THE REPUBLIC OF UGANDA

Ministry of Education and Sports

Lower Secondary Curriculum

TECHNOLOGY AND DESIGN SYLLABUS

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

CONTENTS

INTRODUCTION

The UNESCO Education Strategy (2014 – 2021) advocates for a humanistic and holistic vision of education as a fundamental human right that is essential to personal and socio-economic development. UNESCO further recommends, societies that are just, inclusive, peaceful and sustainable by 2030. The Uganda Vision 2040 aims to transform Uganda into a modern and prosperous country, while the NDP recognises the existing weaknesses in education, including the low efficiency and variable quality at the secondary level. The Sustainable Development Goal 4 advocates for inclusive and quality education, while the National Development Plan II focuses on enhancement of human capital, development, strengthening mechanisms for quality, effective efficient service delivery and improvement of quality and relevance of skills development. The NRM Manifesto (2016-2021), emphasises continuous assessment examination systems , strengthening soft skills, which promote self-esteem, conscientiousness and a generally positive attitude to work, promoting e-learning and computer literacy in order to enhance learning outcomes. All these are lacking and where they exist it is at a minimum level.

In alignment with the above, the Education and Sports Sector Strategic plan (2017/20) advocates for delivery of equitable, relevant and quality education for all. The current secondary school curriculum of Uganda, although highly regarded by some, is focused on the needs of a tiny academically oriented elite yet the needs of the majority of learners need to be the focus. The Ministry of Education and Sports (MoES) through the National Curriculum Development Centre (NCDC) therefore, undertook a review of the Lower Secondary Curriculum, aimed at providing a learning environment, opportunities, interactions, tasks and instructions that foster deep learning by putting the learner at the centre of the learning experience. This is in line with aims of secondary education in Uganda as outlined opposite.

The aims of secondary education in Uganda are to:

- Instill and promote national unity, an understanding of the social and civic responsibilities, strong love and care for others and respect for public property, as well as an appreciation of international relations and beneficial international co-operation;
- Promote an appreciation and understanding of the cultural heritage of Uganda including its languages;
- Impart and promote a sense of self discipline, ethical and spiritual values, personal and collective responsibility and initiative;

- Enable individuals to acquire and develop knowledge and an understanding of emerging needs of society and the economy;
- Provide up-date and comprehensive knowledge in theoretical and practical aspects of innovative production, modern management methods in the field of commerce and industry and their application in the context of socio-economic development of Uganda;
- Enable individuals to develop basic scientific, technological, technical, agricultural and commercial skills required for self-employment;
- Enable individuals to develop personal skills of problem solving, information gathering and interpretation, independent reading and writing, self improvement through learning and development of social, physical and leadership skills such as are obtained through games, sports, societies and clubs;
- Lay the foundation for further education;
- Enable the individual to apply acquired skills in solving problems of community, and to develop a strong sense of constructive and beneficial belonging to that community;
- Instill positive attitudes towards productive work and strong respect for the dignity of labour and those who engage in productive labour activities;
- Develop a positive attitude towards learning as a lifelong process.

BACKGROUND TO THE NEW CURRICULUM

The reform was based on the Education Sector Strategic Plan (ESSP), 2009 – 2018) which set out strategies to improve the quality and relevance of secondary education. The ESSP's sub-objective 2.2 was to ensure that "Post-primary students [are] prepared to enter the workforce and higher education". This is also in line with the current strategic plan of 2017-2020. To achieve this objective, one of the Ministry's strategies was to revise the curriculum and improve instruction and assessment by eliminating the short comings in the current curriculum.

The review focused on: producing a secondary school graduate who has the competences that are required in the 21st century; promoting values and attitudes; effective learning and acquisition of skills in order to reduce unemployment among school graduates.

The reform also aimed at reducing the content overload and contact hours in the classroom so as to create time for: research and project work; talent development and creativity; allowing for emerging fields of knowledge across all subjects and doing away with obsolete information. There was a need to address the social and economic needs of the country like the mining sector, tourism, services provision, science and technology development and to ensure rigorous career guidance programme to expose learners to the related subjects. This will enable learners to make informed choices as they transit and to equip them with knowledge and skills that will enhance their competitiveness in the global value chain.

To meet these requirements, the reforms are based on:

- The development of a holistic education for personal and national development based on clear shared values
- A commitment to higher standards, deeper understanding and greater opportunities for learners to succeed
- A focus on the key skills that are essential to work, to learning, and to life, and which will promote life-long learning
- An integrated and inclusive approach that will develop the ability to apply learning in practical situations.

The ESSP further outlines what the reforms imply:

"This reform will necessitate a sweeping revision of the general secondary curriculum, away from strictly academic learning objectives that are thought to prepare students for erudite higher education and towards a set of competencies that serve both those who continue their education after S4 and those who choose to enter the workforce. The new curriculum will enable learners to acquire specific vocational skills that they can use once they enter the world of work. The new curriculum will help learners make informed decisions as citizens and family members, and it will give those who continue with their education, either immediately in S5 or later in life, the learning skills they need to think critically and study efficiently."

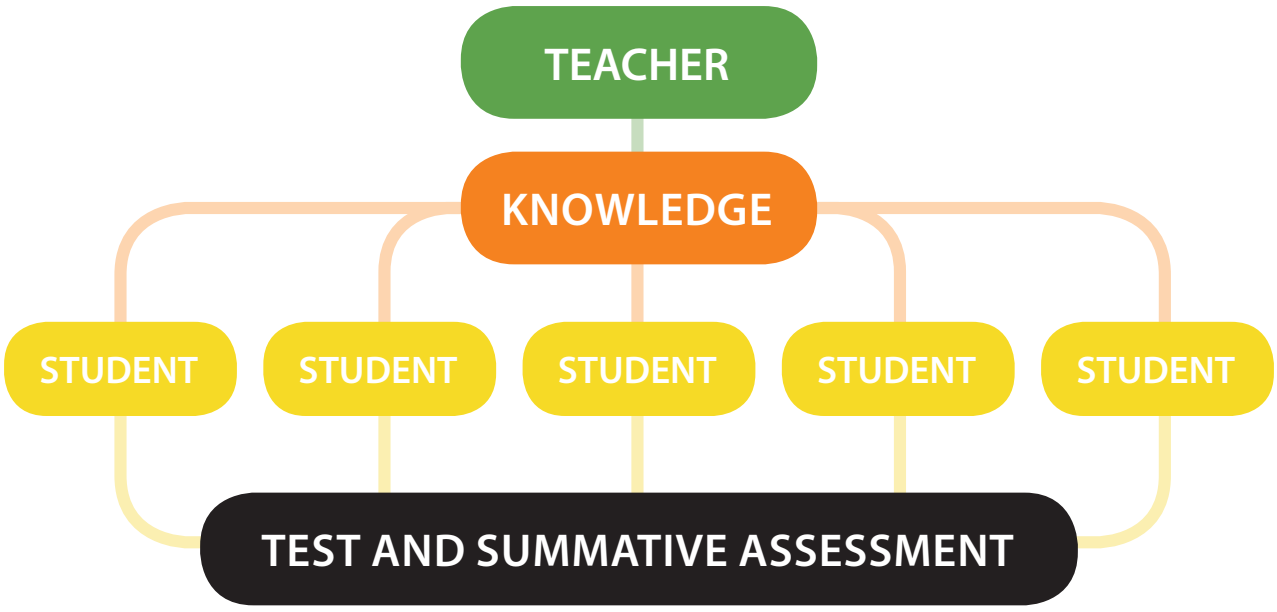
KEY CHANGES

The key change in the new curriculum is a move from a knowledge-based curriculum to a competence and skill-based curriculum. It is no longer sufficient to accumulate large amounts of knowledge. Young people need to develop the ability to apply their learning with confidence in a range of situations. They need to be able to use knowledge creatively. A level of competence is the ability to use knowledge rather than just to acquire it. This requires an active, learner-centred rather than passive, teacher-centred approach.

This approach to teaching and learning is in support of the Sustainable Development Goals (SDG's), otherwise known as the Global Goals. These are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. The key changes in the curriculum will ensure that Uganda is making good progress towards SDG 4 in particular which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

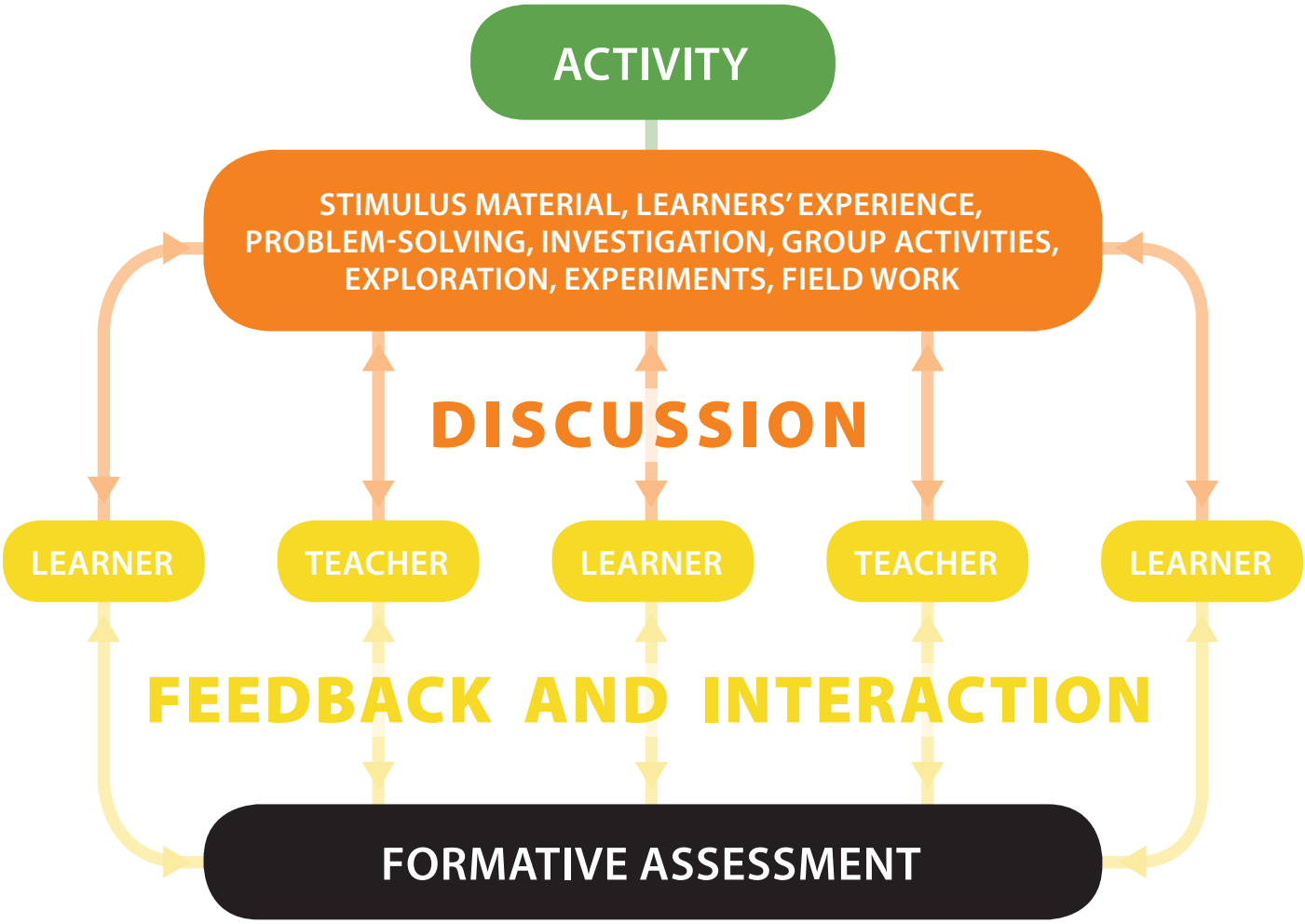
The change can be summarised in the following diagrams.

PREVIOUS KNOWLEDGE-BASED CURRICULUM



Knowledge-based teaching was based on transferring knowledge from the teacher to the students. The teacher had knowledge and transferred this knowledge to the students by lecturing, talking, asking them to read the text book or writing notes on the board for the students to copy and learn. Students acquired the knowledge, often without fully understanding it, and were tested at the end of a unit, term or school course to see if they had remembered it. The knowledge was based mainly on the knowledge in the subjects traditionally taught at University, and little attempt was made to make it relevant to young people's own lives. The whole education system was seen by many people as a preparation for University, but the vast majority of learners never reach university. The new curriculum will cater for this majority as well as those who later go on to University.

NEW COMPETENCE BASED CURRICULUM



In the new competence-based approach, the "student" becomes a "learner". The new Learning Outcomes can only be achieved through active engagement in the learning process rather than simply absorbing knowledge given by the teacher.

The teacher needs to build on the learners' own knowledge and experience and create Learning Activities through which learners can explore the meaning of what is being learned and understand how it is applied in practical situations.

Teaching and learning becomes a two way process of dialogue between the Teacher and Learners. Learners also learn from each other through discussion. Assessment also becomes a two way process of formative assessment; not just to give grades but to find out problems the learners may be having and help to solve them.

THE NEW CURRICULUM

The new curriculum focuses on four "Key Learning Outcomes" of: self – assured individuals; responsible and patriotic citizens; lifelong learners; positive contributors to society. The curriculum emphasises knowledge, application and behavioural change. It is based on a clear set of values which must be imparted to learners during the learning process.

At the heart of every subject there are generic skills that allow development into life-long learners. Besides, there are also cross cutting challenges that are embedded across subjects to enable learners understand the connections between the subjects and complexities of life.

Key Learning Outcomes

The new curriculum sets out 'Key Learning Outcomes' that sum up the expectations of the curriculum as a whole, and set out clearly the qualities that young people will develop.

By the end of the educational process, young people will become:

Self-assured individuals who:

- Demonstrate self- motivation, self-management and self-esteem
- Know their own preferences, strengths and limitations
- Adjust their behaviour and language appropriately to different social situations
- Relate well to a range of personality types

Responsible and patriotic citizens who:

- Cherish the values promoted in the curriculum
- Promote the development of indigenous cultures and languages and appreciate diversity, equity and inclusiveness
- Apply environmental and health awareness when making decisions for themselves and their community
- Are positive in their own identity as individuals and global citizens
- Are motivated to contribute to the well-being of themselves, their community and the nation

Lifelong learners who:

- Can plan, reflect and direct their own learning
- Actively seek lifelong learning opportunities for personal and professional development

Positive contributors to society who:

- Have acquired and can apply the Generic Skills
- Demonstrate knowledge and understanding of the emerging needs of society and the economy
- Understand how to design, make and critically evaluate products and processes to address needs
- Appreciate the physical, biological and technological world and make informed decisions about sustainable development and its impact on people and the environment.

Values

The new curriculum is based on a clear set of values. These values underpin the whole curriculum and the work of schools. They are also the values on which learners need to base their lives as citizens of Uganda.

- Peace and harmony
- Integrity and honesty
- Patriotism
- Positive attitude towards work
- Respect for human rights
- Self-Control

These values are not taught directly in lessons, nor will they be assessed, but they will inform and shape all teaching and learning.

Generic Skills

The generic skills lie at the heart of every Subject. They are the skills that enable the learner to access and deepen learning across the whole curriculum. They are the same skills that are sought by employers and which will unlock the world of work. They are the skills that allow young people to develop into lifelong learners who can adapt to change and cope with the challenges of life in the 21st Century.

Young people need to be able to think critically and solve problems, both at school and at work. They need to be creative and innovative in their approach to learning and life. They need to be able to communicate well in all forms, co-operate with others and also work independently. They need to be able to use functional mathematics and ICT effectively.

Critical thinking and problem-solving

- Plan and carry out investigations
- Sort and analyse information
- Identify problems and ways forward
- Predict outcomes and make reasoned decisions
- Evaluate different solutions

Creativity and innovation

- Use imaginations to explore possibilities
- Work with others to generate ideas
- Suggest and develop new solutions
- Try out innovative alternatives
- Look for patterns and make generalisations

Communication

- Listen attentively and with comprehension
- Talk confidently and explain things clearly
- Read accurately and fluently
- Write and present coherently
- Use a range of media to communicate idea

Co-operation and Learning

- Work effectively in diverse teams
- Interact effectively with others
- Take responsibility for own learning
- Work independently with persistence
- Manage goals and time

Calculation and ICT

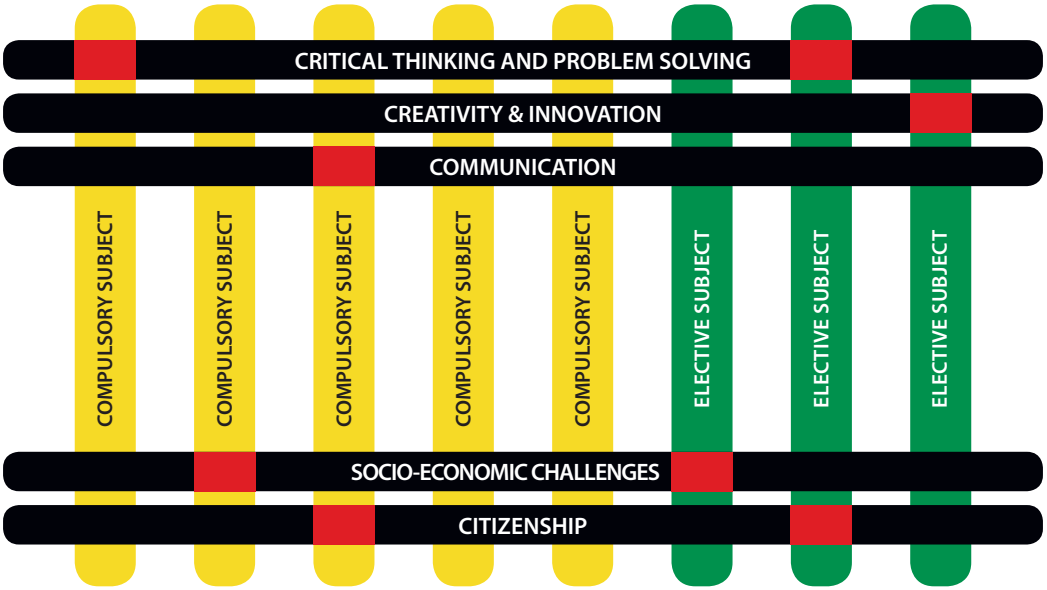
- Use numbers and measurements accurately
- Interpret and interrogate mathematical data
- Use mathematics to justify and support decisions
- Use technology to create, manipulate and process information
- Use technology to collaborate, communicate and refine their work

GENERIC SKILLS WITHIN TECHNOLOGY AND DESIGN

These skills are not separate subjects in themselves; they are developed within the subjects of the curriculum. They also help learning within those subjects. It is when these generic skills are deployed that learning is most effective.

The generic skills are a key part of the new curriculum. They have been built into the syllabuses for each of the Subjects, and these Subjects provide the context for the skill development. Technology and Design provides a rich context for learners to communicate, co-operate, and to think critically, calculate and solve problems.

The Subjects also provide the contexts for progression within the skills. The same skill definitions apply to all year groups, and skills progression is provided by the increasing complexity of the subject matter within each Subject. For example, within 'critical thinking', learners begin thinking critically about the relatively simple subject matter in Senior 1 and then progress to thinking about the much more complex matters in Senior 4. Thus the progression is in the increasing complexity of the matters being thought about.



Cross-cutting Challenges

There are some issues that young people need to learn about, but which are not confined to one Subject. These are the 'Cross-cutting Challenges' and they need to be studied across the Subjects. These issues develop learners' understanding of the connections between the Subjects, and so of the complexities of life.

The Cross-cutting Challenges identified in the curriculum are:

- Environmental awareness
- Health awareness
- Diversity and inclusion
- Socio-economic challenges
- Citizenship

These have been built into the syllabuses of each Subject. The way in which they operate within the Subject is very similar to the generic skills. Technology and Design provides a very good method of investigating impact on the environment and socio-economic challenges. The impact of technology on health and citizenship are also important considerations.

TECHNOLOGY AND DESIGN WITHIN THE NEW CURRICULUM

Technology and Design is a compulsory subject in Senior 1 and 2, and an elective subject in Senior 3 and 4.

Time allocation

TECHNOLOGY AND DESIGN	SENIOR 1 & 2	SENIOR 3 & 4
	2 periods a week	4 periods a week

Rationale

In an increasingly technological and complex world, it is important learners develop knowledge and confidence to critically analyse and respond creatively to design challenges. Technologies can play a crucial role in both enriching and transforming societies and in the management of natural and constructed environments.

In the design and technologies curriculum, learners create quality-designed solutions across a range of technological contexts. Learners consider the economic, environmental and social impacts of technological change, and how the choice and use of technologies may contribute to a sustainable future. Learners also take into account the ethical, legal, aesthetic and functional factors that inform the design processes. Through design and technologies, learners plan and manage projects from conception to realisation. They apply design and systems thinking and design process to investigate ideas, generate and refine them, plan and manage, produce and evaluate designed solutions. They develop a sense of pride, satisfaction and enjoyment from their ability to create innovatively designed solutions.

Through the practical application of technologies, learners develop dexterity and coordination. The curriculum offers learners a broad range of learning experiences readily transferable to their home, life, leisure activities, the wider community, and to work.

Teaching and Learning: Technology and Design

The thrust of the new syllabuses is experiential and towards deeper understanding and the development of skills. The focus in Technology and Design is on the development of the ability to use technology to explore the world around them and to communicate in the wide range of ways that the technology makes available. It is a practical subject where learners need to use the technology, not just be told about it.

The new syllabuses provide learners with a wide range of contexts in which to develop this understanding, and these contexts are designed to engage the interest of the learner and to provide opportunities to build life-related knowledge, experience and skills. Teachers are encouraged to go beyond the textbooks and provide as many meaningful contexts as possible. The generic skills have been integrated throughout the curriculum and can only be acquired through active approaches.

The role of the teacher is to build on learners' existing knowledge and experience, but to extend that by posing problems to the learners. This makes them think about their own ideas and experiences as well as adding new knowledge and skills to it.

Learners need to interact with real situations inside and outside the classroom. They need to look at pictures or diagrams, examine statistics, or read texts from a range of sources. They need to find out knowledge and ideas for themselves. They should then be expected to express these in their own words, not those of the teacher, and so demonstrate that they have understood what they have learnt.

In this approach, learners are encouraged to:

- Be responsible for their own learning
- Think for themselves and form their own ideas and opinions
- Become critical thinkers, ready to face new challenges and situations for themselves

THE TECHNOLOGY AND DESIGN SYLLABUS

Programme Planners

SENIOR 1	THEME	TOPIC	DURATION (NUMBER OF PERIODS)
Term 1	Design Application	1: Introduction to design	10
		2: The design process	10
	Design and Drawing	3: Introduction to drawing	4
Term 2	Design and drawing	4: Basic shapes	10
		5: Tangents to circles	10
	Technology in the making	6: Health, safety, security and environment	4
Term 3	Technology in the Making	7: Tools	8
		8: Materials	8
		9: Making Processes	8
		Total	**72**

SENIOR 2	THEME	TOPIC	DURATION (NUMBER OF PERIODS)
Term 1	Design and Drawing	10: Enlargement and reproduction	8
		11: Transformation	8
		12: Pictorial drawing	8
Term 2	Design and drawing	13: Orthographic projections	12
	Technology in the making	14: Mechanical systems	12
Term 3	Technology in the Making	15: Tools	12
		16: Engineering materials	12
		Total	**72**

SENIOR 3	THEME	TOPIC	DURATION (NUMBER OF PERIODS)
Term 1	Design and Drawing	17: Loci	24
		18: Plain and diagonal scales	24
Term 2	Design and Drawing	19: Further orthographic projections	12
		20: Building drawing	12
		21: Mechanical drawing	12
	Technology in the Making	22: Material preservation and protection	12
Term 3	Technology in the Making	23: Making processes	12
		24: Materials Joining	12
		25: Renewable Energy	12
		26: Maintenance of simple machines	12
		Total	**144**

SENIOR 4	THEME	TOPIC	DURATION (NUMBER OF PERIODS)
Term 1	Design and Drawing	27: Sectioning	24
		28: Surface development of solids	24
Term 2	Technology in the making	29: Electricity and electronics	16
		30: Construction practice	16
		31: Electronics	16
Term 3	Technology in the making	32: Maintenance and repair of simple machines	40
		Total	**136**

The syllabus details for all subjects are set out in three columns:

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT ACTIVITIES
The knowledge, understanding or skills expected top be learned by the end of the topic	The sort of learning activities that include the generic skills and that will help learners achieve the Learning Outcomes.	Opportunities for assessment within the learning

Teachers should base their lesson plans on the Learning Outcomes using the Suggested Learning Activities as a guide. These are not the only possible learning activities, and teachers are encouraged to extend these and devise their own that are appropriate to the needs of their class.

DETAILED SYLLABUS FOR TECHNOLOGY AND DESIGN

SENIOR 1: TERM 1

Theme: Design application

TOPIC 1: INTRODUCTION TO DESIGN

10 PERIODS

Competency: After learning this topic, the learner should be able to demonstrate an understanding of basic design concepts and how they apply in daily life.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a) develop appreciation of function in the design world (k) b) use basic elements and principles of design (k, u) c) demonstrate awareness of environmental considerations related to sustainable material use, production methods and after-use disposal (k, u, s)	• In groups, or collaboratively as a class, learners discuss the design aspect of the immediate environment. In pairs, create a chart relating design features noted to their functions. • In groups, learners discuss and appreciate the role of design elements (lines, shapes, colour, and texture) in relation to design needs. Identify and describe the materials (wood, metal, plastics, and clay), their sources and the reasons for their use. Share conclusions with the class. • In pairs, learners research the meaning of the elements and principles of design and produce a visual aid explaining the importance of each. The visual aid produced should demonstrate that learners have taken good account of both elements and principles in their work. • As a class, learners discuss sustainability of materials, and the societal and cultural influences on design, including a focus on environmentally safe practices of design and after-use disposal. Individuals complete reports on key points.	• Listen as the class, groups and pairs discuss the activities, and ask probing questions to promote critical thinking and avoid misconceptions. • Observe as learners interact in groups and pairs, intervening to ensure all participate and make progress in terms of knowledge, understanding and skills. • Evaluate learning through assessment of products: charts, feedback to the class, visual aids, reports.

SENIOR 1: TERM 1

Theme: Design application

TOPIC 2: THE DESIGN PROCESS

10 PERIODS

Competency: After learning this topic, the learner should be able to demonstrate an understanding of the community's needs regarding design and the correct use of tools and materials while designing.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. understand the community's needs regarding the design of a particular resource/facility (e.g. bus shelter, library, water station, market, recycling centre). (k, u)
b. Make appropriate design decisions (k, u, s)
c. use exploration/experimentation, reflection and revision when producing a variety of models or mock-ups (k, u, s)
	• In pairs or groups, learners define and report on a need by gathering relevant information/conducting research regarding the design needs in relation to a resource/facility for the community.
	• In pairs, learners consider the needs of the community and factors that affect design, and then write a design brief/specification for their chosen community resource facility.
	• In groups, learners:
	  • generate a variety of ideas based on design briefs
	  • use notes, thumbnail freehand sketches and scaled drawings to communicate design ideas
	  • reflect on the suitability of ideas by considering the design factors
	  • revise their plans on the basis of peer assessment
	  • feed back to the class on the process and lessons learned
	• In pairs, learners investigate, select and report on the materials to use in making a model of their design. (Reports should focus on the suitability of materials for the model and the materials that would be suitable for the real thing).
	• In pairs, learners make and evaluate models or mock-ups and produce a report evaluating their models against design specifications.
	• In pairs, learners identify and report on ways they could improve their models.
	• In pairs, learners use models or mock-ups to test ideas.
		• Listen to learners as they carry out activities, prompting as necessary to ensure all make progress towards achievement of learning outcomes.
		• Observing learners involved in pair and group work, offering advice and guidance to avoid misconceptions and to ensure all gain necessary design skills.
		• Evaluate learning through quality of products: reports on community need; design briefs/specifications; the design briefs; feedback to class; reports on materials; models/mock ups and reports on them.

SENIOR 1: TERM 1

Theme: Design and drawing

TOPIC 3: INTRODUCTION TO DRAWING

4 PERIODS

Competency: After learning this topic, the learner will have an understanding of basic items of engineering design equipment and skills in using them.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. use basic drawing equipment and properly lay out drawing paper (k, s) b. Use lines to construct primary and secondary angles (k, s)	• In groups, learners brainstorm and research engineering drawing equipment and techniques for its use. • Individually, learners observe good practice in laying out drawing paper and drawing different lines, and then practise to develop their own skills. • In groups, learners discuss the different types of angles e.g. primary and secondary, acute, obtuse, reflex, complementary and supplementary angles and individuals practise drawing them.	• Observe learners' use of equipment while laying out the paper, drawing lines and angles. Intervene to ensure all individuals understand and develop their skills. • Listen to learners' discussions, asking questions to ensure learning outcomes are achieved. • Evaluate the quality of learning through the precision displayed in the lines drawn and angles constructed.

SENIOR 1: TERM 2

Theme: Design and drawing

TOPIC 4: BASIC SHAPES

10 PERIODS

Competency: After learning this topic, the learner should be able to demonstrate an understanding of the shapes used in design.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. appreciate common shapes and their features as used in design (k, u) construct different shapes used in design (k, s) b. make models/mock-ups of shapes used in design (k, s, u)	• In groups, learners brainstorm and research the common shapes used in design and their features. • In pairs, learners practise drawing the shapes used in design e.g. triangles, circles, quadrilaterals, polygons etc. • In groups or individually, learners make models of shapes using available materials.	• Observe learners as they construct the shapes used in design. • Listen to learners communicating and discussing the common shapes used in design with their peers. • Critique the precision exhibited in the drawings and models/mock-ups made.

SENIOR 1: TERM 2 — Theme: Design and drawing

TOPIC 5: TANGENTS TO CIRCLES — 10 PERIODS

Competency: After learning this topic, the learner should be able to identify, construct and apply tangents in design and drawing.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. identify tangents used in design (k) b. construct different tangents (k, s) c. make models / mock-ups to show how tangents are applied in design in day-to-day life (k, s, u)	• In groups, learners brainstorm/research tangents used in design. • Individually, learners practise the construction of tangents used in design, e.g. common external and internal tangents. • In pairs, learners make models showing the application of tangents in design e.g. pulleys, conveyors	• Observe learners as they construct the tangents used in design and make models. • Listen as learners discuss and explain tangents in design and their applications to their groups. • Assess products: drawings of tangents and models/mock-ups of applications.

SENIOR 1: TERM 2 — Theme 3: Technology in the making

TOPIC 6: HEALTH, SAFETY, SECURITY AND ENVIRONMENT — 4 PERIODS

Competency: After learning this topic, the learner should be able to understand and apply health and safety rules while making a product in a workplace and show responsibility in terms of respect for the environment.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. demonstrate an understanding of health and safety practices associated with the use of materials, tools, and machines in design (k, u, s) b. demonstrate an understanding of how to give first aid in relation to accidents affecting different parts of the body (k, u, s) c. demonstrate an understanding of how the production of design works can affect the environment and apply environmentally responsible practices (k, u, s)	• Individually or in groups, learners practise the correct use of tools and machines in the making of a design (e.g. a tool rack). • In pairs, learners sketch a human figure, annotating it to show areas that need protection while working. • In pairs, learners name the gadgets and tools required in a workshop and the risks associated with each, detailing their conclusions in a report. Learners practise the proper use of protective wear when using the gadgets/tools. • In pairs, learners research and participate in a demonstration of how first aid is applied when an accident occurs. • In pairs, learners produce a chart describing the proper, safe use of materials in the environment and apply safety rules/ regulations while working. • In all activities, learners demonstrate disposal of used materials in environmentally responsible ways (e.g. re-use or recycling of materials where possible).	• Observe learners engaged in activities, intervening to ensure safe and responsible practice: wearing protective gear while working, proper handling of machines and tools to avoid accidents, maintenance of a safe working environment, responsible disposal of materials. • Listen to discussions and ask questions to ensure all understand and achieve learning outcomes. • Evaluate learning through the quality of products: annotated diagrams; reports; first-aid demonstrations; charts.

SENIOR 1: TERM 3 — Theme: Technology in the making

TOPIC 7: TOOLS — 8 PERIODS

Competency: After learning this topic, the learner should be able to accurately use and maintain common marking-out and measuring design tools.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. demonstrate proper use and maintenance of tools used for marking out. (k, u)
b. Demonstrate accuracy while using measuring tools. (k, s)
	• Individually or in pairs, learners investigate, identify and practise the proper, accurate use of marking-out tools (e.g. scriber tools for metals, marking gauge for woodwork, and permanent pens for plastics), presenting examples to the teacher for assessment.
	• In pairs, learners practise and report on how to maintain:
	  • measuring tools *(e.g. care of rules, tape measures, calipers)*
	  • marking out tools *(e.g. sharpening, tightening screws, prevention of drying out of pens).*
		• Observe learners carrying out activities and evaluate the ability of learners to apply the marking-out tools correctly in design activity, offering guidance to improve skills and understanding.
		• Listen as learners discuss the appropriate use of tools to mark out the design, ask probing questions to steer learners towards learning outcomes.
		• Evaluate the quality of marking out on wood, metal and plastic; reports on care of equipment.

SENIOR 1: TERM 3 — Theme: Technology in the making

TOPIC 8: MATERIALS — 8 PERIODS

Competency: After learning this topic, the learner should have an understanding of the nature of materials and be able to use the design materials correctly.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a) understand the nature and properties of common materials used in design (k, u) b) use and manipulate common design materials in design work (k, s, u)	• Individually or in groups, learners research the properties of different materials to be used in design (e.g. wood, clay, metal, and plastics) and produce a chart showing why each is used in particular ways. • In pairs, learners practise using the selected materials to make models while exploring its working properties (e.g. steel is tough, wood can be hard or soft, clay is brittle, and plastic is affected by heat) and tabulate the findings.	• Observe learners selecting materials to suit a given project and the techniques they use while undertaking the task, offering guidance to help them improve. • Listen as learners discuss and present their explanations and justifications of the use of materials on their project, asking questions to promote critical thinking and deepen learning. • Evaluate products; charts, tables and models.

SENIOR 1: TERM 3

Theme: Technology in the making

TOPIC 9: MAKING PROCESSES

8 PERIODS

Competency: After learning this topic, the learner should be able to apply the design processes when making a product.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a) demonstrate the correct use of tools and simple machines (k, u, s)
b) use and follow the procedure for making a product from a specific design (k, u, s)
	• In pairs, learners measure and mark out objects of various shapes and sizes.
	• In pairs, learners follow a design and, as appropriate:
	  • cut out the intended shape using a suitable cutting tool
	  • bend or fold to make the required shape using suitable tools
	  • join and assemble the product using the appropriate method
		• Observe learners marking out, measuring and making designs, offering advice to ensure they do so accurately and correctly.
		• Listen as learners discuss and ask questions to steer them in improving accuracy, selecting the correct tools, cutting out and making designs.
		• Evaluate the quality of practice in relation to each step in the process and the finished article.

SENIOR 2: TERM 1

Theme: Design and drawing

TOPIC 10: ENLARGEMENT AND REDUCTION

8 PERIODS

Competency: After learning this topic, the learner should understand the concept of scale and be able to plot and make objects of the same shape in varying sizes.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. demonstrate an understanding of scaling with respect to shapes, size and space (k, u) b. construct varying (scaling) sizes of the same shapes to ratio of area or sides (k, u, s)	• Individually or in pairs, learners draw representations of a given shape to illustrate the concepts of enlargement and reduction • In pairs, learners make models of shapes to represent enlargement and reduction	• Observe as learners draw enlargements and reductions of shapes and make models, intervening to help learners develop skills. • Listen as learners discuss and develop their techniques, asking questions to deepen learning. • Evaluate learning through quality of finished drawings and models.

SENIOR 2: TERM 1 — Theme: Design and drawing

TOPIC 11: TRANSFORMATION — 8 PERIODS

Competency: After learning this topic, the learner should be able to represent objects in three dimensions (3D).

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. construct varying shapes of the same area (k, u, s)	• In pairs, learners practise drawing a polygon and then transform it into a triangle, rectangle or square that has the same area as the original polygon. • In pairs, learners use any locally available materials to make cut-outs of varying shapes of the same area and produce a report, including calculations that show the (same) area of the shapes. • In groups, learners discuss the significance of transformation to daily life activities (e.g. shape of land/plots).	• Observe as learners draw and transform shapes, make shapes and offer guidance to improve skills and learning. • Listen to learners' discussions and ask questions to deepen and reinforce learning. • Evaluate quality of drawings and cutouts of shapes of the same area.

SENIOR 2: TERM 1 — Theme: Design and drawing

TOPIC 12: PICTORIAL DRAWING — 8 PERIODS

Competency: After learning this topic, the learner should be able to interpret and transform three-dimensional (3D) objects into two-dimensional (2D) views. (Orthographic Projection).

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. use geometric principles to construct three-dimensional blocks (k, u, s) b. appreciate the value of three – dimensional (3D) drawings in daily applications (k, u)	• In groups, learners research and explain and report on the principles used in pictorial drawing. • In pairs, learners apply the principles to draw full blocks, cut blocks and circular/ curved blocks in both isometric and oblique projection. • Individually or in small groups, learners make models of three-dimensional objects, using locally available materials. • In pairs, learners make sketches of simple objects (e.g. houses, boxes) to demonstrate the application of three-dimensionality.	• Observe as learners make isometric/ oblique drawings, models and sketches, offering guidance to ensure that learning outcomes are achieved. • Listen as learners discuss the principles used in pictorial drawing and as they apply them in practice, asking questions to deepen learning. • Evaluate and inspect drawings, models and sketches made by the learners.

SENIOR 2: TERM 2 — Theme: Design and drawing

TOPICV 13: ORTHOGRAPHIC PROJECTIONS — 12 PERIODS

Competency: After learning this topic, the learner should be able to interpret and transform three-dimensional (3D) objects into two-dimensional (2D) views. (Orthographic Projection).

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a) use standard principles to make orthographic drawings of solid objects (k, u, s)
b) understand the three–dimensional drawing in daily applications (k, u)
	• In groups, learners research, discuss and explain/report on the principles used in orthographic projection
	• In pairs, learners apply the principles to project and draw different views of objects, including:
	  • front view
	  • plan view
	  • end view
	• In pairs, learners use orthographic symbols to interpret orthographic drawings.
		• Observe learners as they use the principles to project and draw the three views and interpret orthographic drawings, intervening to assist in skills development.
		• Listen to groups and pairs, asking probing questions to promote critical thinking and deepen learning.
		• Evaluate learners' progress from the quality of their reports, drawings and interpretations.

SENIOR 2: TERM 2 — Theme: Technology in the making

TOPIC 14: MECHANICAL SYSTEMS — 12 PERIODS

Competency: After learning this topic, the learner should be able to identify and model components/systems of simple machines.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. identify the different components of simple machines (k, u, s) b. illustrate the different components of simple machines and describe their applications (k, u, s) c. model components of simple machines (k, u, s)	• As a class, learners brainstorm, research and report on the definition of a simple machine. • In groups, learners identify the different components of simple machines such as levers, pulleys, fasteners, gears, bicycles, producing a report listing the components of each machine. • In pairs, learners draw the different components of the simple machines, annotating drawings to explain the function of each component. • In pairs, learners make models of simple machines, measuring, marking and cutting the different components before joining the components to complete a working model.	• Observe learners as they carry out the activities, intervening to ensure all are engaged and making progress towards achievement of learning outcomes. • Listen to class, group and pair discussions, asking questions to encourage learners to think deeply and develop their skills. • Evaluate learners' progress from the quality of their reports, component lists, drawings and models.

SENIOR 2: TERM 3

Theme: Technology in the making

TOPIC 15: TOOLS

12 PERIODS

Competency: After learning this topic, the learner should be able to identify and use the different cutting, shaping and holding (clamping) tools and devices.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a) apply different cutting tools appropriately (k, s) b) use the holding (clamping) tools and devices to correctly secure materials (k, u, s) c) correctly use shaping tools (k, s, u)	• In groups, learners discuss, research and identify the different cutting tools and their features and applications. • Individuals produce an illustrated report on the applications of the different cutting tools. • In groups, learners select and use cutting tools appropriately in practical situations. • In groups, learners discuss, research and identify the different holding tools/devices and their features and applications. • Individuals produce an illustrated report on the applications of the different holding tools/devices. • In groups, learners select and use holding tools/devices appropriately in practical situations. • In groups, learners discuss, research and brainstorm the different classifications and types of shaping tools. (shaping by: cutting, forming, molding and casting.) • In pairs, learners discuss and illustrate the features and applications of the different shaping tools and practise shaping of various materials, using the different tools. • In pairs, learners research and report on safe and proper maintenance of cutting tools, holding tools/devices and shaping tools.	• Observe as learners perform the activities, intervening to help learners develop skills and safe practice. • Listen as learners discuss and develop their techniques, asking questions to deepen learning and to steer them towards desired outcomes. • Evaluate learning through quality of products: reports on tools and their uses; practical products.

SENIOR 2: TERM 3 — Theme: Technology in the making

TOPIC 16: ENGINEERING MATERIALS — 12 PERIODS

Competency: After learning this topic, the learner should be able to correctly select and appropriately use engineering materials.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. classify engineering materials correctly and identify their properties (k, u) b. use engineering materials appropriately (k, u, s)	• In groups, learners brainstorm and research the meaning of engineering materials. • In pairs, learners produce a report classifying engineering materials and describing their properties. • Working in pairs, learners investigate and collect samples of engineering materials from the local area and classify them, reporting verbally or in writing on their conclusions. • In groups, learners sort materials according to their possible engineering applications, e.g. library book racks, dining benches, cooking stove, food/drink containers, electrical insulators, water pipes, cables, etc, presenting their conclusions to the class.	• Observe as learners engage in activities, intervening to help learners develop their knowledge, understanding and skills. • Listen as learners discuss their ideas and ask probing questions to promote critical thinking and deepen learning. • Evaluate learning through quality of products: reports on materials/properties; material classifications; material sorting exercise.

SENIOR 3: TERM 1 — Theme: Design and drawing

TOPIC 17: LOCI — 24 PERIODS

Competency: After learning this topic, the learner should be able to identify, construct and apply different loci in the design of curved products.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. understand the concept and applications of loci (k, u) b. construct various curved loci: ellipse, parabola, hyperbola, simple mechanisms (k, u, s)	• In groups, learners observe demonstrations of loci and research applications of various loci, presenting their conclusions to the class. • In pairs, learners construct different loci. • In pairs, learners distinguish different loci and their applications (e.g. ellipse in the objects such as swimming pool, rackets, parabolic reflectors, hyperboloidal gears & cooling towers). • In pairs, learners make simplified	• Observe as learners construct different loci to support skill development and to ensure all make progress. • Listen to group & pair discussions and intervene to correct misconceptions and accelerate learning. • Evaluate products: loci constructed; models of applications of various loci

SENIOR 3: TERM 1

Theme: Design and drawing

TOPIC 18: PLAIN AND DIAGONAL SCALES

24 PERIODS

Competency: After learning this topic, the learner should be able to distinguish and apply scales.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a) apply knowledge of scale and proportions in area representations (k, u, s)	• In pairs, learners determine the representative fraction of a plain and diagonal scale, and then construct plain and diagonal scales. • In pairs, learners use plain and diagonal scales to make working drawings.	• Observe learners calculating representative fractions, constructing plain and diagonal scales and making working drawings, offering guidance to deepen learning. • Listen as learners discuss their understanding and how to perform these tasks, intervening to help them achieve learning outcomes. • Evaluate quality of learning through products: representative fraction calculations, scale

SENIOR 3: TERM 2

Theme: Design and drawing

TOPIC 19: FURTHER ORTHOGRAPHIC PROJECTIONS

12 PERIODS

Competency: After learning this topic, the learner should be able to identify, distinguish and apply first and third angle orthographic projection in the production of working drawings.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. Make representations of objects using different projections (k, u, s)	• In groups, learners research, discuss and demonstrate to the class, the principles used in first and third angle orthographic projection. • In pairs, learners draw orthographic drawings of full blocks, cut blocks, circular/curved blocks in first and third angles. • Individually or in pairs, learners convert orthographic views into pictorial views. • In pairs, learners produce a presentation illustrating differences between and the value of first and third angle orthographic projection.	• Listen as learners explain the principles used in first and third angle orthographic projection and deliver presentations to the class, offering guidance to aid learning. • Observe learners making third angle orthographic drawings of full blocks, cut blocks, circular/curved blocks and converting orthographic to pictorial views, intervening to improve skill development. • Evaluate products: demonstrations, drawings, conversions, presentations.

SENIOR 3: TERM 2

Theme: Design and drawing

TOPIC 20: BUILDING DRAWING

12 PERIODS

Competency: After learning this topic, the learner should be able to interpret, draw and make models of simple buildings.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. demonstrate knowledge of the construction of simple structures (models) using symbols and conventions (k, u, s) b. use scales in building drawings (k, u. s) c. make models of simple buildings/houses (k, s)	• In groups, learners research and demonstrate use of conventions and symbols in building drawing. • In pairs or groups, learners brainstorm and research the types of scales used in building drawing. • In groups, learners apply their understanding of scales in building drawings. • In pairs, learners design and draw simple building plans and then in groups discuss and evaluate each others' designs. • In pairs, learners design different types of houses/buildings and include elevations, plan views, sectional views and pictorial views. • In small groups, learners make scale models of simple houses/buildings using locally available materials.	• Observe as learners engage in the activities, offering guidance to ensure that all develop skills and make progress towards learning outcomes. • Listen as learners discuss the activities and their learning, asking probing questions to deepen understanding and ensure misconceptions are avoided. • Evaluate the quality of products: explanations of symbols, conventions and scales; drawings and peer evaluations; different views and scale models.

SENIOR 3: TERM 2

Theme: Design and drawing

TOPIC 21: MECHANICAL DRAWING

12 PERIODS

Competency: After learning this topic, the learner should be able to use the different features and conventions to interpret and produce mechanical engineering assembly drawings and models.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. use conventions and features in mechanical engineering assembly drawings (k, u) b. make models of some simple mechanical components (k, s, u)	• In pairs, learners practise drawing paper layouts, illustrating conventions and features used in mechanical engineering assembly drawings. • In pairs, learners make sketches of machine parts e.g. fastening devices, shafts, bushes, pulleys, brackets, mountings. • In pairs, learners construct and section assembly drawings, including major dimensions. • In small groups, learners brainstorm and research different machine assembly parts, principles of sectioning, materials and processes for making models. • In pairs, learners make models of some simple mechanical components. • In pairs, learners practise laying out drawing paper correctly and producing sectioned mechanical engineering assembly drawings.	• Observe learners carrying out the activities, offering guidance and support to ensure all understand and develop required skills. • Listen as learners discuss principles and techniques, intervening to ensure all make progress and achieve required learning outcomes. • Evaluate learning through the quality of products: illustrations of conventions and features; sketches of machine parts; assembly drawings; models; sectioned drawings.

SENIOR 3: TERM 2 **Theme: Technology in the making**

TOPIC 22: MATERIAL PRESERVATION AND PROTECTION 12 PERIODS

Competency: After learning this topic, the learner should be able to demonstrate an awareness of the techniques used in the preservation and protection of engineering materials.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. identify the common defects in engineering materials (k, u)
b. be familiar with the classification of chemicals used in the preservation of engineering materials (k, u, s)
c. use appropriate techniques to apply preservatives and protect engineering materials (k, s, u)
	• In groups, learners brainstorm, research and report on common engineering materials, common dangers/defects of the materials and remedies for metal and wood.
	• In small groups, learners discuss and produce a graphic explaining the properties of a good preservative.
	• In pairs, learners research, classify and report on the chemicals and methods used in the preservation of engineering materials, with respect to:
	  • cleaning,
	  • storage,
	  • timber preservation,
	  • coating/sealing,
	  • painting.
		• Observe learners engaged in the activities and offer guidance as required.
		• Listen to learners' discussions and ask questions to promote critical thinking and deepen learning.
		• Evaluate products: reports, graphics.

SENIOR 3: TERM 3

Theme: Technology in the making

TOPIC 23: MAKING PROCESSES

12 PERIODS

Competency: After learning this topic, the learner should be able to correctly cut, shape and assemble engineering articles.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. carry out the different cutting processes (k, u, s)
b. carry out the different shaping processes (k, s)
c. carry out fabrication and assembly of engineering components (k, s, u)
	• In groups, learners brainstorm, research, classify and report on different cutting processes.
	• In small groups, learners discuss and report on the basic health, safety, security and environmental considerations and take account of them when carrying out the cutting processes.
	• In groups, learners observe the different metal cooling methods and the properties of coolants.
	• In pairs, learners carry out the different cutting processes on engineering materials while using coolants and observing good practice in terms of health and safety.
	• In groups, learners discuss the different shaping processes and identify the basic health, safety, security and environmental considerations to be observed when carrying out the shaping processes
	• In pairs, learners safely carry out the different shaping processes.
	• In groups, learners brainstorm and research and report on:
	  • the definition of assembly
	  • the different tools used in assembly of components
	  • the different assembly methods/ procedures
	• In groups, learners identify the basic health, safety, security and environmental considerations to be observed when carrying out assembly processes.
	• In pairs, learners produce simple components and safely assemble them.
		• Observe as learners engage in the activities, offering guidance to ensure that all observe health and safety rules, develop skills and make progress towards learning outcomes.
		• Listen as learners discuss the activities, asking probing questions to deepen their understanding and ensure there are no misconceptions.
		• Evaluate the quality of products: reports; cutting and shaping of materials; components made and assembled items.

SENIOR 3: TERM 3

Theme: Technology in the making

TOPIC 24: MATERIALS JOINING

12 PERIODS

Competency: After learning this topic, the learner should be able to join components and materials using the different joining methods.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. join materials using different adhesives (k, s, u)
b. join materials using different types of fasteners (k, s, u)
c. carry out soldering, brazing and welding (k, s, u)
	• In groups, learners brainstorm and research the meaning of adhesives, identify and report on the different types of adhesives.
	• As a class, learners discuss and report on the dangers when handling adhesives and the safety precautions to be observed.
	• In small groups, learners observe demonstrations and practise making articles using correct processes for joining materials, using different adhesives.
	• In groups, learners brainstorm and research the definition of fastening, identify and report on the different types of fasteners.
	• In groups, learners observe demonstrations of different fastening methods and practise them themselves.
	• In groups, learners observe demonstrations of brazing, soldering and welding as joining methods, with a particular focus on health and safety measures.
	• As a class, learners discuss the advantages and disadvantages of brazing, soldering and welding.
	• In groups, learners follow step by step procedures to safely join materials using brazing, soldering and welding.
		• Observe as learners engage in the activities, offering guidance to ensure that all
		  • observe good practice in terms of health and safety,
		  • develop skills and
		  • make progress towards learning outcomes.
		• Listen as learners discuss the activities and their learning, asking probing questions to ensure safe practice, deepen understanding and avoid misconceptions.
		• Evaluate the quality of products: reports; joins made with adhesives; fastenings; joins made using brazing, soldering and welding.

SENIOR 3: TERM 3

Theme: Technology in the making

TOPIC 25: RENEWABLE ENERGY

12 PERIODS

Competency: After learning this topic, the learner should be able to determine the community's energy requirements and provide basic bioenergy and solar energy solutions to the simple domestic houses in the community.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. identify the renewable energy resources in Uganda (k, u) b. demonstrate the making of briquettes and simple energy saving stoves (k, u, s) c. describe and determine the basic solar requirements for a simple domestic house (k, u, s)	• In groups, learners brainstorm, research and report on the different renewable energy resources in Uganda and the potential contribution of bioenergy based on the renewable energy cycle. • As a class, learners discuss and report on bioenergy, biomass resources available locally and their sustainability. • In pairs, learners make energy-saving briquettes from various biomass resources. • In small groups, learners observe demonstrations and simple models and then make energy-saving stoves, producing annotated diagrams to show their energy-saving features. • In groups, learners brainstorm, research and report on the meaning of solar energy and the solar energy conversion process. • In groups, learners identify the basic components of a domestic solar energy system and practise basic solar sizing of simple houses. • In small groups, learners observe demonstrations of the maintenance tasks required on a simple domestic solar system and produce a report/maintenance guidelines.	• Observe as learners carry out the activities, offering support as required to ensure that learners make progress and achieve learning outcomes. • Listen as learners discuss the activities, offering advice and asking questions to deepen understanding. • Evaluate the quality of products: reports; briquettes and stoves; annotated diagrams; solar sizing calculations.

SENIOR 3: TERM 3 **Theme: Technology in the making**

TOPIC 26: MAINTENANCE OF SIMPLE MACHINES — 12 PERIODS

Competency: After learning this topic, the learner should be able to use and maintain simple machines in the community.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. identify and safely use the simple machines found in the community (k, u, s)
b. carry out basic maintenance and repair of simple machines (k, u, s)
	• In groups, learners brainstorm the meaning of simple machines, identify those used in their communities and produce reports illustrating the features of common simple machines.
	• In groups, learners observe demonstrations and report on the working principles of simple machines.
	• In groups, learners discuss and report on:
	  • the safety precautions to be observed when using simple machines
	  • how the use of simple machines contributes to the community's work.
	• In groups, learners:
	  • brainstorm the meaning and importance of maintenance and repair
	  • describe and report on the various forms of maintenance, including preventive and corrective, giving examples of different machines and the specific types of maintenance they need
	• In groups, learners observe demonstrations of the maintenance of simple machines and the safety measures to be observed, and then apply learning in practice.
		• Observe as learners engage in the activities, intervening to make sure all develop required skills and achieve learning outcomes.
		• Listen as learners discuss the activities, asking probing questions to encourage critical thinking and deepen understanding.
		• Evaluate the quality of products: reports; guidance documents, maintenance and repair work.

SENIOR 4: TERM 1 — Theme: Design and drawing

TOPIC 27: SECTIONING — 24 PERIODS

Competency: After learning this topic, the learner should be able to demonstrate sectioning principles used in engineering design and drawing.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. identify the principles of sectioning used in engineering design and drawing (k, u) b. produce sectioned engineering drawings (k, u, s) c. make models of sectioned objects (k, u, s)	• In groups, learners discuss the need for, and the principles of, sectioning in engineering design and drawing. • In pairs, learners practise producing sectioned engineering drawings. • In pairs, learners make models of objects based on simple sectioned engineering drawings.	• Listen as learners discuss the principles of sectioning and how to apply them in their own work, offering guidance as necessary. • Observe learners as they produce drawings and models, intervening to ensure all develop skills of interpreting and drawing. • Evaluate the quality of learners' products: sectioned drawings and models.

SENIOR 4: TERM 1 — Theme: Design and drawing

TOPIC 28: SURFACE DEVELOPMENT OF SOLIDS — 24 PERIODS

Competency: After learning this topic, the learner should be able to distinguish and apply methods of development to engineering drawings.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a. identify and use development in engineering drawing (k, u, s)
b. construct engineering drawings showing the development of solids (k, u, s)
c. create models showing application of development (k, s, u)
	• In groups, learners brainstorm, research and report on the different methods used in the development of solids.
	• In small groups, learners practise drawing the development of solids, using different methods:
	  • parallel line development
	  • radial line development
	• In pairs, learners show the application of development by making simple models.
		• Listen as learners discuss the methods of development used in engineering drawing, the techniques for representing development in drawings and making models, asking questions to deepen learning.
		• Observe learners as they produce drawings and make models, intervening to ensure all make progress and achieve learning outcomes.
		• Evaluate the quality of drawings and models made by learners.

SENIOR 4: TERM 2 **Theme: Technology in the making**

TOPIC 29: ELECTRICITY AND ELECTRONICS 16 PERIODS

Competency: After learning this topic, the learner should be able to repair basic electronic components and carry out basic domestic wiring for simple houses in the community.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY

a) know electrical installation tools and their uses (k, u)
b) understand and produce simple wiring diagrams (k, u)
c) carry out wiring or modelling of wiring in simple houses (k, u, s)
d) know the tools used in electronics (k, u)
e) understand electronic components and their symbols (k, u)
f) practise basic repair of simple electronic components (k, u, s)
	• In pairs, learners research and define the basic terms and principles of electricity.
	• In groups, learners discuss, identify and report on electrical installation tools and their uses.
	• In pairs, learners:
	  • discuss and report on the applications of electricity in the community
	  • draw electric symbols and use them in simple wiring diagrams
	• In pairs, learners practise (model) wiring of a simple house.
	• In groups and class discussion, learners identify and report on tools used in electronics and their purposes.
	• In pairs, learners illustrate electronic symbols and produce simple component diagrams.
	• In groups, learners troubleshoot problems with simple electronic devices and components and carry out basic repairs.
		• Observe as learners carry out activities, ensuring that all individuals participate, develop skills and make good progress towards learning outcomes.
		• Listen as learners discuss the activities, asking questions to encourage thinking, to deepen understanding and ensure all understand.
		• Evaluate the quality of products: definitions of terms; reports; drawings and wiring diagrams, practical wiring

SENIOR 4: TERM 2

Theme: Technology in the making

TOPIC 30: CONSTRUCTION PRACTICE

16 PERIODS

Competency: After learning this topic, the learner should be able to demonstrate the basic skills of constructing domestic structures with mono-pitched roofs.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a) prepare mortar for building, identify and use building tools (k, u, s) b) practise basic brick laying for simple structures (k, s) c) identify materials and tools for roofing (k, u) d) practise mono-pitched roofing of simple domestic structures (k, u, s)	• In groups, learners identify the basic building tools and materials and report on how and why each is used. • In pairs, learners practise preparation of mortar and basic brick laying for simple structures and produce a diagrammatic good practice guide. • In small groups, learners identify and select materials and tools for roofing, reporting on reasons for their choices. • In groups, learners observe demonstrations of how to construct mono-pitched roofs of simple domestic structures and demonstrate their learning in practice and/or in a report.	• Observe as learners engage in the activities, offering practical guidance to ensure that all develop required skills and make progress towards learning outcomes. • Listen as learners discuss the activities, asking probing questions to deepen understanding and ensure all appreciate the need for quality standards. • Evaluate the quality of products: reports on tools and materials for building and roofing; mortar and brick-laying; roofing.

SENIOR 4: TERM 2 **Theme 3: Technology in the making**

TOPIC 31: ELECTRONICS 16 PERIODS

Competency: After learning this topic, the learner should perform basic repairs of domestic analog electronic appliances.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. Demonstrate an understanding of electronics in domestic appliances (k,s)	• Using the internet, learners research on the use and types of electronic appliances in society and document their findings in preparation for a class discussion. • Learners as a whole class, discuss on the different domestic analog electronic appliances basing on the previous research done. • Learners identify the domestic analog electronic appliances and instruments used in repair and maintenance of electronic appliances • Illustrate simple component layout diagrams of the basic domestic analog electronic appliances. • Lead a discussion to identify basic tools and instruments used in repair and maintenance of electronic appliances • Guide learners to illustrate the simple component layout diagrams of basic domestic analog electronic appliances and identifying common faults with analog electronic appliances. • Guide learners to practice basic repair and maintenance of simple domestic analog electronic appliances to include; Flat irons, kettles, cathode ray tube (CRT)televisions, analog mobile phones, wall clocks and hand clocks	1. Observe individual learners participation in a discussion on the use and types of different electronic appliances in the community. 2. Assess learners' illustrations to ascertain accuracy of drawings.

SENIOR 4: TERM 3

Theme: Technology in the making

TOPIC 32: MAINTENANCE AND REPAIR OF SIMPLE MACHINES — 40 PERIODS

Competency: After learning this topic, the learner should maintain and repair simple machines used in the community.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
a. Know basic machines (k,u) b. Demonstrate an understanding of the principle of the working of machines.	**Sawing machines:** • Learners brainstorm about the importance of simple machines used in the community (e.g. sewing machines) • Learners individually identify the different parts/ features of a sewing machine and parts that require maintenance; specify the types of maintenance required for the different parts. • Demonstrate to learners the working principle of a sewing machine. • In groups, learners discuss the safety precautions to be observed when using and maintaining sewing machines. • Learners individually demonstrate the use of sewing machines and carry out the different forms of maintenance on sewing machines, while observing the safety precautions.	1. Observe learners individual contribution in a discussion on the importance of sawing machines. 2. In a conversation assess learners understanding of the safety precautions while using a sewing machine. 3. Observe learners as they demonstrate the use of a sewing machines.

LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
c. Demonstrate an understanding of the maintenance and repair of machines (s,k,u)	**Wheelbarrows** • Brainstorm with learners the importance of a wheel barrow in the community. • Learners identify the different parts/ features of a wheel barrow and describe its working principle. • Guide learners in specifying the parts of a wheel barrow that require maintenance, and specify the types of maintenance required for the different parts. • Guide learners to carry out the different forms of maintenance to include preventive and corrective, as required for the wheel barrow, while observing safety.	1. Observe learners participation in the brainstorming sessions to purposes of positive participation. 2. Evaluate the learners' illustrations showing the basic features of a wheel barrow. 3. Observe learners and assess them as they demonstrate the maintenance of wheel barrows, to ascertain suitable application of the different types of maintenance and observation of safety precautions.
	Mowers • Learners individually describe a mower and its importance in the community. • Guide learners to learners to identify the different parts/ features of a mowing machine. • Demonstrate to learners in groups the working principle of a mowing machine. • Guide learners in identifying the parts of a mower that require maintenance, and specify the types of maintenance required for the different parts. • Guide learners to discuss the safety precautions to be observed when using and maintaining mowing machines. • Guide learners to demonstrate mowing and carry out the different forms of maintenance on mowing machines, while observing the safety precautions.	1. In a conversation with the learners assess their individual knowledge and understanding of the different parts mowers and its working principle. 2. Assess the learners' illustrations showing the basic features of a mowing machine, to ascertain accuracy and appropriateness. 3. Observe learners demonstrations of using a mower to ascertain practicing of the safety precautions when using and maintaining a mowing machine. 4. Observe learners and assess them as they demonstrate the maintenance of mowers, to ascertain suitable application of the different types of maintenance and observation of safety precautions

ASSESSING TECHNOLOGY AND DESIGN

This section should be considered alongside the Assessment Guidelines.

Assessing the new expectations for learning

The new curriculum sets new expectations for learning, with a shift from Learning Outcomes that focus mainly on knowledge to those that focus on skills and deeper understanding. These new Learning Outcomes require a different approach to assessment.

The "Learning Outcomes" in the syllabuses are set out in terms of Knowledge, Understanding, Skills, and Attitudes. This is what is referred to by the letters k,u,s & a.

It is not possible to assess attitudes in the same way as knowledge, understanding and skills because they are more personal and variable and are long-term aspirations. This does not mean that attitudes are not important. It means that we must value things that we cannot easily assess.

So this guidance booklet focuses on knowledge, skills and understanding. Each has its own implications for learning and assessment.

Knowledge	The retention of information
Understanding	Putting knowledge into a framework of meaning – the development of a 'concept'.
Skill	The ability to perform a physical or mental act or operation

To assess knowledge, skills and understanding we need to look for different things. Knowledge can be assessed to some extent through written tests, but the assessment of skills and deeper understanding requires different approaches. Because of this, the role of the teacher in assessment becomes much more important.

Knowledge

Knowledge is the easiest to assess because it is fairly straightforward to find out whether or not a learner has retained some information: a simple question can usually find this out. We ask them to name something, or state something, or label a diagram.

Understanding

Assessing deeper understanding is much more difficult, so we usually ask learners to explain, compare or outline a process. This can be done orally (in conversation) or in writing, and will give us some idea of the extent of their understanding.

Skills

Skills are the ability to perform a mental or physical operation, so we have to observe the skill being performed or look at the product, or outcome, of the skill; for example a piece of writing, a picture or diagram. Some skills, such as speaking or a physical education skill do not have a product so need to be observed.

Examinations

There will no longer be examinations or tests set at the end of every year. Instead, there will be a summing up of on-going teacher assessments made in the context of learning.

The final examination at the end of Senior 4 will be very different in nature, and will focus on the learners' ability to apply their learning in new situations, rather than on the ability to recall information.

Formative Assessment

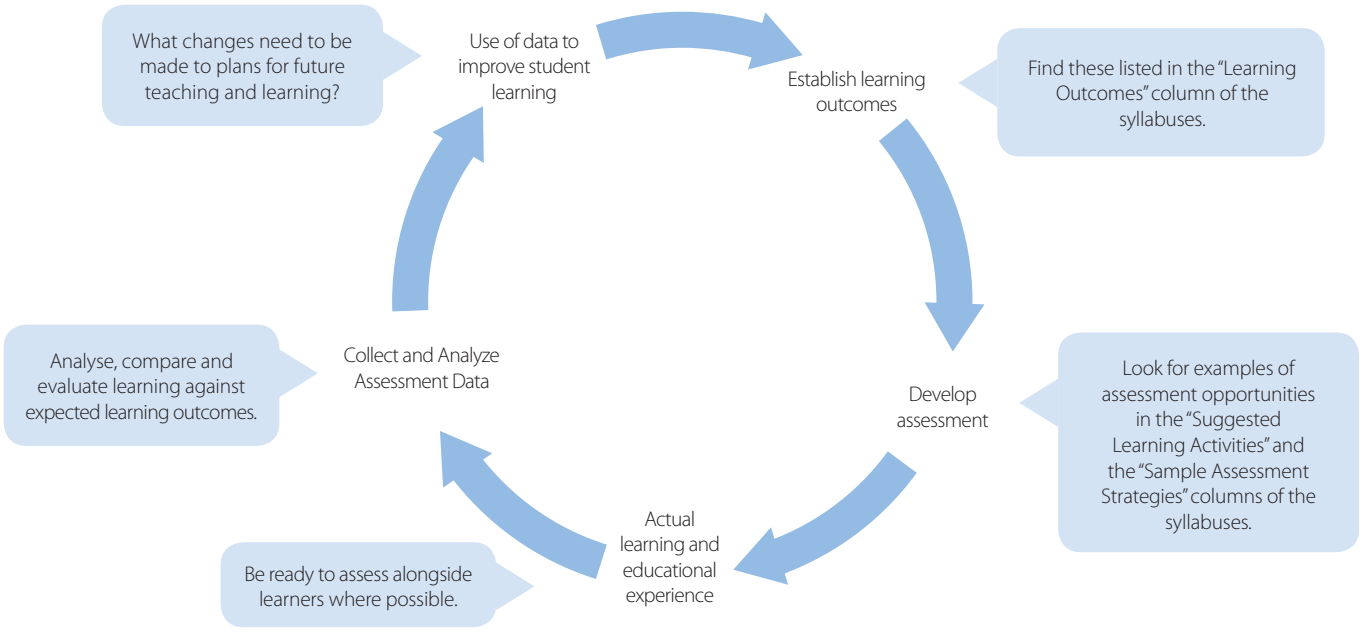
If assessment is to make a difference to teaching and learning, then teachers must use the information they gain from assessment to make some change to the teaching and learning process. This is formative assessment. If teaching and learning stay the same, there would have been no point in carrying out the assessment. The changes that can be made include decisions about:

- What needs to be learned next
- Whether an element of the syllabus needs to be taught again in a different way
- Changing teaching approaches if necessary
- Identifying learners who need more support, or who are making exceptional progress
- Enabling learners to understand what they have to do to improve

It is the use of the assessment data within this cycle to improve learning that is key to the success and impact of formative assessment.
It is this cycle that enables formative assessment to impact on learning:

- The syllabuses set out the learning outcomes
- The lessons seek to achieve these outcomes
- Assessment finds out whether or not the outcomes has been achieved
- This information guides the next steps in learning and so sets new learning outcomes

The process of teaching, making formative assessments and then changing the teaching and learning in some way can be seen as a cycle:



FORMATIVE ASSESSMENT INVOLVES USING ALL PARTS OF THE CYCLE.

ASSESSING TECHNOLOGY AND DESIGN

How do we find the opportunity to make formative assessments?

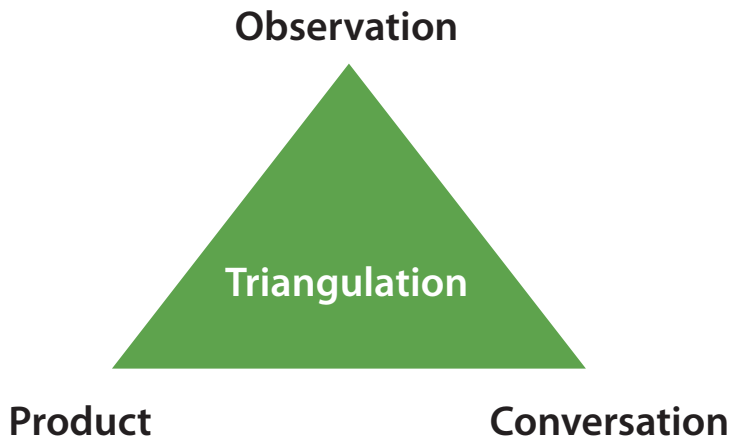
In the new curriculum, the teacher's assessment role is not to write tests for learners, but to make professional judgements about learners' learning in the course of the normal teaching and learning process. The professional judgement is about how far the learner meets the Learning Outcomes that are set out in this syllabus. To make these judgements the teacher needs to look at how well the learners are performing in terms of each Learning Outcome.

School-based formative assessment is a part of the normal teaching and learning process, and so the assessment opportunities will also occur during this normal process. It is not something that needs to be added on after learning; it is an integral part of it.

These opportunities occur in three forms and are often called:

- Observation – watching learners working (good for assessing skills)
- Conversation – asking questions and talking to learners (good for assessing knowledge and understanding)
- Product – appraising the learner's work (writing, report, translation, calculation, presentation, map, diagram, model, drawing, painting etc). In this context, a "product" is seen as something physical and permanent that the teacher can keep and look at, not something that the learner says.

When all three are used, the information from any one can be checked against the other two forms of assessment opportunity (eg evidence from "observation" can be checked against evidence from "conversation" and "product"). This is often referred to as "triangulation".



Triangulation of assessment opportunities

To find these opportunities, look at the syllabus units. These set out the learning that is expected and give 'Sample Assessment Activities", and in doing so they contain a range of opportunities for the three forms of assessment.

Generic Skills

The Generic Skills have been built into the syllabuses and are part of the Learning Outcomes. It is therefore not necessary to assess them separately. It is the increasingly complex context of the subject content that provides progression in the Generic Skills, and so they are assessed as part of the subject Learning Outcomes.

Attitudes

It is not possible to assess attitudes in the same way as knowledge, understanding and skills because they are more personal and variable and are long-term aspirations. This does not mean that attitudes are not important. It means that we must value things that we cannot easily assess.

Record keeping

Keeping detailed records of learners' individual progress is always difficult with very large numbers of pupils. For the purposes of school-based formative assessment, it is not even always necessary to keep such detailed records anyway. If feedback is give immediately and action is taken, then learning is changed and the record would soon become out of date and redundant.

Most formative class-based assessments are dynamic in that they feed straight back into the teaching and learning process. Therefore detailed records of these are not appropriate.

What is needed is record of assessments of learners' learning made in terms of each Topic or unit. This means recording the on-going summative assessments of each unit. There is no need to make separate records of each of the Learning Outcomes because this would be very time-consuming and also unnecessary. It is much more useful to make an overall assessment about whether or not each learner met the Learning Outcomes for each Topic as a whole.

Each Sub-Strand is made up of a number of Learning Outcomes. Therefore teachers need to consider all the Learning Outcomes when making an overall judgement about the Sub-Strand as a whole. It is not always necessary for every individual Learning Outcome to be achieved for the Sib-Strand as a whole to be achieved. This will vary with the Learning Area and Topic.

By looking at the Learning Outcomes within each Topic, it is possible to identify four broad groups of learners in terms of their achievements:

Descriptor
No Learning Outcome (LO) achieved
Some LOs achieved, but not sufficient for overall achievement
Most LOs achieved, enough for overall achievement
All LOs achieved – achievement with ease

ASSESSING TECHNOLOGY AND DESIGN

There is no need to set a test to find this out.

These overall assessments should be made on the basis of the many formative assessments that the teacher has made during the course of teaching the unit. If teachers have been working with the learners over the course of the unit, they will be able to make a broad judgment about which learners have achieved or have failed to achieve the unit's overall Learning Expectation. These "Authentic Assessments" will be more valid and valuable than a test set by the school.

Recording these overall assessments will be simple, manageable and yet valuable, and can be recorded on a sheet such as the one below in which the categories are indicated with a number.

Although a very simple process, these four categories will give rich data when a comparison is made between the learners in each category for different subjects and units. They will also identify easily those learners who need extra support or who may not be ready to move on to the next grade at the end of a year.

If records are kept of the learning outcomes of each syllabus unit through the year, then there will be no need for an end of year test. Teachers will already have a record of those learners who have met the learning outcomes, and those who have not done so. Therefore teachers will know if there were any learners not ready to progress to the next grade.

An overall record should be made of the individual unit assessments by subject in terms of the 4 descriptors. If numbers (0-3) are used as identifiers, then it will be possible to arrive at an overall number for a year by aggregating the identifiers for each unit.

Descriptor	Identifier
No Learning outcome achieved	0
Some LOs achieved, but not sufficient for overall achievement	1
Most LOs achieved, enough for overall achievement	2
All LOs achieved – achievement with ease	3

In the example below, the table shows the end-of-unit assessment for six learners.

	Technology and Design									
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
Learner A	3	3	2	3	3	3	3	2	3	3
Learner B	2	2	3	2	3	2	2	2	3	2
Learner C	1	1	2	1	1	2	2	3	2	3
Learner D	1	1	2	1	1	2	1	1	2	1
Learner E	0	1	2	1	0	1	0	1	1	1
Learner F	0	0	1	0	0	1	0	0	1	0

This method will give much more information than using a tick. For example, at a glance it can be seen that learners A & B are achieving much higher than learners E & F. It can be seen that Learner C has improved during the year. We can even see that more learners achieved success in Topic 9 than Topic 7.

All of this is very valuable assessment information and can be used to improve learning.

This summative teacher assessment will contribute to the final grade of the School Leaving Certificate.

The assessment of the practical or pre-vocational subjects at Lower Secondary level will take three forms:

i) Classroom based assessment which will be moderated and contribute 20% of the final mark

ii) Final examinations which will contribute 80%

iii) Assessment for the world of work or occupation which will lead to the award of a work pass at Level 1 in the Uganda Vocational Qualification Framework (UVQF. These assessments will occur at the end of Senior 3 and be carried out according to the specification of the Directorate of Industrial Training (DIT).

Glossary of Key Terms

TERM	DEFINITION
Competency Curriculum	One in which learners develop the ability to apply their learning with confidence in a range of situations.
Differentiation	The design or adaptation of learning experiences to suit an individual learner's needs, strengths, preferences, and abilities.
Formative Assessment	The process of judging a learner's performance, by interpreting the responses to tasks, in order to gauge progress and inform subsequent learning steps.
Generic skill	Skills which are deployed in all subjects, and which enhance the learning of those subjects. These skills also equip young people for work and for life.
Inclusion	An approach to planning learning experiences which allows each student to feel confident, respected and safe and equipped to learn at his or her full potential.
Learning Outcome	A statement which specifies what the learner should know, under-stand, or be able to do within a particular aspect of a subject.
Process Skill	A capability acquired by following the programme of study in a particular Learning Area; enables a learner to apply the knowledge and understanding of the Learning Area.
Sample Assessment Activity	An activity which gives a learner the opportunity to show the ex-tent to which s/he has achieved the Learning Outcomes. This is usually pat of the normal teaching and learning process, and not something extra at the end of a topic.
Suggested Learning Activity	An aspect of the normal teaching and learning process that will enable a formative assessment to be made.

NCDC
NATIONAL CURRICULUM
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