Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

JUNIOR SECONDARY PHASE

DESIGN AND TECHNOLOGY SYLLABUS

GRADES 8 & 9

For implementation:

Grade 8 in 2017
and
Grade 9 in 2018

Ministry of Education, Arts and Culture
National Institute for Educational Development (NIED)
Private Bag 2034
Okahandja
Namibia

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Design and Technology syllabus Grades 8 & 9

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1. Introduction

This syllabus describes the intended learning and assessment for Design and Technology in the Junior Secondary phase. As a subject, Design and Technology is within the technological area of learning in the curriculum, but has thematic links to other subjects across the curriculum. Learning about technology includes applying knowledge of how to work more efficiently using tools, materials and processes. Technology is a specific way of solving problems through planning, design, realisation and evaluation. Learners develop the necessary knowledge, skills and attitudes to perform tasks using appropriate technology.

2. Rationale

The presentation of Design and Technology at school is first and foremost an educational matter, with the overall goal being that learners attain proper adulthood in the society. As a result of the increasing industrialisation and mechanisation of modern times, technological knowledge and skills have become indispensable in everyday life.

The inclusion of Design and Technology in the learners' curriculum does not aim at vocational training in the narrow sense of the word. It simply provides the learner with a broad educational foundation for further specialised training. It also provides the learners with a clear understanding of technology and assists them in becoming better adapted and prepared for life.

The integration of entrepreneurial concepts and activities lays the foundation for the development of human resources as a basis for studies, occupations or self-employment. Design and Technology, together with entrepreneurial concepts and activities, empowers the individual to be creative and gain problem-solving skills.

The particular features of Design and Technology at this phase are to enable the learners to achieve technological literacy through the development of technological knowledge and understanding, technological capacity and an awareness of the significance of Design and Technology upon society.

Learners should develop a thorough knowledge of basic concepts which they can apply in a wide range of situations. They must also develop the broad-based skills that are so important for effective functioning in the world of work. They must learn to identify and analyse problems and to explore and test solutions in a wide variety of contexts. This firm conceptual base is at the heart of the Design and Technology and must be the focus on teaching and learning in the classroom.

3. Aims

The Design and Technology syllabus promotes the following aims in the curriculum:

- foster an awareness of local, regional and national needs of Namibia and contribute towards development
- equip learners to play an effective and productive role in the economic life of the nation
- help learners to develop pre-vocational skills
- promote positive attitudes towards the challenges of co-operation, work, entrepreneurship and self-employment.

4. Inclusive education

Inclusive education is the right of every learner and promotes participation in, or access to, the full range of educational programmes and services offered by the education system in mainstream schools. It is based on the principle of supporting and celebrating the diversity found among all learners and removing all barriers to learning. The Design and Technology teacher in the Junior Secondary phase should therefore accommodate learners with special educational needs by adapting this syllabus to the needs of the learner through differentiation of teaching methods and material as indicated in the *Curriculum Framework for Inclusive Education: A Supplement to the National Curriculum for Basic Education (2014)*. The adaptation for assessment of learners with special educational needs must be done as prescribed in the *Handbook for Centres (2014*) by the Directorate of National Examinations and Assessment (DNEA). The accommodations prescribed in this handbook are not only for external examinations, but apply to learners from Grades 1 to 12.

Learners who are so severely impaired that they cannot benefit from attending mainstream schools will be provided for according to their needs in learning support units, resource units or resource schools until such time that they can join a mainstream school structure, if possible.

Including gender perspectives is important in all social themes in order to raise awareness of gender stereotyping, how limitations are set on gender equity, and how to promote gender equity in all spheres of life.

All teaching/learning materials should be analysed to ensure that they promote gender equity.

5. Links to other subjects and cross-curricular issues

The cross-curricular issues include Environment Learning; HIV and AIDS; Population Education; Education for Human Rights and Democracy (EHRD); Information and Communication Technology (ICT). These have been introduced to the formal curriculum to be dealt with in each subject and across all phases, because each of the issues deals with particular risks and challenges in our Namibian society. All our learners need to:

- understand the nature of these risks and challenges
- know how they will impact on our society and on the quality of our people's lives now and in future
- understand how these risks and challenges can be addressed on a national and global level
- understand how each learner can play a part in addressing these risks and challenges in their own school and local community

The main risks and challenges have been identified as:

- the challenges and risks we face if we do not care for and manage our natural resources
- the challenges and risks caused by HIV and AIDS
- the challenges and risks to health caused by pollution, poor sanitation and waste
- the challenges and risks to democracy and social stability caused by inequity and governance that ignores rights and responsibilities
- the challenges and risks we face if we do not adhere to road safety measures
- the challenges and risks we face from globalisation

Since some subjects are more suitable to address specific cross-curricular issues, those issues will receive more emphasis in those particular syllabuses. In this syllabus the following cross-curricular issues can be dealt with in the topics as indicated:

Cross-curricular issues	HIV and AIDS	Environmental Education	Human Rights and Democracy	Entrepre-neurship Education	ICT
Grade 8	Health and safety	Structures Materials	Career prospects	Job Shadowing	Design and realisation Communication
Grade 9	Safety precautions and first aid measures	Structures Materials	Human Resource	Job observation	Design and realisation Communication

6. Approach to teaching and learning

The approach to teaching and learning is based on a paradigm of learner-centred education (LCE) described in ministerial policy documents and the LCE conceptual framework. This approach ensures optimal quality of learning when the principles are put into practice.

The aim of learner-centred education is to develop learning with understanding, and the knowledge, skills and attitudes to contribute to the development of society. The starting point for teaching and learning is the fact that the learner brings to the school a wealth of knowledge and social experience gained continually from the family, the community and through interaction with the environment. Learning in school should involve, build on, extend and challenge the learner's prior knowledge and experience.

Learners learn best when they are actively involved in the learning process through a high degree of participation, contribution and production. At the same time, each learner is an individual with his/her own needs, pace of learning, experience and abilities. The teacher must be able to identify the needs of the learners and the learning that still needs to take place, and know how to shape learning experiences accordingly. Teaching strategies must therefore be varied and flexible within well-structured sequences of lessons.

The teacher should decide, in relation to the general objectives and specific objectives in Design and Technology to be achieved when:

- it is best to convey content directly
- it is best to let learners discover or explore information for themselves
- learners need directed learning
- there is a particular progression of skills or information that needs to be followed
- learners can be allowed to find their own way through a topic or area of content.

Work in groups, in pairs, individually, or as a whole class must therefore be organised as appropriate to the task in hand. Co-operative and collaborative learning should be encouraged whenever possible. In such cases, tasks must be designed so that pair or group work is needed to complete it, otherwise the learners will not see any relevance in carrying out tasks together. As the learners develop personal, social and communication skills, they can gradually be given increasing responsibility to participate in planning and evaluate their work, under the teacher's guidance.

Design and Technology emphasises the re-use of locally available resources (recyclable materials) to conserve the environment and the content has been adapted to suit the local context.

7. End-of-phase competencies

On entry to the Junior Secondary phase, all learners are expected to have a basic awareness of and some practical skills in pre-vocational subjects within the Namibian school curriculum. They should consider the social and environmental impact of these subjects and also have basic entrepreneurial awareness.

A few learners might not be able to achieve all the specific objectives satisfactorily and must receive learning support through adapted teaching approaches, adapted materials, and assistance from peers. A small number of learners have special educational needs to a degree which requires greater individual attention, resources or assessment. Others will have impairments which do not necessarily limit cognitive and affective learning and development, e.g. the visually impaired, hearing impaired and physically challenged.

On completion of the Junior Secondary phase, learners are expected to be able to demonstrate their competence in simple technological processes. They should be able to make informed choices about design and/or materials and evaluate a finished product in these areas. They should also be able to use basic equipment and know the safety precautions in doing so.

8. Summary of the learning content

Nr	Topic	Grade 8	Grade 9
1	Design and technology	1. Design and technology concepts	1. Design and technology - more concepts
2	Safety precautions	2. Safety precautions for hand tools	2. Safety precautions for power tools
3	Design	3. Design stages	3. Design tools and materials
4	Design communication	4. Design communication	4. Design communication
5	Resistant materials	5. Resistant materials: wood, metal, plastics	5. Resistant materials: wood, metal, plastics
6	Technology	6.1 Structures	6.1 Structures
		6.2 Mechanisms	6.2.Rotary systems
		6.3 Energy	6.3 Energy
		6.4 Electricity	6.4 Electricity

9. Learning content

9.1 Introduction to learning content

1. The learning content outlined below is designed to provide guidance to teachers as to what will be assessed in the overall evaluation of learners. It is not meant to limit, in any way, the teaching programme of any particular school.

2. **Topics** refer to those components of the subject which learners are required to study/master.
   The **general objectives** are derived from the topic/skill and are the general knowledge, understanding and demonstration of skills on which learners will be assessed.
   The **specific objectives** are the detailed and specified content of the syllabus, which learners need to master to achieve the general objectives, and on which they will be assessed. For skills-based subjects, specific objectives indicate what learners should be able to do at the end of the year.

9.2 Learning content

9.2.1 Grade 8 learning content

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 8 SPECIFIC OBJECTIVES** *Learners should be able to:*

1. Design and technology	• understand the concepts of design and technology	• describe the concepts:
		  - design
		  - technology
		• describe the link between design and technology
		• explain and describe the negative and positive environmental and social impacts of design and technology

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 8 SPECIFIC OBJECTIVES** *Learners should be able to:*
2. Safety precautions	• understand safety rules for hand tools	• apply the safety rules relevant to: - punches - vices - hammers - screwdrivers - saws - files - chisels - pliers - tape measure - rulers - snips - squares - compass - clamps
	• know the basic National Occupational Safety Association (NOSA) safety regulations in the classroom environment	• apply and use tools safely • explain the necessity of wearing protective clothing
	• understand HIV and AIDS prevention	• list appropriate safety measures with prevention of HIV and AIDS in mind regarding: - open wounds - bleeding
3. Design	• know the stages in the design process	• list, describe and apply the first four design stages: - general analysis of the problem and the formulation of the design brief - preparation and precision of specification - exploration of ideas - development of proposed solution

TOPIC	GENERAL OBJECTIVES *Learners will:*	GRADE 8 SPECIFIC OBJECTIVES *Learners should be able to:*
4. Design communication	• know the drawing equipment and instruments	• identify and use drawing equipment and instruments (drawing board; T-square; rule; compasses; pencil; rubber; $30^{o}/60^{o}$ and 45^{o} set squares) • discuss and apply the factors influencing the neatness and quality of drawings • plan and apply a proper layout on drawing paper with efficient use of working space • estimate size and proportion
	• understand graphical communication techniques	• use appropriate shading and colouring techniques on presented freehand sketches • apply freehand sketching techniques to present two and three dimensional views of simple objects
5. Resistant materials	• be introduced to and gain awareness of the basic properties and uses of wood, plastic and metal	• collect and identify examples of household containers made of selected materials • carry out simple experiments to determine approximate properties of collected materials (appearance, hardness, strength) • list possible reasons why a material has been used for a particular purpose
	• acquire a working knowledge of wood	• collect and discuss a selection of locally used wood regarding: - types - origin - properties - uses

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 8 SPECIFIC OBJECTIVES** *Learners should be able to:*
5. Resistant materials (continued)	• acquire a working knowledge of plastic	• collect and compare various plastics regarding: - thermo and thermo setting - properties - plastic forming
	• acquire working knowledge of metals	• identify different metal shapes: - round bar - flat bar - square tubing - angle iron - sheet metal - round tube
	• know how to work with metal	• demonstrate the procedures in: - measuring and marking out - sawing and cutting - filing to accurate size - drilling - abrading and finishing - joining using fasteners
6. Technology: 6.1. Structures	• acquire a working knowledge of structures	• identify and classify structures into main groups • illustrate and discuss static and dynamic forces acting on a structure • determine and identify, through experimentation, methods to strengthen and stabilise structures • suggest and construct a solution for selected structural design problems

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 8 SPECIFIC OBJECTIVES** *Learners should be able to:*
6.2 Mechanisms	• know types of movement and how movement can be transmitted	• identify and describe different types of movement: - linear - rotary - reciprocating - oscillating • illustrate mechanisms that produce the listed motions • explain the concepts: - lever - mechanical advantage (MA) • calculate mechanical advantage given that $MA = \frac{Load}{Effort}$
6.3 Energy	• know the forms of energy	• discuss that energy is the capacity for doing work • identify and describe different forms of energy
	• understand that energy can be converted from one form into another form	• carry out simple experiments to find out how one form of energy could be converted into another form of energy • research and illustrate that energy conversions result in energy losses • carry out simple experiments to show methods of converting solar energy into a usable energy form (e.g. heat for cooking, electricity to power a motor)
6.4 Electricity	• know first aid and safety precautions when working with electricity	• apply appropriate first aid and safe working procedures when working with electrical and electronic equipment

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 8 SPECIFIC OBJECTIVES** *Learners should be able to:*
6.4 Electricity (continued)	• know methods to generate electricity	• identify and describe methods of generating electricity: - solar - hydro electric - wind - thermal - tidal - nuclear - fossil fuels
	• understand components in simple circuits	• utilise the listed components in simple circuits: - conductors - semi-conductors - insulators • identify and describe the purpose of components used in the selected circuits
	• understand Ohm's law	• carry out experiments to calculate: - current - voltage - resistance (Ohm's law)
	• understand basic circuit diagrams	• construct elementary circuits from a circuit diagram • draw and interpret a selection of simple electric and electronic circuit diagrams using standard symbols

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 8 SPECIFIC OBJECTIVES** *Learners should be able to:*
6.4 Electricity (continued)	• acquire basic working knowledge of magnets and electromagnetism	• carry out simple experiments to determine the electromagnetic effect of current carrying conductors: - on one another - in a magnetic field - draw/sketch magnetic fields - apply the concept “electricity-in-practice” (through practical uses of electrical toys or appliances)
	• know the molecular theory of magnets (like poles repel, unlike poles attract)	• compare the relationship between magnets and electricity • discuss magnets and their properties

9.2.2 Grade 9 learning content

TOPIC	GENERAL OBJECTIVES *Learners will:*	GRADE 9 SPECIFIC OBJECTIVES *Learners should be able to:*
1. Design and technology	• appreciate conservation of resources	• research and compare the concepts: - renewable resources - non-renewable resources • identify and describe ways to conserve resources
2. Safety precautions	• know the safety rules/precautions regarding basic power tools	• compare and discuss safety rules/precautions regarding: - electrical soldering iron - pillar drill - angle grinder - electric hand drill - welding machine - multi tester - router - planer - jig saw - generator • list safety precautions when doing minor adjustments to electrical power tools (e.g. changes of plug, adjustment of saw blades)
	• know advanced safety precautions according to the NOSA regulations	• handle safety regulations including: - correct selection of materials and finishes - dust and fume extraction - making use of colour association, e.g. red for danger

TOPIC	GENERAL OBJECTIVES *Learners will:*	GRADE 9 SPECIFIC OBJECTIVES *Learners should be able to:*
2. Safety Precautions (continued)	• know advanced safety precautions according to the NOSA regulations (continued)	• describe safety regulations which include: - workers within the (projected) working environment - flammable and toxic substances - the use of barrier creams - disposal of chemicals and redundant products in a safe and environmentally friendly way
	• be aware of those infected and affected by HIV and AIDS	• demonstrate HIV and AIDS awareness by: - creating posters - role plays • describe appropriate ways to care for the HIV and AIDS infected and affected including: - moral support and counselling - taking of drugs on time - healthy diet • apply appropriate ways to handle: - open wounds - bleeding
3. Design	• know appropriate tools and materials to make a designed product with precision and control according to working drawings and a production plan	• construct and produce a design product with precision and control according to working drawings and the production plan in the design folder • discuss and compare quality and practical difficulties encountered during the construction process to make appropriate adjustments to working drawings and the production plan as required • illustrate, compare and apply working practices and efficient use of materials and tools

TOPIC	GENERAL OBJECTIVES *Learners will:*	GRADE 9 SPECIFIC OBJECTIVES *Learners should be able to:*
4. Design communication	• know appropriate media and graphic techniques to make graphical presentations of design ideas	• present a graphical view (freehand drawing, isometric and orthographic projection) of a selection of natural and human-made objects demonstrating the application of: - thin and thick lines - light and shade to show form and mass - textural representation to represent material type - colour rendering to show space and depth
	• understand flow charts and graphs to present data graphically	• read and interpret graphs • read and interpret data of quantity and distribution presented on a variety of flow charts and graphs
5. Resistant materials: 5.1 Wood	• know timber	• describe the following processes: - conversion of logs into timber - conversion methods - seasoning of timber
	• know manufactured boards	• collect and compare a selection of locally used manufactured boards regarding: - types - properties - uses
	• know how to work with and accurately manipulate wood	• demonstrate the procedures in measuring, marking out and making a selection of elementary wood joints • demonstrate the procedures in fitting joints appropriately to form a designed framework or artefacts • demonstrate the procedures in joining manufactured boards using fittings, fixtures and adhesives

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 9 SPECIFIC OBJECTIVES** *Learners should be able to:*
5.1 Wood (continued)	• know how to work with and accurately manipulate wood (continued)	• demonstrate the procedures in selecting and applying suitable wood finishes from: - sanding sealant - stains - oils - waxes - varnish - paints - creosote
5.2 Plastics	• acquire working knowledge about processes and procedures to shape plastics	• demonstrate the following shaping processes: - deforming - blow moulding - vacuum forming - injection moulding - extrusion moulding - compression moulding - line bending
	• know how to work with and accurately manipulate plastic	• design and construct simple moulds to carry out elementary shaping on plastics • identify and use the required hand tools, equipment and sundries for listed procedures appropriately • apply the relevant safety principles and procedures for the relevant procedures, tools and equipment appropriately

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 9 SPECIFIC OBJECTIVES** *Learners should be able to:*
5.3 Metals	• acquire working knowledge of metals	• collect and discuss a selection of locally used metals regarding: - types (ferrous metals, non-ferrous metals, alloys) - properties - uses
	• work with and accurately manipulate metal	• identify and prepare elementary joints for: - soft soldering - brazing - oxy-acetylene welding - arc welding
6. Technology 6.1 Structures	• acquire working knowledge of structures	• identify and classify structures into main groups • illustrate and discuss static and dynamic forces acting on a structure
	• understand frame structures	• discuss and compare frame structures regarding: - basic structural components (columns, beams, struts and ties - reinforcing techniques (triangulation, webs and fillets, orientation and cross-sectional areas of members)
	• know the type of forces acting on structures	• identify the types of force acting on structures: - torsion/twisting - shear - bending/warping - compression - tension • describe the effects of the listed forces

TOPIC	**GENERAL OBJECTIVES** *Learners will:*	**GRADE 9 SPECIFIC OBJECTIVES** *Learners should be able to:*
6.1 Structures (continued)	• understand the forces in frame structures	• calculate moments around a point
	• understand appropriate concepts and principles to solve selected structural design problems	• select/adapt/design simple structures to meet the demands of a particular design situation
6.2 Rotary systems	• acquire working knowledge of gears and gear systems	• discuss various methods of converting: - rotary motion into reciprocating motion - reciprocating motion into rotary motion • identify possible uses for: - spur gear systems - idler gears - bevelled gear systems - worm gear systems - rack and pinion gear systems • compare pulley and belt drive systems, chain and sprockets systems and gear systems regarding: - main features - advantages and disadvantages - main uses
	• solve basic calculations on velocity ratio	• calculate the velocity ratio (VR) from: - $VR = \frac{\text{Distance moved by effort}}{\text{Distance moved by load}}$ - $VR = \frac{\text{Distance moved by driver pulley}}{\text{Distance moved by driven pulley}}$ - $VR = \frac{\text{Diameter of driven pulley}}{\text{Diameter of driver pulley}}$

TOPIC	GENERAL OBJECTIVES *Learners will:*	GRADE 9 SPECIFIC OBJECTIVES *Learners should be able to:*
6.2 Rotary systems (continued)	• understand efficiency	• determine the relation between mechanical advantage (MA), velocity ratio (VR) and efficiency in rotary systems efficiency $= \frac{MA}{VR}$
	• acquire working knowledge of cam systems and crankshaft and connecting rod systems	• illustrate the following systems: - cam and cam follower systems - crankshaft and connecting rod systems • carry out simple experiments to form an understanding of how the profile of a cam influences the movement transmitted to a cam follower
	• know concepts and principles of mechanisms to solve identified design problems	• apply concepts and principles regarding cam systems and crankshaft and connecting rod systems to solve simple identified design problems
6.3 Energy	• know sources of energy	• identify and list energy sources • illustrate and discuss the sun as primary source of energy
	• understand different forms of energy storage	• identify and describe different forms of energy storage in use including: - kinetic (movement) energy - potential energy - thermal (heat) energy - electrical energy - chemical energy

TOPIC	GENERAL OBJECTIVES *Learners will:*	GRADE 9 SPECIFIC OBJECTIVES *Learners should be able to:*
6.3 Energy (continued)	• know practical ways of converting and transmitting energy	• identify and describe practical and efficient methods of the conversion and transmission of energy through simple mechanisms like engines, electric motors • apply concepts and principles regarding energy storing, conversion and transmission to solve simple identified design problems
6.4 Electricity	• understand first aid and safety precautions	• apply first aid and safety precautions and procedures applicable to the working and testing tasks
	• know energy, force, work and power	• calculate: - energy - force - work - power
	• know basic maintenance and repairing procedures	• describe minor inspection, maintenance and repairing procedures for portable electrical powered tools/equipment
	• understand electromagnetism	• explain the effects of electromagnetism as applied in simple circuits such as electric bells, indicators and relay switches

10. Assessment

A learner-centred curriculum and learner-centred teaching encompass a broad range of knowledge and skills which are relevant to the knowledge-based society. The specific objectives in the syllabus state what understanding and skills a learner must demonstrate as a result of this teaching-learning process, and which objectives will be assessed. However, it is intended that the curriculum should focus on learning, not on assessment and examination. Assessment and examination are only to support learning.

10.1 Continuous assessment

In order to capture the full range and levels of competence, a variety of formal and informal continuous assessment situations is needed to give a complete picture of the learner's progress and achievements in all subjects. Continuous assessment must be clear, simple and manageable, and explicitly anchored in learner-centred principles and practice. Teachers must provide a reliable and valid assessment of the learner's performance in the specific objectives. The information gathered about the learners' progress and achievements should be used to give feedback to the learners about their strong and weak points, i.e. where they are doing well, and why, and where, how and why they need to improve. The parents should be informed regularly about the progress of their children in all subjects, be encouraged to acknowledge achievements, and given suggestions as to how they can support the child's learning activities. The learner's progress and achievements in this subject must be reported to parents in the school report.

10.2 Formative and summative assessment

The two modes of assessment used are formative continuous assessment and summative assessment. Formative continuous assessment is any assessment made during the school year in order to improve learning and to help shape and direct the teaching-learning process. Assessment has a formative role for learners if and when:

- it is used to motivate them to extend their knowledge and skills, establish sound values, and to promote healthy habits of study
- assessment tasks help learners to solve problems intelligently by using what they have learnt
- the teacher uses the information to improve teaching methods and learning materials

Summative assessment is an assessment made at the end of the school year based on the accumulated total of the progress and achievements of the learner throughout the year in a given subject, together with any end-of-year tests or examinations. The result of summative assessment is a single end-of-year promotion grade.

10.3 Informal and formal methods

The teacher must assess how well each learner is mastering the specific objectives described in the syllabus and from this gain a picture of the all-round progress of the learner. To a large extent, this can be done in an informal way and in their participation in general, through structured observation of each learner's progress in learning and practice situations while they are investigating things, interpreting phenomena and data, applying knowledge, communicating and making value judgements.

When it is necessary to structure assessment more formally, the teacher should as far as possible use situations similar to ordinary learning and practice situations to assess the competency of the learner. Formal written and oral tests can be used to assess only a limited

range of specific objectives and therefore should not take up a great deal of time. Short tests should be limited to part of a lesson and only in exceptional cases use up a whole lesson.

10.4 Evaluation

Information from informal and formal continuous assessment is to be used by the teacher to ascertain where it is necessary to adapt methods and material to the individual progress and needs of each learner. At the end of each main unit of teaching and at the end of each term, the teacher, together with the learners, should evaluate the learning-teaching process in terms of tasks completed, participation, what the learners have learnt, and what can be done to improve the working atmosphere in and achievements of the class.

10.5 Criterion-referenced grades

When grades are awarded in continuous assessment, it is essential that they reflect the learner's actual level of achievement in the specific objectives, and are not related to how well other learners are achieving these objectives or to the idea that a fixed percentage of the learners must always be awarded a Grade A, B, C, and so on (norm-referencing). In criterion-referenced assessment, each letter grade must have a descriptor for what the learner must demonstrate in order to be awarded the grade. Grade descriptors must be developed for each subject for each year. It is important that teachers in each department/section work together to have a shared understanding of what the grade descriptors mean, and how to apply them in continuous assessment, so that grades are awarded correctly and consistently across subjects. Only then will the assessment results be reliable.

10.6 Grade descriptors

The learner's summative achievement in the specific objectives will be shown in letter grades A to E, where A is the highest and E the lowest grade for learners achieving minimum competency level. In cases where a learner has not reached the minimum level of competency a U will be awarded. When letter grades are awarded, it is essential that they reflect the learner's actual level of achievement in relation to the specific objectives. The relation between the letter grades and specific objectives is shown in the table below.

Grade	% Range	Grade descriptors
A	80%+	**Achieved objectives exceptionally well.** The learner is outstanding in all areas of competency.
B	70-79%	**Achieved objectives very well.** The learner's achievement lies substantially above average requirements and the learner is highly proficient in most areas of competency.
C	60-69%	**Achieved objectives well.** The learner has mastered the specific objectives and can apply them in unknown situations and contexts.
D	50-59%	**Achieved objectives satisfactorily.** The learner's achievement corresponds to average requirements. The learner may be in need of learning support in some areas.
E	40-49%	**Achieved the minimum number of objectives to be considered competent.** The learner may not have achieved all the specific objectives, but the learner's achievement is sufficient to exceed the minimum competency level. The learner is in need of learning support in most areas.
U	0-39%	**Ungraded.** The learner has not been able to reach a minimum level of competency in the objectives, even with extensive help from the teacher. The learner is seriously in need of learning support.

10.7 Conducting and recording assessment

Continuous assessment should be planned and programmed at the beginning of the year, and kept as simple as possible. Marks given for class activities, practical activities, project work, assignments, homework and short tests may be recorded for continuous assessment.

10.8 Assessment objectives

The four assessment objectives for Design and Technology are:

10.8.1 Assessment objective A: Knowledge with understanding

Learners should be able to:

A1 demonstrate the ability to state facts, recall and name items, recall and describe processes

A2 demonstrate the ability to apply and relate knowledge to basic design and manufacturing

A3 make reasoned arguments and anticipate consequences about outcomes of the design and realisation process

A4 demonstrate a crucial awareness of the interrelationship between design and the needs of society

10.8.2 Assessment objective B: Design problem solving

Learners should be able to:

B1 identify clearly, from a situation, a specific need for which a solution is required and compose a design brief

B2 analyse a problem by considering any relevant functional, aesthetic, human, economic and environmental design issues and draw up a design specification

B3 generate a range of outline solutions to a design problem, giving consideration to the constraints of time, skills and resources

B4 test and refine the functional and aesthetic effectiveness of design solutions

10.8.3 Assessment objective C: Design communication

Learners should be able to:

C1 recognise information in one form and where necessary change it into a more applicable form

C2 propose and communicate ideas graphically

C3 develop ideas and represent details of form, shape, constructive movement, size and structure through graphical presentation

10.8.4 Assessment objective D: Realisation

Learners should be able to:

D1 plan and organise the work procedure involved in the realisation of a solution

D2 select, from a range of resources, those appropriate for the realisation of the product

D3 demonstrate appropriate manipulative skills by showing an understanding of materials and their characteristics in relation to their use

D4 demonstrate appropriate manipulative skills by showing the ability to correctly and efficiently use instruments and tools used in the realisation of a product

10.9 Continuous assessment: detailed guidelines

A specified number of continuous assessment activities per term should be selected, graded and recorded. Not more than two assessments per term are to be topic tests. These continuous assessments must be carefully planned and marked according to a marking scheme, marking criteria or memorandum. The criteria used to assess activities other than tests should be given to the learner before the assessment activity. Evidence of the work produced by good, average and low-achieving learners, as well as the written assignment and marking scheme, has to be kept at school until the end of the next year. Teachers can choose

to grade and/or record more than the required continuous assessments if it is necessary for formative purposes. An end-of-year summative grade will be based only on the assessment tasks described in the syllabus. Not more than 40% of the continuous assessment may be based on tests, which include topic tests and end-of-term tests.

Types of continuous assessment

In Design and Technology, in the Junior Secondary phase, the continuous assessment tasks are as follows:

Projects: All the relevant stages in the design folder should be taken into account.

Each learner will undertake a personally identified project centred in the chosen option. The project, which will be internally marked and externally moderated, is expected to be completed over the final two terms of the course.

The work presented for assessment will typically be in the form of an A3 size folder and the 'made product/artefact'. The folder should include photographic evidence of the made product.

Grade 8: Learners should be introduced to the framework and stages of a design folder. Results achieved on tasks set on the application regarding the investigation and developing of the different stages within the proper framework, should be used as continuous assessment mark under the heading: "Practical investigation/topic tasks".

Grade 9: Learners are expected to identify, develop and plan a suitable design for a proposed artefact and to compile this information into a design folder according to the framework and stages introduced to in Grade 8. The folder should be completed by the end of Grade 9 and results recorded on the Record Sheet.

A learner may opt for a product/artefact other than proposed and designed during his/her Grade 8 year. However, he/she should then first complete a new design and compile an appropriate design folder for that specific product/artefact before realising the design into a completed artefact.

The finished artefact must be tested and an evaluation report written on the outcome of these tests to be included in their design folder. The design portfolio, together with photographic evidence of the made artefact, would be externally moderated.

Practical investigation: These are assessments of practical skills done during a practical activity where learners are required to plan and to carry out investigations and to collect, report and analyse information. Except for one major investigation or project towards the end of the second term/beginning of third term, activities should be aimed to assess not more than two practical skills.

Observations/reports/worksheets or topic tasks: These are activities that most teachers already use in their day-to-day teaching. These are recorded, assessed activities that could introduce a topic, be used during the teaching of a topic and /or revision a topic. They may well include assessment involving specific objectives to do with locating information, conducting surveys, analysing information or presenting information. This will involve assessments of specific objectives in all assessment objectives; however, not all assessment objectives need to be present in every topic task.

Topic tests: Completed topics should be concluded with a test indicating the achievements of the learners in these topics.

End-of-term test: This will be a more comprehensive topic test of the term's work. No homework should be assigned during the time of writing the end-of-term tests.

Summary of continuous assessment tasks

Continuous assessment Grade 8						
	Term 1		Term 2		Term 3	
Components	**Number & marks**	**Total**	**Number & marks**	**Total**	**Number & marks**	**Total**
Practical investigations	2×20	40	2×20	40	1x20	20
Topic tasks	2×10	20	2×10	20		
Topic tests	2×20	40	2×20	40	1x20	20
End-of- term tests	100	100	100	100		
Term marks		200		200		40
Weighted term marks (report marks)		(200÷2) 100		(200÷2) 100		
Total term mark						440
Converted term mark			(440÷11)			40
Design folder			(80x0.75)			60
CA mark			(40+60)			100

Continuous assessment Grade 9				
	Term 1		Term 2	
Components	**Number & marks**	**Total**	**Number & marks**	**Total**
Practical investigations	2×25	50	2×25	50
Topic tasks	2×25	50	2×25	50
Topic tests	2×25	50	2×25	50
End-of-term tests		150		150
Term marks		300		300
Weighted term marks (report marks)		(300÷3) 100		(300÷3) 100
Total term mark		(300+300)		600
Converted term mark		(600÷30)		20
Design folder				80
Product				50
CA Mark		(20+80+50)÷1.5		100

The continuous assessment (CA) marks for one term (trimester) is converted to a mark out of 100 (weighted mark). Only this mark should be used for the report at the end of Term 1 and Term 2. Learners should not write an examination at the end of the first two trimesters, but only an end-of-term test which is part of the CA and part of the weighted term mark.

10.10 End-of-year examination: detailed guidelines

In Grade 8 there will be an internal end-of-year examination and at the end of Grade 9 a semi-external examination. The Grade 9 papers will be set by DNEA and marked regionally. The purpose of this examination is to focus on how well learners can demonstrate their thinking, communication, and problem-solving skills related to the areas of the syllabus which are most essential for continuing in the next grade. Preparing for and conducting these examinations should not take up more than two weeks altogether right at the end of the year.

The description of the various papers for the written examination is as follows:

Written examination Grades 8 and 9		
Description of papers	**Duration**	**Marks**
This Paper will consist of **three** sections: **Section A:** Section A will consist of 10 short answer questions intended to assess knowledge (20 marks) **Section B:** Section B will consist of **three** structured questions intended to assess the learners' abilities of analysis and synthesis and will be set on: • graphics and graphic products (20 marks) • resistant materials (20 marks) • technology (20 marks) **Section C:** Section C will consist of **one** open-ended question intended to assess the learners' basic design and problem solving skills and abilities regarding graphics and graphic product, resistant materials and technology (20 marks)	2 h 30 min	100
Total Marks		**100**

10.11 Promotion mark

For Design and Technology in Grades 8 - 9 continuous assessment contributes 50% to the promotion mark and the end-of-year examination contributes 50%.The weighting of each assessment component is as follows:

Component	**Description**	**Marks**	**Weighting**
Written examination	Section A: Section B: Section C:	20 60 20	50%
Continuous assessment	Observation/report/work sheets, practicals, topic tests, end-of-term tests, design folder, product	100	50%
Total marks		**200**	**100%**

The promotion marks are calculated as follows:

Promotion mark Grade 8				
	Term 1	**Term 2**	**Term 3**	**Total**
Term mark	200	200	40	440
Converted term mark	(440÷11)			40
Design folder	(80x0.75)			60
CA mark	(40+60)			100
End-of-year examination				100
Promotion mark	(CA mark + end-of-year examination)÷2 (200÷2)			100

Promotion mark Grade 9			
	Term 1	**Term 2**	**Total**
Term mark	300	300	600
Converted Term Mark	(600÷30)		20
Design Folder			80
Product			50
CA mark	(150÷1.5)		100
End-of-year examination			100
Promotion mark	(CA mark + end-of-year examination)÷2 (200÷2)		100

10.12 Specification grid

The specification grid below shows the mark weighting allocated to each objective for both the written examination and continuous assessment.

Components	Weighting	Total (marks)
Assessment objectives for written examination		
Objective A Knowledge with understanding	40%	40
Objective B Design problem solving	16%	16
Objective C Design communication	22%	22
Objective D Realisation	22%	22
Assessment objectives for continuous assessment		
Objective A Knowledge with understanding	16%	16
Objective B Design problem solving	42%	42
Objective C Design communication	16%	16
Objective D Realisation	26%	26

10.13 Assessment Criteria

The descriptors of three levels of work are given with a mark band for each [High (H); Medium (M) and Low (L)]. The highest mark in a band is for work that fully satisfies the descriptor.

The Design Folder

(For Grade 8 criteria 1-4 are used and for Grade 9 criteria 1-5 are used**)**

Criterion	Level		Part Mark	Max Mark
1. General Analysis of the problem and formulation of Design brief:	H M L	A wide-ranging analysis with many of the aspects of the problem considered and a clearly expressed brief. A relatively sound analysis with a range of aspects of the problem considered and a full brief. An analysis with aspects of the problem considered and a skeleton brief only	7 –10 4 – 6 1 - 3	**10**
2. Preparation and precision of Specification:	H M L	A concise and comprehensive specification. A statement of some of the specific requirements. An unclear specification	7 –10 4 – 6 1 - 3	**10**
3. Exploration of Ideas:	H M L	A wide range of ideas combined with imaginative interpretation. A fair range of ideas with some ideas examined. Little variety of ideas with a tendency to concentrate on a single concept.	14-20 8 - 13 1 - 7	**20**
4. Development of Proposed Solution:	H M L	Thorough and thoughtful development with attention to fine detail. A developed idea with sufficient attention to detail only. An undeveloped idea lacking in attention to detail.	14-20 8 - 13 1 - 7	**20**
5. Planning for Production:	H M L	Good insight into processes involved, clear and detailed planning. Some awareness of main processes involved a simple plan. Consideration of processes, lacking in detail, no overall plan.	14-20 8– 13 1 - 7	**20**

The Product

(Only for Grade 9)

Criterion	Level		Part Mark	Max. Mark
1. Quality of Production:	H	Overall judgement required how range of skills contained has been applied. Typically:	21-30	**30**
	M	Precise, accurate, well finished. Mastery of most aspects, refinement of detail.	11-20	
	L	Competent, some minor inaccuracies, blemishes, some degree of mastery. Product marred by limited skills.	1-10	
2. Evaluation:	H	Detailed appraisal related to specification, objective tests applied where possible, and modifications proposals.	11-15	**15**
	M	Main aspects of specification critically appraised some objectivity.	6-10	
	L	General overall appraisal with little reverence to specification.	1 - 5	
3. Fitness for Purpose:	H	Completed solution fulfilling the brief.	4 – 5	**5**
	M	Completed solution fulfilling the brief in part only.	2 – 3	
	L	An incomplete solution failing to satisfy the brief.	0 - 1	

Annexe 1: Glossary of terms

acquaint	to make somebody aware off or familiar with something
aesthetics	how something looks, especially when considering how pleasing it is
analyse	examine information in detail to discover patterns or relationships
axonometric	used to describe a method of drawing a 3-dimensional object so that the vertical and horizontal axes are drawn to scale but the curves and diagonals appear distorted
CAD	Computer Aided Drafting, used to make sketches with the help of a computer e.g. building plans
calculate	a numerical answer is required - working must be shown
CAM	Computer Aided Manufacturing, used where instructions for manufacturing is given via a computer
CFCs	(chlorofluorocarbons) chemicals used in refrigerators and in some aerosols that damage the ozone layer
classify	to assign things or people to classes or groups
communication (graphical)	the exchange of information between individuals, by means of speaking or using a system of signs or behaviour (drawing)
compare	find resemblances and differences
conceptualise	to arrive at a concept or generalization as a result of things seen experienced or believed
define	give the meaning of
demonstrate	to show or prove something clearly and convincingly
describe	write down what you do, or what you would see, in as much detail as possible
determine	use the information given to work out the answer
discuss	give a critical account of the points involved in the topic
display	to make something visible or available for others to see
distinguish	show the difference between one or more variables
ergonomics	the study of how a workplace and the equipment used there can best be designed for comfort, safety, efficiency and productivity
evaluate	use the information provided to make a judgement about something
explain	give a reason for your answer
give/state/write	write down your answer
hydraulic	relating to or operated by a device in which pressure applied to a piston is transmitted by fluid to a larger piston, giving rise to a larger force
identify	find out what is unique about a material or situation / recognise

interpret	reasoning or some reference to theory, depending on the context / explain the meaning of something
investigate	examine a problem in a systematic way
list	name or write a number of items to form a record
mechanism	the methods, procedures or processes in how something works or is done
media	the various means of mass communication thought of as a whole, including radio, television, magazines and newspapers, together with the people involved in their production
natural	present in or produced by nature, rather than being created by people, for example a tree or spider web.
oblique	sloping or joining something at and angle that is not a right angle
pictorial	containing illustrations or photographs as opposed to written text (3-D sketches)
pneumatics	the mechanical properties of air and other gases
principle	the basic way something works
pulley	a mounted rotating wheel with a grooved rim over which a belt or chain can move to change the direction of a pulling force
recognise	be aware of a fact or problem
recycle	to process used or waste materials so that it can be used again
relate	find the relationship between one or more variables
report	to give information about something that has happened
research	methodical investigation into a subject in order to discover facts, to establish or revise a theory or to develop a plan of action based on the facts discovered
scale	a ratio representing the size of an illustration or reproduction, especially a map or a model, in relation to the object it represents
select	choose from a number of alternatives
sketch	in case of diagrams, make a simple, freehand drawing and in graph work, the shape and/or position of the curve should be given
specification	a detailed description of a particular thing, especially one detailed enough to provide somebody with the information needed to make that thing
sprocket	a projecting tooth on a wheel or cylinder that engages with the links of a chain or with perforations in a film to make the chain or film move forward
technology	scientific knowledge used in practical ways in industry
time management	to plan and execute a task within a given period

triangulation	a navigation technique that uses the trigonometric properties of triangles to determine a location or course by means of compass bearings from two points a known distant apart.
trusses	to support or strengthen a roof, or bridge or other elevated structure with a network of beams and bars
wasting	misuse / use to no purpose / extravagant or ineffective use of an asset or materials

Annexe 2: List of tools, equipment and materials

- Selection of paper and card
- Basic drawing equipment: Rotring A3 drawing board (college board), ruler, compasses, pencils, rubber, set squares (30 and 45 degrees)
- Colouring pencils, markers
- Modelling equipment: scissors, craft knives and adhesive tape
- Selection of available wood, metals and plastics
- Marking out tools: Tri-square, divider, scriber, punches, measuring tape, steel rule
- Holding devices: vice, G-clamps,
- Power tools: electric hand drill, angle grinder, jig saw, bench grinder, soldering iron, welding machine, multi tester, pillar drill, generator, router machine, pipe bender, belt sander
- Hammers: mallets, claw hammer
- Posters/brochures of tools and equipment
- Selection of abrasive papers, paints, polishes, adhesives, brushes, cleaning materials
- Fitting and fixing: nails, screws, nuts and bolts, rivets and dowels
- Protective clothing: eye goggles, dust masks, apron
- Cutting tools: saws (tenon saw, hack saw, coping saw), snips, trimming knives, files, scrapers, jack planes, chisels, drill bits, rasps, combination pliers, side cutters.
- Other bench tools: pincer, screwdriver sets, hand drill, spanners, rivet gun.
- Gear kits (spur, idler, bevelled, worm, rack and pinion)
- Bridge building kits

Annexe 3: Assessment record sheet for Grade 8

Assessment record sheet: Design and Technology **Grade: 8…….** **Year:………….**

School:…………………………………………………………………..… **Teacher:…………………………………………………..…………..**

Name of Learner	Term	Practical investigation		Topic task		Topic test		End-of-term test	Term mark		Weighted term mark	Total term mark (200+200+40)	Converted term mark (440÷11)	Design folder (80x0.75)	CA mark (40+60)	End-of-year examination	Promotion mark (200÷2)
		20	**20**	**10**	**10**	**20**	**20**	**100**	**200**	**40**	**100**	**440**	**40**	**60**	**100**	**100**	**100**
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Annexe 4: Assessment record sheet for Grade 9

Assessment record sheet: Design and Technology **Grade: 9……** **Year:…………….**

School:…………………………………………………………….….. **Teacher:……………………..……………………..**

Name of Learner	Term	Practical investigation		Topic task		Topic test		End-of-term test	Term mark	Weighted term mark (300÷3)	Total term mark	Converted term mark (600÷30)	Design folder	Product	CA mark (20+80+50)÷1.5	End-of-year examination	Promotion mark (200÷2)
		25	**25**	**25**	**25**	**25**	**25**	**150**	**300**	**100**	**600**	**20**	**80**	**50**	**100**	**100**	**100**
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The National Institute for Educational Development
Private Bag 2034
Okahandja
NAMIBIA

Telephone: +264 62 509000
Facsimile: +264 62 509073

Website: http://www.nied.edu.na

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