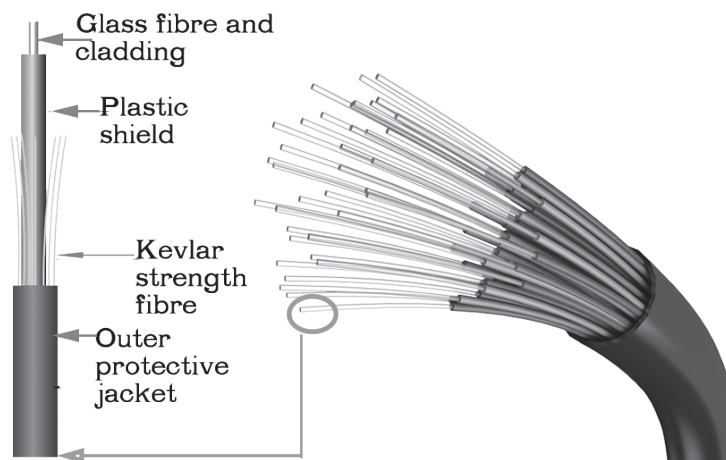
The copper wire is surrounded by a plastic insulator which is covered by a conducting shield that acts as a return path and also filters Electromagnetic Interference (EMI).




Coaxial cables

(c) Fibre optic cable

This type of cable uses glass material strands which are as thin as a human hair. The strands carry digital information over long distances. Light is used to transmit data signals unlike in coaxial and twisted pair cables which use electrical signals.



- 
7. At the Football World Cup, officials and photographers will have wireless-enabled notebook computers. These will be used to update results, statistics, and photographs for the website. The digital video cameras are connected to computers and may transmit their video images to the temporary server by wireless or cable network.
- (a) **State two disadvantages of using wireless network.**
- Initial installation cost is very high.
 - Vulnerable to tapping, hence security of information can be compromised.
 - They suffer high attenuation due to encountering of obstacle along transmission paths.
- (b) **Identify two networking resources that will be used.**
- Storage space.
 - Application used for creating data.
- (c) **Identify one network peripheral that will be used.**
Digital Video Camera.
8. **Social media is today becoming very popular in communication. Identify various examples of social media platforms.**
Facebook, Twitter, Google+, LinkedIn, YouTube, Blogging, and Skype among others.
9. **Some best practices when interacting in social media:**
- **Transparency:** Being open builds trust among the social media members.
 - **Be genuine:** Be the real person the members of the platform would have the pleasure to know.
 - **Be interested in others.** “Listen instead of talking,” which shows that one takes interest in other people.
 - **Follow back and interact.** The interacting members should always be in contact. This creates a healthy goodwill for chatting with each other.
 - **Do not overshare.** Always focus on sharing items that are of value to members.
 - **Respond to positive and negative comments.** Do not only be responding to positive comments but also pay attention to negative comments.
 - **Keep it short.**
10. **Some values of social media are:**
- **Clarity of information.** The information should be clear and easy to understand in order to be very helpful.

- **Effectiveness.** Only write or talk about something when there is solid evidence that it is true.
- **Interesting:** One should not be boring. Ensure that the information is engaging and interesting.
- **Respectful:** One should be careful to be respectful and to appreciate diverse points of view with openness and inclusion.

8.22 Teacher Support on Assessment: Additional Questions and Answers

1. Defining the term social media.

Social media refers to Internet-based applications that enable users to create and exchange information.

2. Some disadvantages of social media are:

- Decreases face-to-face conversations. This affects interpersonal relationships.
- Loss of valuable time. Individuals get addicted to spending countless hours on social media sites.
- Leaking of personal information on social media sites. This is because one's posts and data can easily be copied. Photographs can easily be downloaded and shared without one's knowledge.
- Crimes and exposure to activities that are illegal. Some bloggers may damage one's reputation by posting malicious and inaccurate information.

3. The functions of a bridge are:

- Extend a LAN beyond its length limit.
- Segment a LAN to reduce network traffic bottlenecks.
- Extend a LAN when the maximum connection limit has been reached.

4. Defining a repeater:

It is a network device used to expand the boundaries of a wired or wireless network. A repeater receives a signal, cleans it to remove any distortion, and amplifies or boosts the signal, then finally sends the signal to another network segment.

5. The purpose of a network interface card is:

It provides a port where a transmission medium is connected to enable communication and sharing of resources.

Unit 9

Game Programming

Introduction

This topic introduces the learner to Game programming. It is expected that by the end of this topic, the learner should be able to design a game, collect data in a table, and add game rules in Scratch.

9.9 Content Map for the Unit

Topic Area	Programming (Scratch)
Subtopic Area	Game Programming
Number of periods	10
Introduction	Game Programming
Classroom organisation	Whole class orientation then work in groups. Individual activities.
Equipment required	Scratch editor, Internet connection, digital material, projector, and computer
Activities	Practical activities, discussions, field trips.
Competencies Practice	Team work, communication skills and research.
Language Competencies and Practice	<ul style="list-style-type: none"> • Defining • Explaining • Writing • Communicating • Group discussions • Report
Additional Vocabulary (Key terms to be explained to the student)	Game designer, Block palettes, Stage area, bpm, Timer, Stack blocks, Reporter blocks, Boolean block, C block , Cap block
Numeracy	Constituting groups with a manageable number of learners

Study Skills (including Language Competencies)	<ul style="list-style-type: none"> • Note taking/ Writing • Organisation of ideas • Listening to audio lessons • Watching video lessons • Presentation/ Reporting skills • Observation skills
Revision	<ul style="list-style-type: none"> • Learning Activities and examples provided in the ICT Senior 2 Student's Book
Assessment	<ul style="list-style-type: none"> • A formative assessment of the ability to work in groups and carry out activities. • Assess whether the objectives are met. Use Continuous Assessment Tests (CATs) and oral questions. • A summative evaluation at the end of the unit to examine the extent the intended learning objectives have been accomplished.
Learning Outcomes	<p>The learner should be able to:</p> <ul style="list-style-type: none"> • Choose the adequate instruction needed to produce a game. • Associate commands and produce a good game. • Include rules in the game using scratch commands such as touching colour, broadcast, when I receive, go to, change by, and show. • Conceptualise the ICT contribution in real life especially in developing games.

Note: For a sample of a competence-based lesson plan, see pages 18 to 21 of this Teacher's Guide.

9.2. Subtopics/Content to be covered

Game concepts

- Game Name
- List of sprites (name, costumes, sounds, movements).
- How sprites interact in this game. Provide the list of backgrounds.
- The score counter rule and level advancement rule.

Collect detailed data in the table

- Provide in a well-drawn table (draft) of each item that will guide the game designer in order to limit the occurrences of mistakes or jumping of steps.

Commands to set game rules

- Switch to costume, forever, if, touching colour, broadcast, when I receive, go to, change by, show, repeat, hide, wait, stop all, point in direction, round pick random, if on edge bounce, turn and if else among others.

9.3. Reference to the Learners' Book for Senior 2

Refer to the ICT for Senior 2, Student's Book, pages 257 to 293.

- 9.4. Key Unit Competency:** By the end of this unit, the learner should be able to design a game, collect data in a table, and add game rules.

9.5. Learning Objectives

Knowledge and understanding

By the end of this unit, the learner should be able to:

- Identify different classes needed to make a good game.
- Apply detailed classes to develop a game.
- Include rules in the game.

Skills to be imparted in this unit

By the end of this unit, the learner should be able to:

- Interact with the basic classes to produce a game such as game name, sprites, sprite interaction, backgrounds, and scores and levels.
- To detail each class by providing an information table for clarity and greater understanding.
- Create scripts based on the sprite interaction rules.

Attitudes and values to be developed in this unit

By the end of this unit, the learner should be able to:

- Choose the adequate instruction needed to produce a game.
- Conceptualise the ICT contribution in real life, especially in developing games.
- Express the desire to produce more games using scratch commands.
- Appreciate the produced game.
- Pay attention on how to use commands and produce a game.
- Be proud of arranging commands and producing a game.

9.6. Teacher Preparation

- (i) Prepare the lesson plan and make lesson notes. Study and master the content to be taught. Refer to the Student's Book for Senior 2, Unit 9.
- (ii) Practise how to associate commands and produce a good game.
- (iii) Attempt the learning activities in ICT Senior 2 Student's Book.

9.7. Key Concepts to be covered

- Game programming is the process of writing codes that animate objects in a video game. It involves taking the design specifications of the game designers, combining the art and sound, and translating it all into a playable game.
- The basic classes to produce a game include game name, sprites, sprite interaction, backgrounds, and scores and levels.
- Some of the Commands used to set game rules include switch to costume, forever, if, touching colour, broadcast, when I receive, go to, change by, show, repeat, hide, wait, stop all, point in direction, round pick random, if on edge bounce, turns, and if else among others.

9.8. Additional Content for the Teacher

To learn more about each block in Scratch 2.0, simply right-click on the block and select **Help**. The block palettes can further be categorised as discussed below:

(i) Motion blocks

There are seventeen Motion blocks categorised into two, namely Motion Stack blocks and Motion Reporter blocks with fourteen and three blocks respectively. Check-marking the Reporter block displays a counter at the stage area.

The Motion Stack blocks are move () steps, turn () degrees, point in direction (), point towards (), go to x: () y: (), go to (), glide () secs to x: () y: (), change x by (), set x to (), change y by (), set y to (), if on edge, bounce and set rotation style () as shown in Figure 9.1.

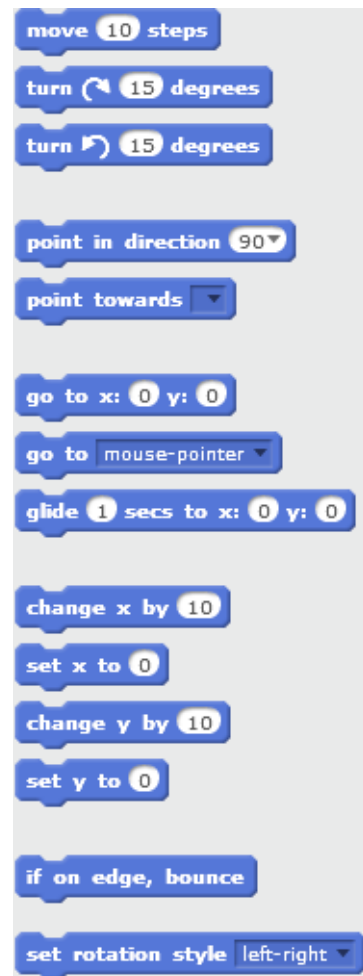


Figure 9.1: Motion Stack blocks

The Motion Reporter blocks are x position, y position, and direction as shown in Figure 9.2.



Figure 9.2: Motion Reporter blocks

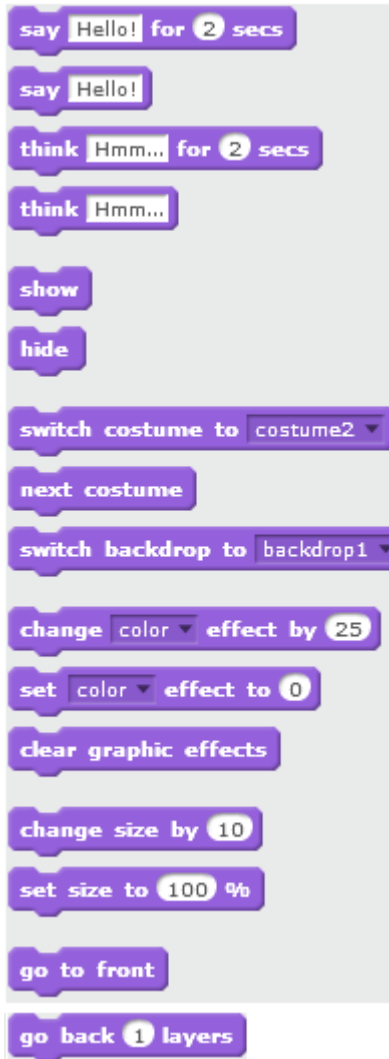


Figure 9.3: Looks Stack blocks

(ii) **Looks blocks**

- The Looks Stack blocks are say () for () secs, say (), think () for () secs, think (), show, hide, switch costume to (), next costume, switch backdrop to (), change () effect by (), set () effect to (), clear graphic effects, change size by (), set size to () %, go to front, go back () layers as shown in Figure 9.3.
- There are nineteen Looks blocks categorized into two namely Looks Stack blocks and Looks Reporter blocks with sixteen and three blocks respectively.

The Looks Reporter blocks are costume #, backdrop name, and size as shown in Figure 9.4.

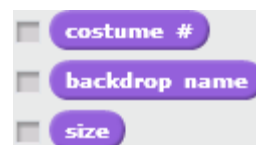


Figure 9.4: Looks Reporter blocks

(iii) Sound blocks

- There are thirteen Sound blocks categorized into two, namely Sound Stack blocks and Sound Reporter blocks with eleven and two blocks respectively.
- The Sound Stack blocks are play sound (), play sound () until done, stop all sounds, play drum () for () beats, rest for () beats, play note () for () beats, set instrument to (), change volume by (), set volume to () %, change tempo by () and set tempo to () bpm.
- The Sound Reporter blocks are volume and tempo as shown in Figure 9.5.

(iv) Pen blocks

There are eleven Pen Stack blocks namely clear, stamp, pen down, pen up, set pen colour to (), change pen colour by (), set pen colour to (), change pen shade by (), set pen shade to (), change pen size by () and set pen size to () as shown in Figure 9.6.

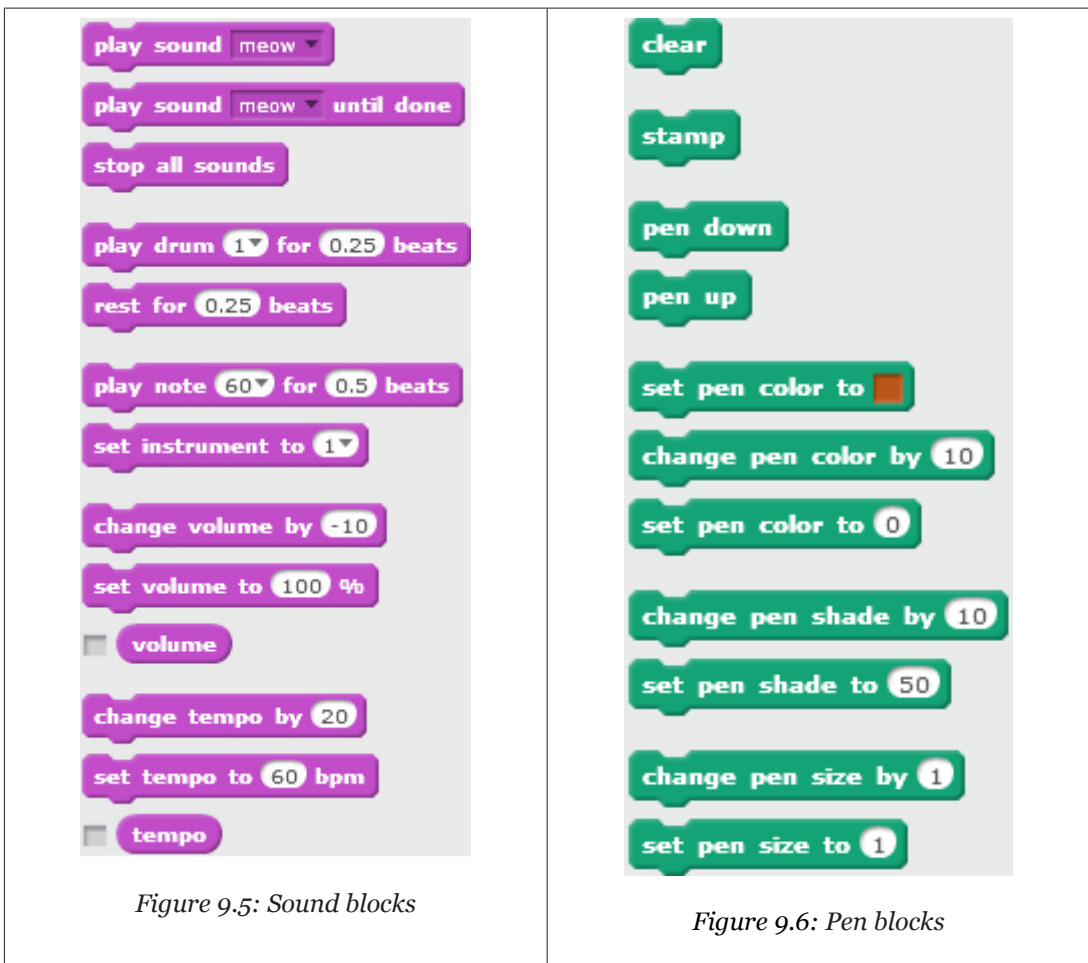


Figure 9.5: Sound blocks

Figure 9.6: Pen blocks

(v) **Data blocks**

Data blocks contain two blocks, namely Variable (*Make a Variable*) blocks and List (*Make a List*) blocks.

- There are 5 blocks under the Variable block categorised into two namely Variable Stack blocks and Variable Reporter block with four and one blocks respectively.
- The Variable Stack blocks are set () to (), change () by (), show variable () and hide variable ().
- () block is the only Variable Reporter block.

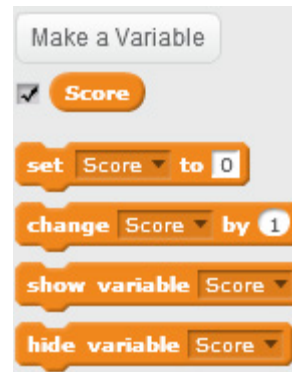


Figure 9.7: Variable (*Make a Variable*) blocks

List block

- There are ten blocks under List block categorised into three namely List Stack blocks, List Reporter blocks and List Boolean block with six, three and one blocks respectively.
- The List Stack blocks are add () to (), delete () of (), insert () at () of (), replace item () of () with (), show list () and hide list ().
- The List Reporter blocks are (), item () of () and length of ().
- () contains () is the only List Boolean block.



Figure 9.8: List (*Make a List*) blocks

(vi) Event blocks

- There are eight Event blocks categorised into two, namely Event Hat Blocks and Event Stack blocks with six and two blocks respectively
- The Event Hat Blocks are when green flag clicked, when () key pressed, when this sprite clicked, when backdrop switches to (), when () is greater than () and when I receive ().
- The Event Stack blocks are broadcast () and broadcast () and wait.

(vii) Control blocks

- There are eleven Control blocks categorised into four, namely Control Stack blocks, Control C blocks, Control Cap blocks and Control Hat block with three, five, two and one blocks respectively.
- The Control Stack blocks are wait () secs, wait until () and create clone of ().
- The Control C blocks are repeat (), forever, if () then, if () then, else and repeat until ().
- The Control Cap blocks are stop () and delete this clone.
- When I start as a clone is the only Control Hat block.

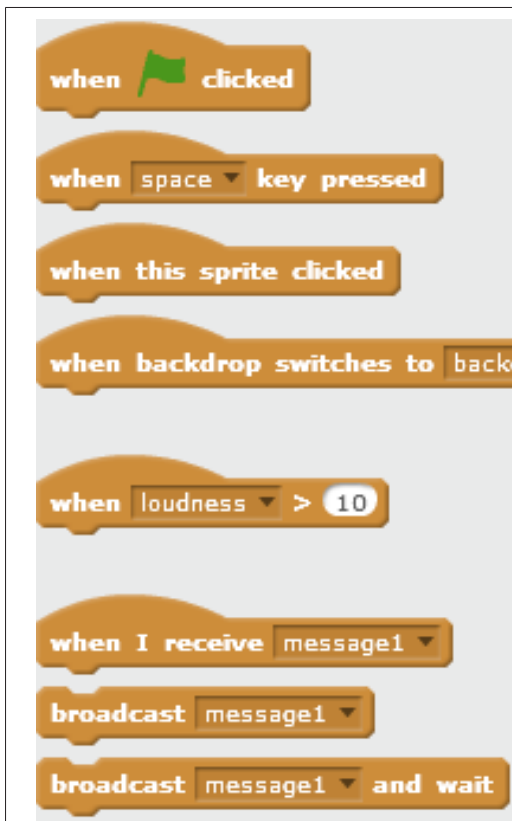


Figure 9.9: Event blocks

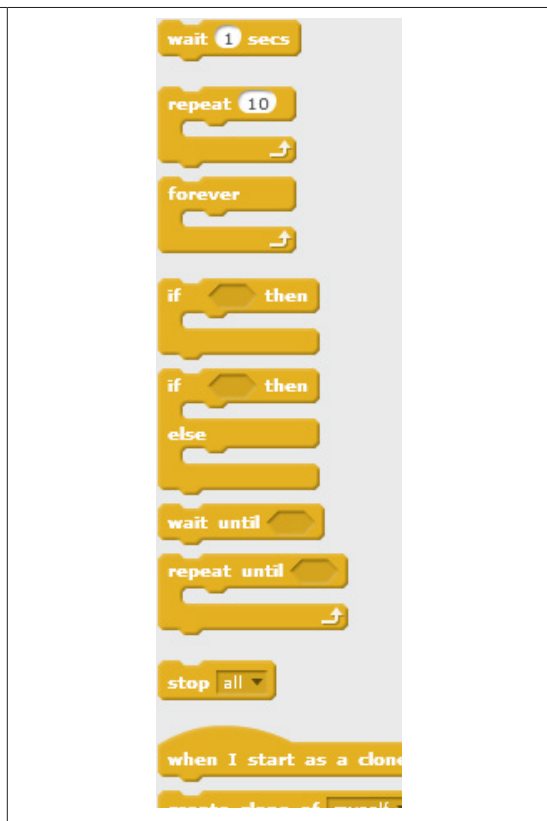


Figure 9.10: Control blocks

(viii) Sensing blocks

- There are twenty Sensing blocks categorised into three, namely Sensing Stack blocks, Sensing Reporter blocks and Sensing Boolean blocks with four, eleven and five blocks respectively.
- The Sensing Stack blocks are ask () and wait, reset timer, turn video () and set video transparency to () % as shown in Figure 9.11.
- The Sensing Reporter blocks are distance to (), answer, mouse x, mouse y, loudness, timer, video () on (), () of (), current (), days since 2000 and username as shown in Figure 9.12.



Figure 9.11: Sensing Stack blocks

The Sensing Boolean blocks are touching ()?, touching colour ()?, colour () is touching ()?, key () pressed?, mouse down? as shown in Figure 9.13.

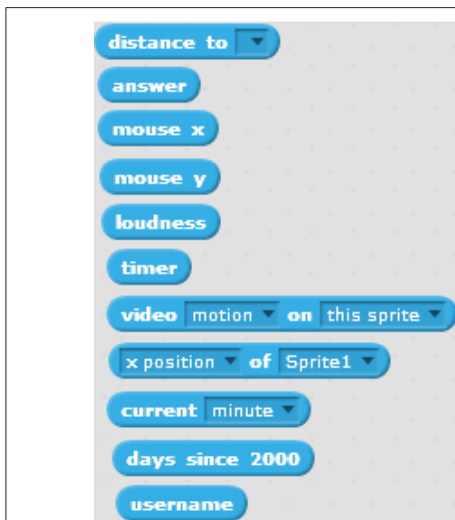


Figure 9.12: Sensing Reporter blocks



Figure 9.13: Sensing Boolean blocks

(ix) Operators blocks

- There are seventeen Operators blocks categorised into two, namely **Operators Boolean blocks** and **Operators Reporter blocks** with six and eleven blocks respectively.

- The Operators Boolean blocks are $() < ()$, $() = ()$, $() > ()$, $()$ and $()$ and $\text{not} ()$.
- The Operators Reporter blocks are $() + ()$, $() - ()$, $() * ()$, $() / ()$, $\text{pick random} () \text{ to} ()$, $\text{join} () ()$, $\text{letter} () \text{ of} ()$, $\text{length of} ()$, $() \bmod ()$, $\text{round} ()$ and $() \text{ of} ()$.

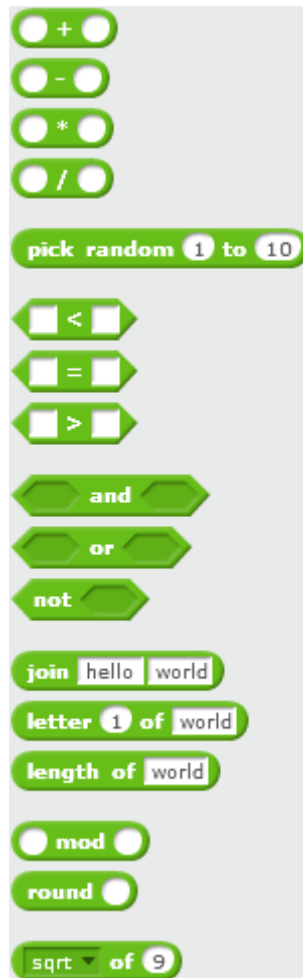


Figure 9.14: Operators blocks

(x) More blocks are user-made custom blocks.

- They are categorized into two namely Make a block and Add an Extension.
- **Block Shapes:** There are six block shapes in Scratch 2.0 namely Hat, Stack, Boolean, Reporter, C and Cap blocks.

- **Hat blocks:** They start every script. They are shaped with a bump at the bottom and a rounded top. The bump enables placing blocks only below them.



Figure 9.15: The shape of a Hat block

- **Stack blocks:** These perform the main commands. They are shaped with a bump at the bottom and notch at the top. The bump and notch enables placing blocks below and above them respectively.



Figure 9.16: The shape of a Stack block

- **Boolean blocks** are conditions that are either true or false. For example, touching mouse-pointer? The answer would either be “Yes” or “No”.



Figure 9.17: The shape of a Boolean block

- **Reporter blocks** hold numbers and strings. They are shaped with rounded edges and display the values (answers). For example, what is your age? Reporter blocks would answer say “12”.



Figure 9.18: The shape of a Reporter block

- **C blocks** are also known as **Wrap blocks**. They are shaped like a C and loop the blocks within the Cs or check if a condition is true. They can be capped or bumped at the bottom.



Figure 9.19: The shape of a C block

- **Cap blocks** end scripts. They are shaped with a notch at the top and a flat bottom to prevent placing any blocks below them. There are only two Cap blocks found in the Control category.



Figure 9.20: The shape of a Cap block

Use of timer and variable in Scratch

Timer

- This is a feature that records how much time, in seconds, has passed since a project was started or the timer was reset.
- The timer is very accurate and its value is not affected by lag. However, it accumulates one second of error after about 46 minutes.
- There are two blocks associated with the timer under the **Sensing** block palette namely *timer* and *reset timer*.
- The *timer* block displays the stage monitor and reporter block of the value whereas the *reset timer* block sets the timer value to 0.0



Figure 9.21: Timer

How the timer works

- It counts continuously upwards by tenths of seconds and displays the value in seconds.
- It continues counting even when the project stops running.
- It cannot be paused or stopped but can be reset.
- It only resets when a project is opened or by execution of the reset timer block.

Variable

- A variable is a changeable value that can only hold one value at a time. The value can be either a number or string (text). Variables enable one to see and manipulate numbers and text in the program.
- In Scratch, a variable is preferred instead of the timer because it can be stopped by pressing the **Stop button** unlike the timer which cannot. However, a variable is slower than the timer.



Figure 9.22: Variable named Score

9.9. Suggested Teaching and Learning Materials

- Computers installed with Scratch Editor 2.0.
- Internet connection.
- Digital material.
- Projector.
- ICT Senior 2 Learners' Book and other relevant text books.

9.10. Suggested Low-cost or No-cost Materials

- Free Scratch 2.0 software downloads from authentic websites.
- Free Scratch tutorials on identified websites.

9.11. Suggested Teaching Methods

A teaching method refers to the principles and ways used for instruction by teachers to achieve the desired learning objectives. It is determined partly by the subject being taught and by the nature of the learners. Some of the teaching methods suggested for this topic include:

- **Discussion:** This is where each learner is given an equal opportunity to interact and contribute. The discussion can be facilitated either by the teacher or a learner. The discussion may be followed by a presentation or a demonstration. The teacher should ask questions that develop critical thinking such as “What combination of blocks can make this sprite ...”
- **Practical activities:** In practical activities, learners are involved in manipulating blocks to create games or observe the teacher creating games. Learners are expected to recall what they have observed and attempt to carry out the same tasks.
- **Project-Based Learning:** This is an approach to teaching in which learners explore real-world problems and challenges. They learn about a subject by working for an extended period of time to investigate and respond to complex questions, problems, or challenges.
- **Demonstration:** This is the process of teaching through examples. The teachers should have working examples of scripts to control sprites in a game to support their content. This method helps improve learners’ interest and retention because the method provides connections between facts and real-world applications of those facts.
- **Question-and-answer method:** The questions should be presented in a manner that raises curiosity among learners on a given topic. The teacher can ask follow-up questions that are linked to learners’ responses.
- **Watching video recordings:** The teacher should guide learners in watching video that is relevant to the lesson or the subject, for example, video recording of an animated game.
- **Use of resource persons:** A resource person is an expert on a subject, and who shares the information with the participants in a learning situation. The teacher should prepare both the learners and the resource person by informing them of

the topic of discussion. The learners may prepare questions related to the topic to be answered by the resource person.

9.12. Suggested Teaching and Learning Activities and Exercises to Support Delivery of Content and Development of Student Competencies

- **Class discussions on the importance of Game Programming:** The teacher or learner should lead other learners in discussing the importance of Game programming. The teacher should provide practical examples of how and where Game programming has been of importance. He/she should invite the learners to also give their contributions.
- **Group discussions on the various blocks and their use:** The teacher could organise the learners into groups consisting of mixed abilities; that is, weak, average, and bright learners and let them discuss the various blocks. The group leaders should then present their work to the whole class under the guidance of the teacher.
- **Watching online projects in Game Programming:** The teacher should organise for Internet access and have a projector. He or she should guide the learners on how to access authentic websites and explain the various online projects in Game programming.
- **Inviting resource persons with practical Game Programming experience to give talks:** The teachers should invite persons with advanced Game programming knowledge and experience to motivate and guide the learners on various game programming concepts.
- **Question-and-answer method on Game Programming concepts:** The teacher should pose questions on different Game programming concepts in order to assess the learners' level of understanding.
- **Joining online Scratch groups:** Learners should be encouraged to join online Scratch groups to share their challenges and successes in Game Programming. The teacher should help learners identify authentic online Scratch groups and give out assignments that could prompt them to join the groups.
- **Learners to be involved in timed creation of games:** The teacher should give learners exercises that must be completed within a given period of time. This will help them assess the learners' level of understanding.

9.13. Suggestions for Accommodating Special Education Needs (SEN)

The teacher should identify learners with special needs and help them to cope during the teaching learning activities.

Type of impairment	Support for the learner
Sensory impairment (visual)	<ul style="list-style-type: none"> Group the learners to ensure that those with good vision help those with mild visual impairment.
Sensory impairment (visual) ... continued	<ul style="list-style-type: none"> Provide Braille keyboards and Braille printer (Braille embosser) to those learners with severe visual impairment. If possible, use adaptive technology, especially voice-to-print conversion using a scanner and voice production software. This is where textbooks are converted into audio formats and stored on secondary media or in the PC. Ensure preferential seating since the learners depend on listening. For example, allow partially sighted students to sit in front.
Sensory impairment (hearing)	<ul style="list-style-type: none"> Make an effort to face the learners when talking; talk slowly and clearly but do not shout. Allow learners with hearing impairment to sit close to the teacher. Repeat the questions posed by other learners before answering them. Allow learners with hearing impairment to participate in class discussions. Allow the learners to work with audiovisual material independently and for a longer period of time. Use lots of pictures, graphics, and text labels, keeping in mind that these learners are visual learners.
Motor impairment	<ul style="list-style-type: none"> Consult with the other learners on how they can assist those with motor-impairment. For learners in wheel chairs, ensure the classroom is arranged to accommodate the learners' needs. For learners with hand-function limitations, use competencies-based assessment rather than speed as a grading criteria. For learners with chronic back problems, allow them to alternate activities in sitting, standing, and walking.

Gifted or talented learners	<ul style="list-style-type: none"> • Assign learners extra and more challenging tasks. • Allow learners to pursue independent game programming projects based on their own individual interests. • Encourage creativity and original thinking among gifted students. • Teach interactively. Encourage the learners to work together and actively teach one another through peer teaching. Introduce activities to challenge the gifted learners further. • Provide opportunities for gifted learners to interact with others across levels and schools through creating game projects.
------------------------------------	---

9.14. Suggestions for Supporting Multi-Ability Learning

Fast learners	<ul style="list-style-type: none"> • Learners to work together with slow learners and actively teach one another. • Assign learners extra and more challenging tasks.
Slow learners	<ul style="list-style-type: none"> • Take time to go over procedures and use very simple language. • Remedial teaching. • Learners to work together and actively teach one another.

9.15. Suggestions for Assignments

As an individual:

- Attempt learning activities given in the ICT Senior 2 Student's Book. The instructions given are clear.

Groups:

- In groups of five let the students attempt the projects given in the Student's Book.
- In pairs, create simple games as assigned by the teacher.

Whole class work:

- Discuss the more challenging tasks.

9.16. Support for the Development of Positive Skills, Values and Attitudes

Some life skills to develop include critical thinking, creative thinking, effective communication, problem-solving and self-esteem. Some values to be developed include responsibility, patience, appreciation, cooperation, and curiosity.

These can be developed in the following ways:

- Learners to individually create sprites using the paint editor to encourage creativity and critical thinking.
- Working on projects in groups encourages effective communication and develops cooperation.
- Learners carrying out more challenging tasks to develop patience, self-esteem, curiosity, problem solving skills, and allow critical thinking.
- Individual or group presentations before other learners to develop effective communication and responsibility.

9.17. Suggested Formative and Summative Assessment

- Learning activities in ICT Senior 2 Student's Book.
- Oral questions
- Assignments
- Written and practical examinations
- Individual and group presentation
- Project development

9.18. Links to Other Subjects

- Fine art: The teacher should ensure that learners master the paint editor window. They should acquire the ability to paint both in bitmap and vector modes.

9.19. Additional Remedial, Consolidation and Extension Activities

- (i) Assign learners simple practise tasks to be attempted individually and save the work to be marked by the teacher.
- (ii) Learners to work in pairs on challenging tasks and present their work to the whole class.
- (iii) In groups of three, learners to discuss the various block palettes and make brief notes. The group leader to present the work to the whole class.


9.20. Answers to the Learning Activities in the Student's Book ICT Senior 2

Revision Activity 9.1 (Student's Book page 268)

Part A (Individual work)


1. Sprite action
2. Motion
3. Motion Stack blocks, Motion Reporter blocks
4. **Speaker** icon to choose sound from library, **record** button icon to record new sound, **Folder/ Import** button to select sound from file.

Part B (Pair work)

1. x position, position, and direction
2. Turn () degrees. There are two motion blocks, that is, one that turns the sprite clockwise and another that turns it anti-clockwise.
3. Steps of adding sound to a sprite.
 - (i) Select the sprite.
 - (ii) Click on the **Sounds** tab.
 - (iii) Select the sound from the thumbnail displayed. If no sound is displayed in the thumbnail area, click on the **Speaker** icon to choose sound from library, **record** button icon to record new sound or click on **Folder/Import** button to select sound from file.
4. Procedure for applying background in a game.
 - (i) Click on the icons under **New backdrop**.
 - (ii) To choose backdrop from library, click the  icon to view the Backdrop Library.
 - (iii) Scroll to view all backdrops available in Scratch or click on each folder to view the backgrounds underneath.
 - (iv) Select the desired background.
 - (v) Click **OK** to apply or **Cancel** to exit.

Part C (Students to work in groups of three)

1. Double click on the Scratch icon on the desktop to open or Right-click then select **Open** from the menu that appears.
2. Guide the learners to make the class presentations.
3. By default, the following block palettes appear:
 - (i) **Motion blocks** which control movement of the sprite. There are seventeen Motion blocks categorized into two namely Motion Stack blocks and Motion Reporter blocks with fourteen and three blocks respectively.
 - (ii) **Looks blocks** which control how the sprite appears. There are nineteen Looks blocks categorized into two namely Looks Stack blocks and Looks Reporter blocks with sixteen and three blocks respectively.
 - (iii) **Sound blocks** which control sound. There are thirteen Sound blocks categorized into two namely Sound Stack blocks with eleven and two blocks respectively.
 - (iv) **Pen blocks** which control the pen and are colour-coded dark-green.



They are useful when creating a one sprite one script project allowing one to take various actions, for, example, stamp the sprite. An example of a one sprite one script project is a simple drawing program.

(v) **Data blocks** which contain two blocks namely Variable (*Make a Variable*) blocks and List (*Make a List*) blocks.

(vi) **Event blocks** which control events and activate scripts to run. There are eight Event blocks categorized into two namely Event Hat Blocks and Event Stack blocks Event Stack blocks with six and two blocks respectively

(vii) **Control blocks** which direct scripts.

There are eleven Control blocks categorized into four namely Control Stack blocks, Control C blocks, Control Cap blocks and Control Hat block with three, five, two and one blocks respectively.

(viii) **Sensing blocks** which detect things and interact with the surrounding of a project.

There are twenty Sensing blocks categorized into three namely Sensing Stack blocks, Sensing Reporter blocks and Sensing Boolean blocks with four, eleven and five blocks respectively.

(ix) **Operators blocks** which perform mathematical functions and string handling.

There are seventeen Operators blocks categorized into two namely Operators Boolean blocks and Operators Reporter blocks with six and eleven blocks respectively.

(x) **More blocks** which are user-made custom blocks. They are categorized into two namely Make a block and Add an Extension.

Revision Activity 9.2 (Student's Book page 286)

Solution

Paint a simple race track for the backdrop and the finish line. To do this:

- (i) Click on the Paint new backdrop button under the stage backdrop pane.
- (ii) From the **Bitmap Editor** tools, click on **Brush** then select the preferred colour from the colour palette, for example, black.
- (iii) Increase the line width next to the colour palette to increase the width of the brush and the paint the race track.
- (iv) Click on **Line** then select the preferred colour from the colour palette, for example, Red and draw the finish line as shown in Figure 9.23.

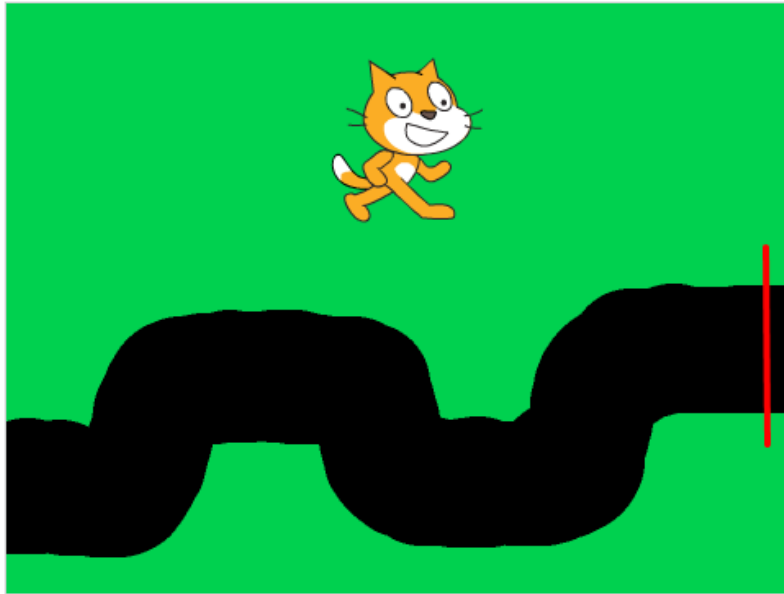


Figure 9.23: Race track

- Delete the Cat sprite and paint a simple Car sprite to fit on the track. Save the project as *CarRacingRevised* as shown in Figure 9.24.

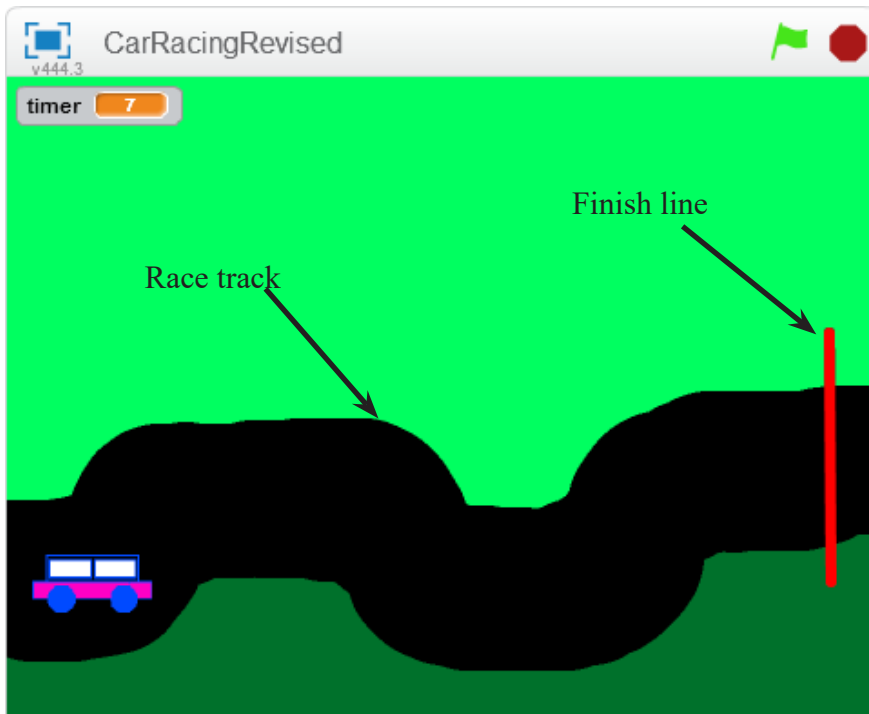


Figure 9.24: Painted Car on Race Track

- Add the scripts below to control the game.

The following are the scripts for the game:

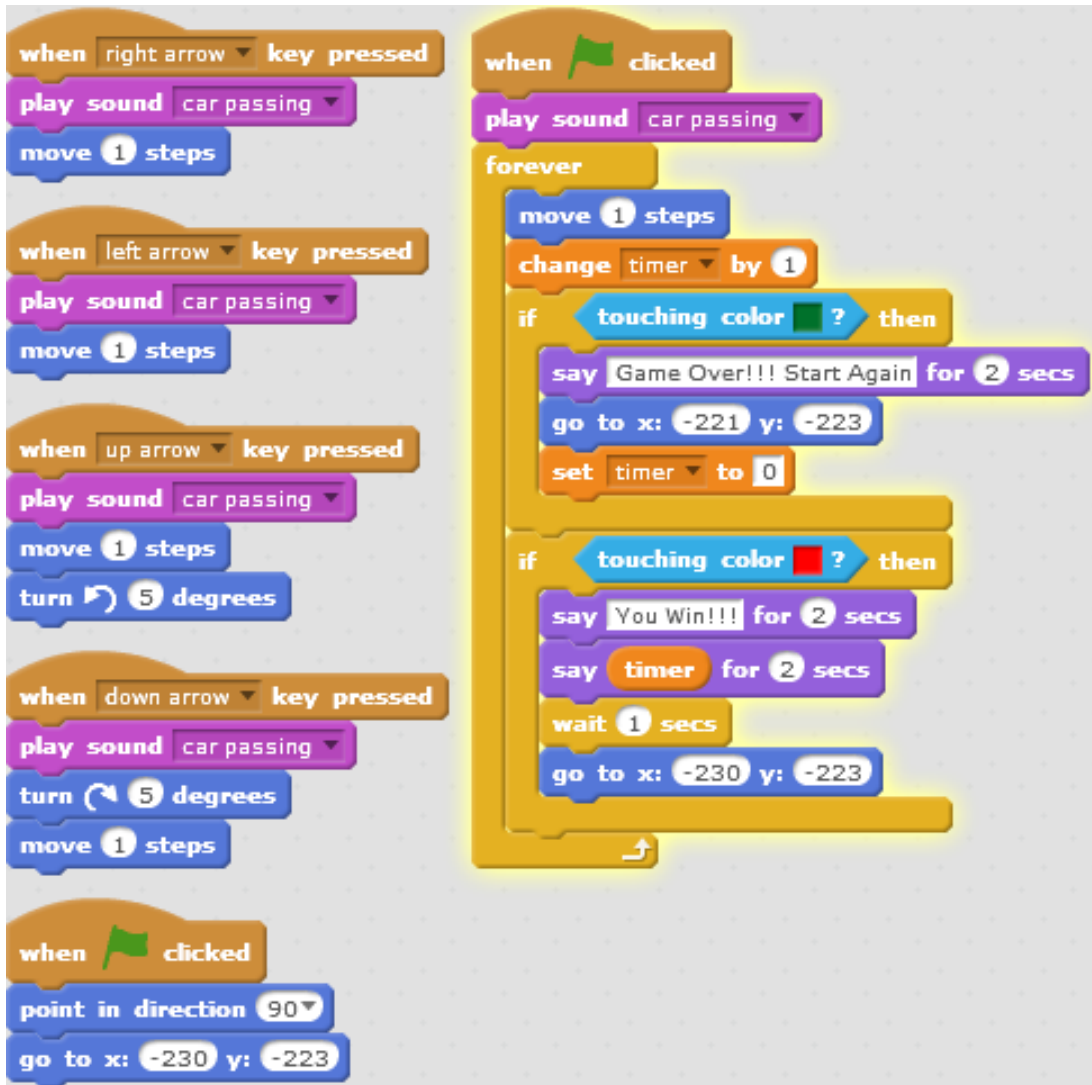


Figure 9.25: Scripts for the Car Racing game

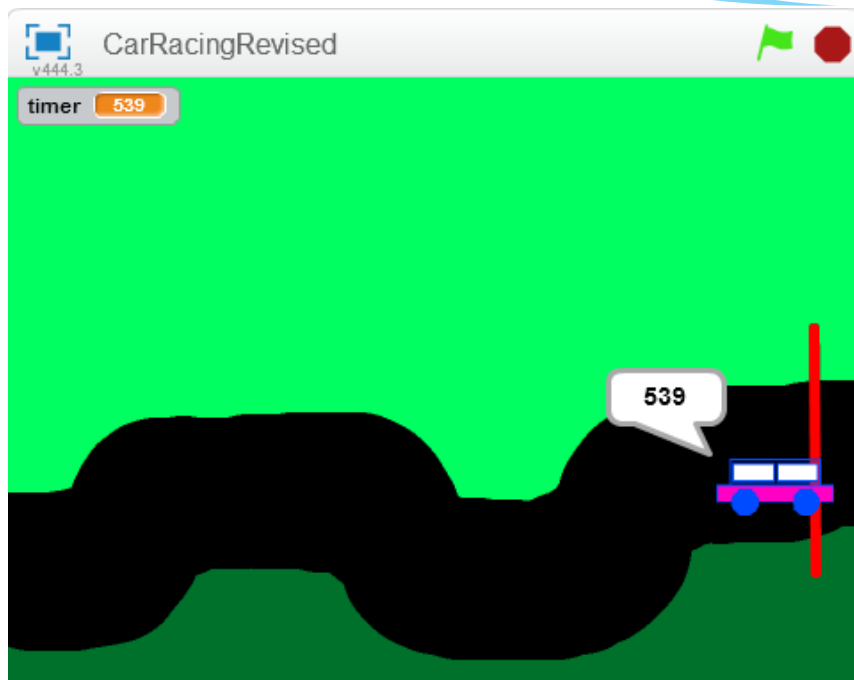


Figure 9.26: Variable showing how long it takes for the car to get to the finish line

Revision Activity 9.3 (Student's Book page 291)

Part A (Individual work)

1. Cap , hat
2. Stack
3. Reporter blocks
4. Repeat (), Forever, If () then, If () then else, Repeat until ()
5. If on edge, bounce

Part B (Pair work)

1. Motion
2. When Green Flag clicked, When () key pressed, When this sprite clicked, When backdrop switches to (), When () is greater than (), When I receive ().
3. Broadcast; When I receive
4. Event Stack block
5. **Sensing Reporter blocks.**
 - (i) Distance to (): Displays the distance from the sprite to the mouse-pointer or another sprite.
 - (ii) Answer: Displays the most recent input with the ask () and wait block.

- (iii) Mouse x: Displays the x position of the mouse-pointer.
 - (iv) Mouse y: Displays the y position of the mouse-pointer.
 - (v) Loudness: Displays how loud the noise that the microphone is sensing is.
 - (vi) Timer: Displays the time passed since the Scratch program was started or the timer was reset.
 - (vii) Video () on (): Displays the motion or direction of video on a sprite or stage.
 - (viii) () of (): Displays the x position, y position, direction, costume, costume name size or volume of a sprite or the stage.
 - (ix) Current (): Displays the specified time unit, for example, year, month and date among others.
 - (x) Days Since 2000: Displays the number of days since the year 2000.
 - (xi) Username: Displays the user's name.
6. Motion, sensing, control blocks.
 7. Give the main difference between a timer and variable counter.

Timer	Variable
Cannot be stopped even when the project stops running.	Can be stopped by pressing the Stop button
Faster and very accurate compared to variable.	Slower compared to the timer.

Part C (Group work)

1. To draw a new ball:
 - (a) Click on **Paint new sprite** button under the Stage area to open the **Paint editor**.
 - (b) Click on the **Ellipse** and draw a circle to represent the ball sprite. Design the ball as desired.



Figure 9.27: Ball sprite painted using Ellipse, Pencil and Fill with color tools

- (c) Use the **Grow** or **Shrink** buttons to set the desired size for the ball.
2. Decrease or increase the value of the **move () steps** block to change the speed of the ball in the Ping-Pong game.
3. Turn () **degrees block** either clockwise or anti-clockwise to adjust the angle of the ball.

4. Change the background and colour of the **Rod sprite** and **base line** to the preferred colour.

To change the background, use any of the options under **New Backdrop**. In this example, **playing-field** backdrop has been selected from the backdrop library.



Fig. 9.28: Background, Rod sprite and baseline colour changed

5. Add a variable named **Score**, which keeps score of how many times the ball bounces on the Rod and which reduces the score by -1 when the ball touches the baseline.



Fig. 9.29: Script for the Score counter

In Figure 9.29, the score is set to 0 when the Green Flag button is clicked. If the ball touches the rod, the score increases by 1 and if the ball touches the base of the stage, the score reduces by 1.

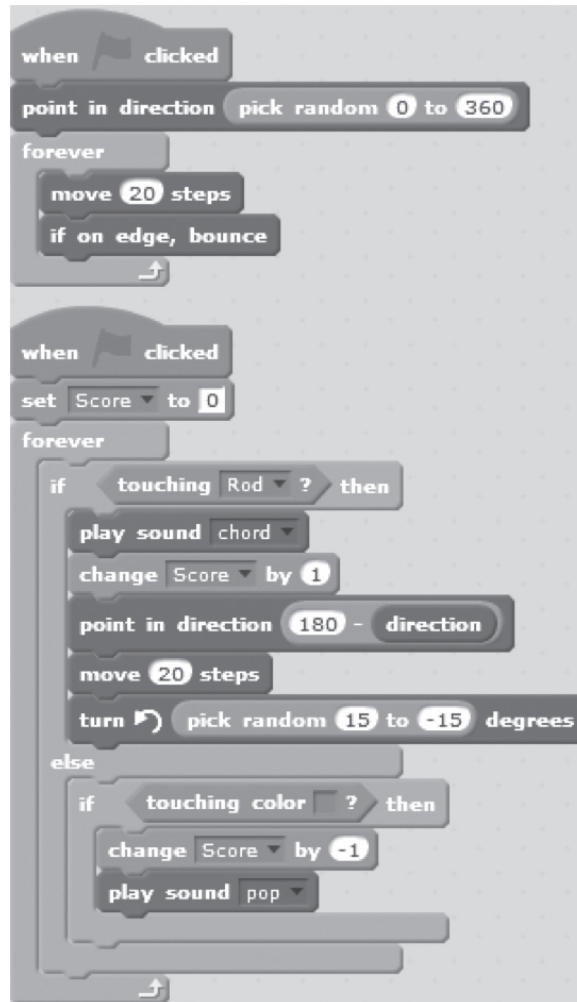


Fig. 9.30: Scripts for the Ball

The first script in Figure 9.30 randomly positions the ball at any value between 0 and 360 when the Green Flag button is clicked and continually moves the ball 20 steps. The ball bounces if it touches the edge of the stage.

The second script sets score to 0 when the Green Flag button is clicked. If the ball touches the rod, chord sound is played, the score increases by 1 and the ball moves 20 steps in direction as specified. If the ball touches the base of the stage, the score reduces by 1 and pop sound is played.

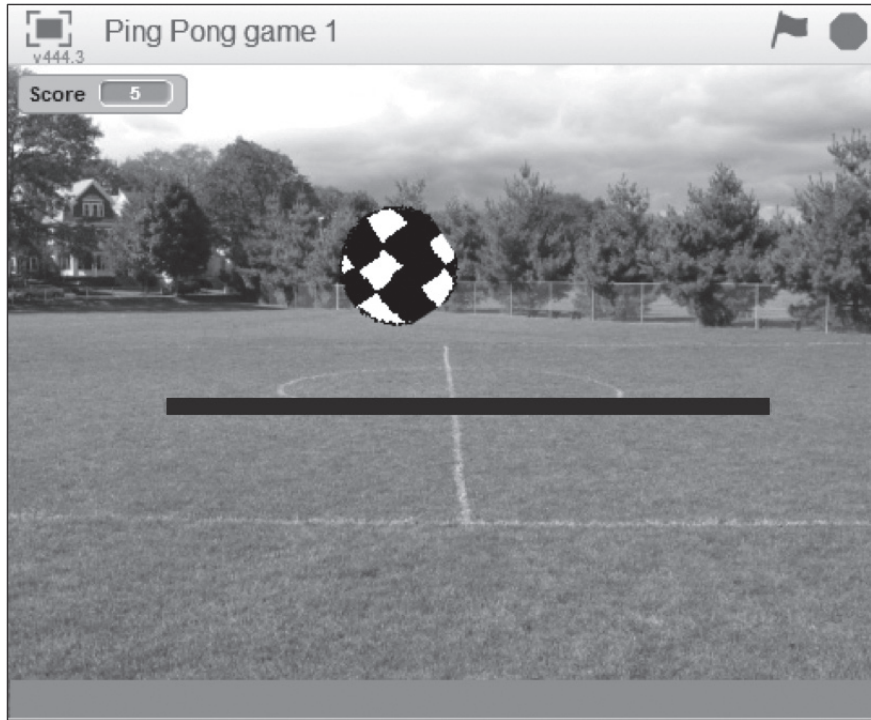


Figure 9.31: Stage area showing playing-field background

Additional Information on the Ping Pong Game

Game Name Table

Game Name	Ping Pong game
How to play	The ball bounces on the Rod and gets one point.
How to win	Get maximum points by ensuring that the ball does not touch the baseline of the stage.


Sprites Table

	Name	Costume	Sounds	Movements
Sprites	Rod	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • None
	Ball	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • Chord • Pop 	<ul style="list-style-type: none"> • None

Sprite Interaction Table

Sprite Interaction	Sprite 1	Sprite 2	Interaction
	Rod	Ball	If the Ball touches the Rod chord sound would be produced, one point gained.
	Ball	Stage baseline	If the Ball touches the baseline of the stage pop sound would be produced, one point lost.

Background Table

Name	Description
 Level 1_1	Playing-field

Score Management Table

How	How many points
Ball bounces on the Rod	1
Ball touches baseline	-1

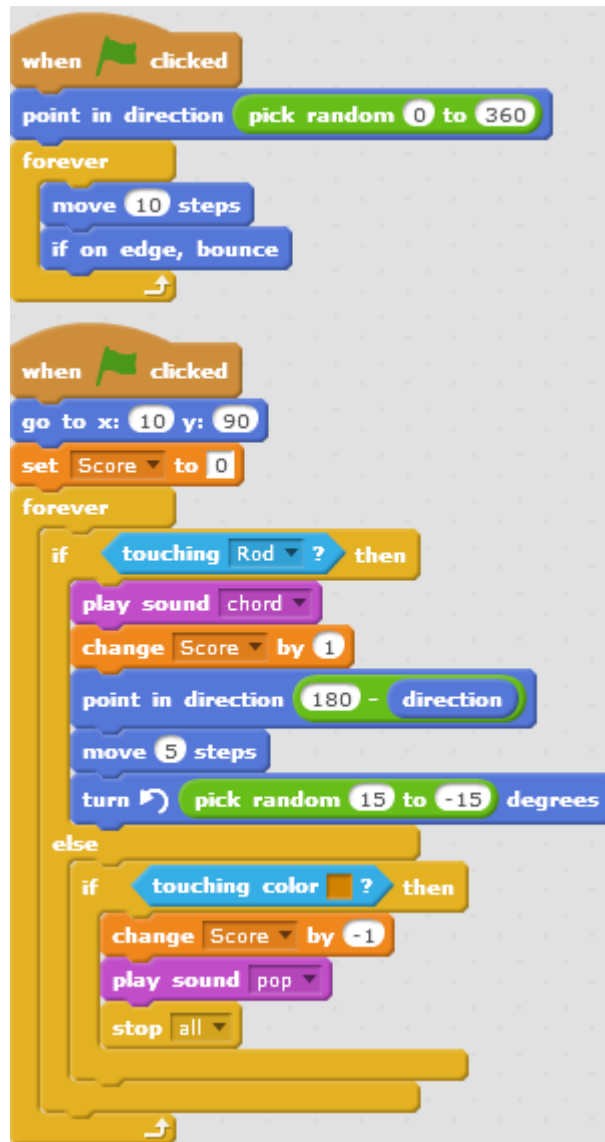


Figure: Final Script for the Ping Pong game

Revision Activity 9.4 (Student's Book page 293)

Part A (Individual work)

1. B 2. C 3. C 4. B 5. A

Part B (Pair work)

Use the Anna game above and do the following:

1. Add two sprites to the Anna game namely Crab and Bat.

Solution: Use the **Choose sprite from library** option to add the two sprites.

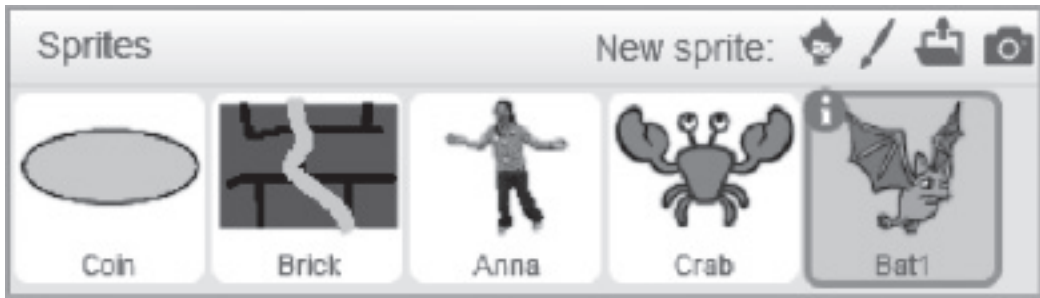



Figure 9.32: Crab and Bat sprite added to the Anna Game

Creating the Bat Sprite

Sprites Table

Name of sprite	Looks	Sounds	Movement
 Bat	Fly	None	Fly


Add a script to simulate wings flapping when the bat is flying:



Script to simulate flying

Creating the Crab Sprite

Sprites Table

Name of sprite	Looks	Sounds	Movement
 Crab	Walk	None	Walk

Add a script to simulate its claws opening and closing as it moves:



Script to simulate crab movement

2. Rule: If Anna is touched by Crab or Bat, she would die.
- (a) The Crab randomly crawls to the Right and Left.

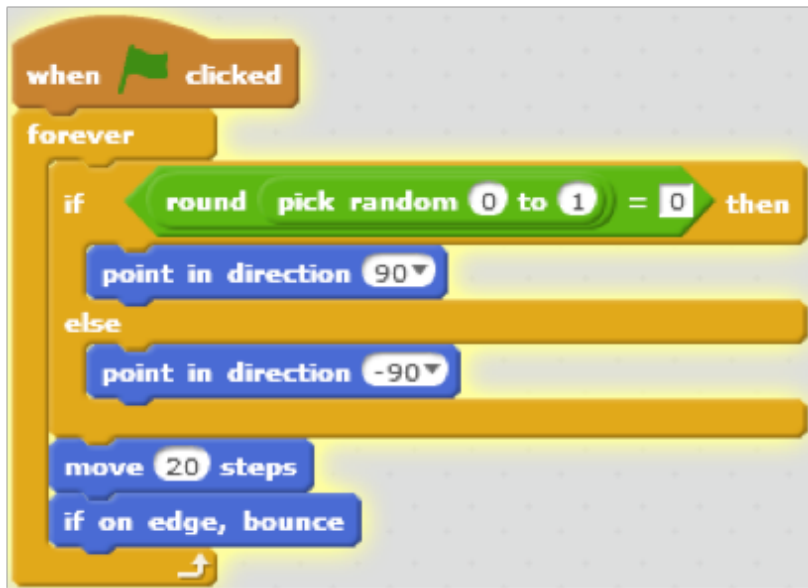


Figure 9.33: Motion script to make the Crab randomly crawl to the Right and Left

- (b) The Bat flies towards Anna with some randomness and in all four directions.



Figure 9.34: Motion script to fly the Bat towards Anna with some randomness and in all four directions

Explanation

When the Green Flag button is clicked, the Crab crawls side to side, and the Bat flies in zigzag motion.

Note: The Brick is a colour-sensitive sprite of the red colour and therefore the Brick will crack when touched by the red Crab. In the Anna Game, the colour of the Crab has been changed to black.

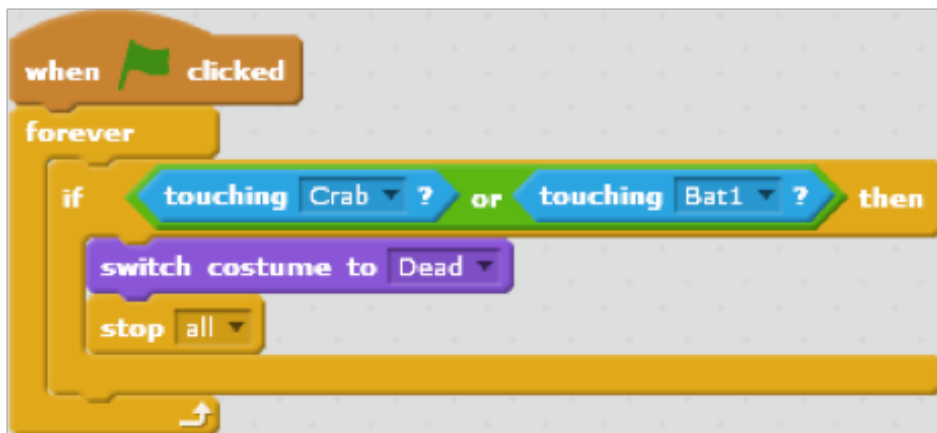


Figure 9.35: Script that would make Anna to die when touched by the Crab or Bat

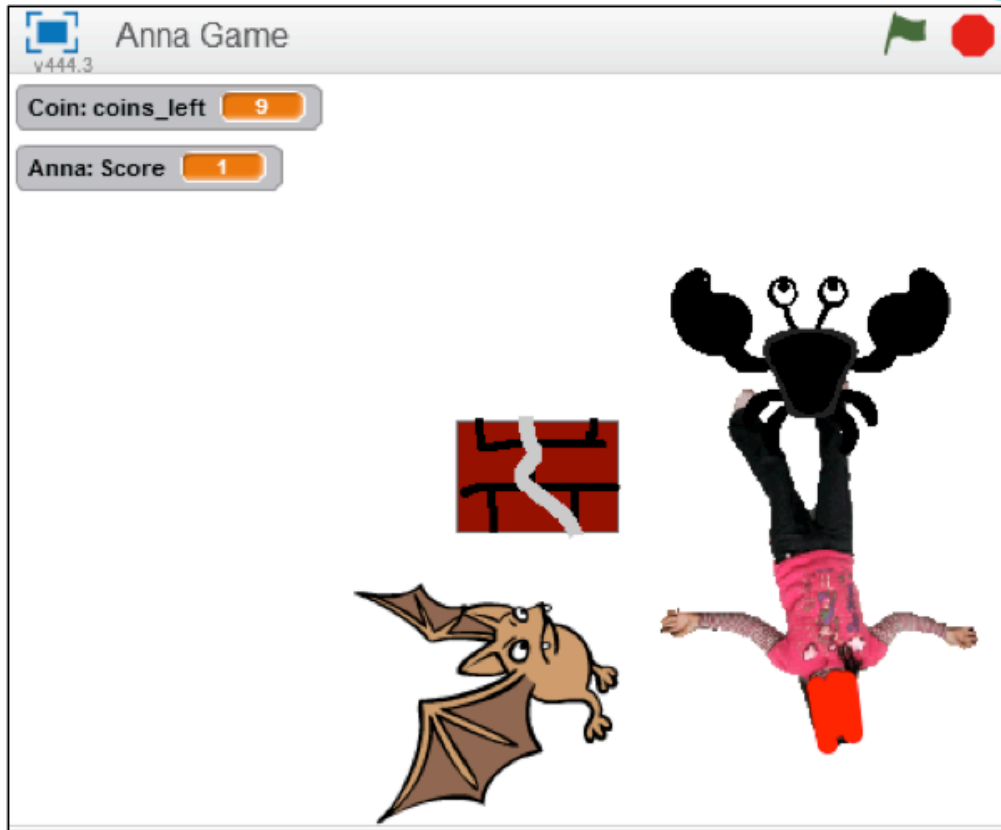


Figure 9.36: Stage area showing Dead Anna costume

In Figure 9.36 above, Anna would die when touched by either the Crab or Bat and the game would stop. Click the arrow keys and the Green Flag button to restart the game.

Additional Information on the Anna Game

Game Name Table

Game Name	Anna game
How to play	If Anna sprite's hand with red colour touches the Brick, the Brick would crack. When the Brick cracks, Coin would start spinning above it.
How to Score	Anna gets one point each time the Coin disappears.



Sprites Table

	Name	Costumes	Sounds	Movements
Sprites	Coin	Spin1 Spin2 Spin3	None	Spin
	Brick	Regular Cracked	None	Crushed
	Anna	Walk1 Walk2 Jump	Jump	Walk Jump
	Crab	Walk1 Walk2	None	Sidle
	Bat1	Bat1-a Bat1-b	None	Fly

Sprite Interaction Table

	Sprite 1	Sprite 2	Interaction
Sprite Interaction	Anna	Brick	If Anna sprite's hand with red colour touches the Brick, the Brick would crack.
	Anna	Coin	Anna scores 1 point when the Coin disappears.
	Brick	Coin	When the Brick cracks, the Coin would start spinning above it.
	Anna	Crab	Anna would die if she touches the Crab.
	Anna	Bat1	Anna would die if she touches Bat1.

Backgrounds Table

Name	Description
 Level 1_1	Solid ground, Anna as enemy to the brick.
 Level 1_2	Ground with blood, Crab and Bat as enemies to Anna

Levels Management Table

Level	Requirement	Starting background	Ending background
1	When the Anna game is started	Level 1_1	Level 1_1
2	When Anna is touched by the Crab or Bat	Level 1_1	Level 1_2

Score Management Table

How	How many points
Anna collects one coin by touching the brick	1



Figure 9.37: Final script for Anna game

Projects in Game Programming

Project 1: Helicopter game



Solution

1. Paint a cave.



Figure 9.38: Cave created using Paint Editor

2. Add a helicopter from the **Transportation** folder and create a costume by clicking costume tab. Duplicate the costume under the **New costume** pane then click on **Flip up-down** button on the paint editor. Add scripts to control the up of the helicopter and simulate gravity.

 <p>Figure 9.39: Script to control the up of the helicopter</p>	 <p>Figure 9.40: Script to simulate gravity</p>
--	---

3. Provide feedback to tell the user that the Game is over or Game is won. The game is won when the x position of the helicopter is greater than 205 and is over when it touches the edges of the cave. The sprite switches between costumes when the Game is over.
4. Combine the scripts to execute.


```

if touching color [ ] ? then
  switch costume to Crash
  say Game Over for 2 secs
  stop this script

if x position of Helicopter > 205 then
  say Game Won for 2 secs
  stop this script

```

Figure 9.41: Script to provide feedback and switch between costumes

```

when clicked
  switch costume to helicopter
  go to x: -160 y: 20
  forever
    change x by 1
    change y by -1
    if touching color [ ] ? then
      switch costume to Crash
      say Game Over for 2 secs
      stop this script
    if x position of Helicopter > 205 then
      say Game Won for 2 secs
      stop this script
  when space key pressed
    change y by 5

```

Figure 9.42: Script to create Helicopter game

Note: Helicopters can also be downloaded from the Internet then uploaded from file or can be painted. The teacher to guide learners on how to download or paint a helicopter.

Additional Information on the Helicopter Game

Game Name Table

Game Name	Helicopter game
How to play	The helicopter must not touch the edges of the cave. Space key is used to control helicopter movement.
How to win	The game is won when the x position of the helicopter is greater than 205.

Sprites Table: There is only one sprite for this game, that is, the Helicopter.




Name	Costumes/Looks	Sounds	Movements
Helicopter	Helicopter	Helicopter passing	Fly
	Crash	Helicopter crashed	Crash

Sprite Interaction Table

The Helicopter interacts with the backgrounds, that is, **black background** used as route for the helicopter and **grey background** used as edges of the cave. When the helicopter is passing and does not touch the edges of the cave, the background is backdrop1 but switches to backdrop2 when it crashes.

Sprite	Background	Interaction
Helicopter	Black and Grey (backdrop1)	The helicopter will keep flying as long as it is on its route and will crash whenever it touches the edge of the cave.
	Backdrop2	The helicopter flies successfully to the end.
	Backdrop3	The background will switch from backdrop1 to backdrop2 when the helicopter crashes.

Backgrounds Table

Name	Description
 Level 1_1	Helicopter flying, not touching edges.
 Level 1_2	Game won when the x position of the helicopter is greater than 205.
 Level 2_1	Helicopter crashed

Level Management Table

Level	Requirement for this level	Starting Background	Ending Background
1	When the game starts and the helicopter's position is greater than 205	Level 1_1	Level 1_2
2	When the helicopter touches the edges of the cave.	Level 1_1	Level 2_1

```

when clicked
  switch backdrop to backdrop1
  switch costume to helicopter
  play sound helicopter passing
  go to x: -160 y: 20
  forever
    change x by 1
    change y by -1
    if touching color ? then
      switch costume to Crash
      switch backdrop to backdrop3
      stop all sounds
      say Game Over for 2 secs
      play sound helicopter crashed
      stop this script
    if x position of Helicopter = 205 then
      say Game Won for 2 secs
      switch backdrop to backdrop2
      stop this script
  
```

Figure 9.43: Script to create Helicopter game



Figure 9.44: Stage area showing the x position of the helicopter greater than 205

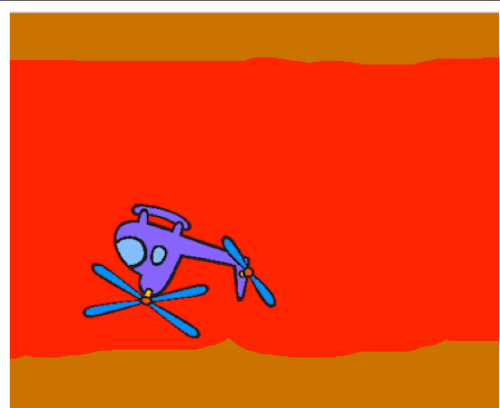


Figure 9.45: Stage area showing crashed helicopter