

# EDUCATORS' GUIDE FOR PEDAGOGY AND ASSESSMENT

USING A LEARNING OUTCOMES APPROACH



# LIFE SCIENCE

LEVELS **8** **9** **10**



Learning  
Outcomes  
Framework



## Learning Outcomes Framework

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# Introduction

Following the endorsement of the National Curriculum Framework (NCF) in 2012, an ambitious plan was launched with the aim of putting theory into practice. Built upon the National Minimum Curriculum (2000), it addressed the gaps in Malta's learning processes where emphasis shifted from teaching the subject to teaching the learner.

The National Minimum Curriculum framework took important policy-related documents issued by the European Commission into consideration. These included the *Key Competences for Lifelong learning – A European Reference Framework* (included in the annex of the Recommendations; 2006/962/EC); the *Strategic Framework for European Cooperation in Education and Training* (ET 2020; 2009) and *Europe 2020 – A Strategy for Smart Sustainable and Inclusive Growth* (COM (2010) 2020) which is the follow up to the *Lisbon Strategy for Growth and Jobs* (Memo 06/478/12 Dec 2006).

Against the background of Malta's historical development and on the basis of the curriculum and EU documentation the NCF seeks to provide strategic direction by rationalising the necessary changes and their implications for area/subject content, pedagogies and assessment. The NCF was presented within a lifelong learning perspective and celebrates diversity by catering for all learners at each stage of their education. It aims to introduce more equity and decentralisation in the national system. The NCF seeks to present a seamless curriculum which reflects smooth transitions, building and extending on the firm foundations in early childhood education. In essence, the NCF aims to provide a quality education for all learners, reducing the percentage of early school leavers and encouraging their enrolment in further and higher education.

The NCF proposed a Learning Outcomes Framework (LOF) as the keystone for learning and assessment throughout the years of compulsory schooling. The aim of the Learning Outcomes Framework is to free schools and learners from centrally-imposed knowledge-centric syllabi and to give them the freedom to develop programmes that fulfil the framework of knowledge, attitudes and skills-based outcomes that are considered national education entitlement of all learners in Malta. The LOF is thus intended to eventually lead to more curricular autonomy of colleges and schools so as to better address the learning needs of their learners.

A number of other local policy documents published in recent months have also contributed to the need of a learning outcomes-based approach in today's educational structures. In particular, the *Framework for the Education Strategy for Malta 2014 – 2024* (2014), *A National Literacy Strategy for All in Malta and Gozo 2014 – 2019* (2014), *A Strategic Plan for Early School Leaving in Malta 2014* (2014), *Education for All: Special Needs and Inclusive Education in Malta* (2014), *Malta National Lifelong Learning Strategy 2020* (2015) and *Respect for All Framework* (2015) all point toward the need to provide equitable opportunities for all learners to achieve educational outcomes at the end of their schooling which will enable them to participate in lifelong and adult learning, reduce the high incidence of early school leaving and ensure that all learners attain key competences in literacy, numeracy, science and technology.

The ESF 1.228 Project – *Design of Learning Outcomes Framework, Associated Learning and Assessment Programmes and Related Training* is intended to deliver this Learning Outcomes Framework approach to the educators and all relevant stakeholders within compulsory schooling. It addresses the holistic development of all learners and advocates a quality education for all as part of a coherent strategy for lifelong learning which aims to ensure that all children have the opportunity to obtain the necessary skills and attitudes to be future active citizens and to succeed at work and in society irrespective of socio-economic, cultural, racial, ethnic, religious, gender and sexual status.

The LOF will allow for flexibility in teaching and learning programmes in order to address specific needs and to build upon strengths within the context of the learning communities in different colleges and schools. This concept of flexibility is promoted throughout the entire framework. While acknowledging that out-of-school factors such as poverty and social exclusion affect learner achievement, the LOF seeks to improve learners' learning experiences by encouraging creativity, critical literacy, entrepreneurship and innovation at all levels. This will allow learners to reach their potential by connecting what they have learnt to their individual contexts. Consequently, this will help learners develop a positive attitude towards learning and a greater appreciation of its usefulness.

The move from a prescriptive content-based curriculum towards a learning outcomes approach will impact all programmes in schools and all external examinations and assessment at the end of compulsory education in Malta.

The LOF was also designed to meet the four broad education goals outlined in the *Education Strategy for Malta 2014 – 2024* (Ministry for Education and Employment, 2014), namely to:

- reduce the gaps in educational outcomes between boys and girls and between students attending different schools, decrease the number of low achievers, raise the bar in literacy, numeracy and science and technology competence and increase student achievement.
- support educational achievement of children at-risk-of-poverty and from low socio-economic status and reduce the relatively high incidence of early school-leavers.
- increase participation in lifelong learning and adult learning.
- raise levels of learner retainment and attainment in further, vocational and tertiary education and training.

The Learning and Assessment Programmes (LAPs) which were drawn up for each subject will ensure that the focus is on the learner. As such, learning activities will be geared to stimulate creativity and imagination; enable learners to make correct value judgements when editing/correcting their own work; develop learners' investigative and constructive skills by making use of different media and promote receptive skills (listening and reading) which lead to productive skills (speaking and writing). LAPs are also intended to create an atmosphere where learners develop their own problem solving skills and their ability to think and reason logically; reflect on outcomes and consequences and explore possible alternatives and apply interesting and realistic contexts that are personally meaningful to them.

With the use of LAPs, teachers will be encouraged to create situations and resources which are intrinsically interesting, culturally embedded and cognitively engaging and enable learners to connect the various types of information that they have acquired.

## THE LEARNING AND ASSESSMENT PROGRAMME FOR LIFE SCIENCE

This document, which is aimed at policy makers, educators and educators in the classroom, presents the Learning and Assessment Programme (LAP) for Life Science.

The LAP comprises:

- **The Learning Outcomes Framework (LOF)** - this encompasses a set of subject learning outcomes (SLOs) that set out what a learner is expected to know, understand or be able to do as a result of a process of learning. These learning outcomes are designed to be used in a range of delivery contexts and taught using different methods. They state the end result rather than describe the learning process or the learning activities.
- **Notes on Pedagogy and Assessment** - the learning outcomes are written in a way that informs pedagogy and, in conjunction with the assessment strategies related to each outcome, set a clear assessment expectation. This document sets down good practice teaching and assessment guidelines which educators may wish to take on board and adapt to meet the needs of their learners.

This document has been collaboratively developed by the Outlook Coop Learning Outcomes Framework Joint Venture comprising Outlook Coop as the lead partner, East Coast Education Ltd. and the University College London Institute of Education together with the Directorate for Quality and Standards in Education (DQSE). Mr Barry Smith (Joint Venture Technical Director), Mr Godfrey Kenely (Joint Venture Contract Director), Dr Michelle Attard Tonna (Head of Project) and Mr Gaetano Bugeja (Project Leader) directed the project experts.

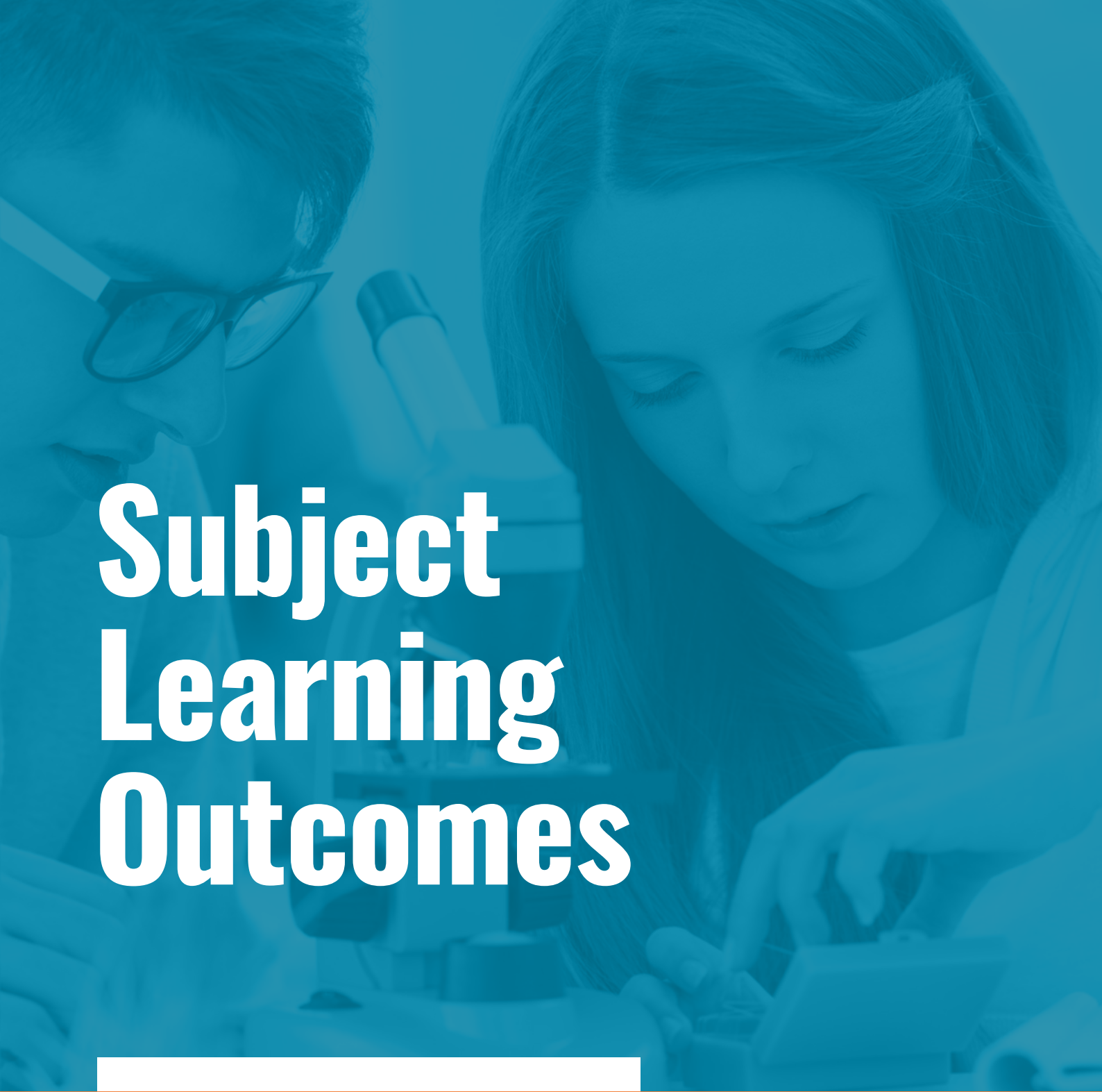
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# Subject Learning Outcomes

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## LIFE SCIENCE

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LEVELS **8** **9** **10**

The Subject Learning Outcomes (SLOs) for Life Science span from Attainment Level 8 to Attainment Level 10.

Within the Learning Outcomes Framework, Level 10 is viewed as the ‘gifted and talented’ level. Outcomes within this level sit at the upper end of the ability spectrum and extend learners further.







The core concept is *better* rather than *more*. At Level 10 learners demonstrate a deeper understanding and wider application of Level 9 content which marks the end of compulsory schooling. Level 10 outcomes may draw on three main areas:



- increased sophistication of understanding of the Level 9 content
- greater learning autonomy in developing understanding and skills
- increased application and problem solving.

It should be noted that each Attainment Level can be extended further and suggestions for this will be included in the Pedagogy and Assessment section of the document.









## LEVEL 8






### Subject Focus: Principles of Life

- I can distinguish between living things and non-living things by identifying and discussing the characteristics common to all organisms.  
 COGNITIVE LEARNING
- I can describe viruses as complex molecules consisting of a protein coat surrounding genetic material.
- I can explain the fact that because viruses need a living cell host in order to reproduce, they are not living organisms since they do not have all characteristics common to all organisms.
- I can distinguish between eukaryotic cells and prokaryotic cells using the presence of the nucleus and membrane-bound organelles, limited to mitochondria and chloroplasts, as their distinguishing characteristics.
- I can distinguish between plant cells and animal cells by the presence or absence of specific organelles *such as the presence or absence of chloroplasts and structures e.g. cell wall*, related to the organisms' mode of life *e.g. autotrophic and heterotrophic*.
- I can explain the functions of the plant and animal cell structures visible under a light microscope.
- I can describe the mitochondrion as an organelle specialised in aerobic cellular respiration.
- I can use a microscope to prepare a temporary slide, *e.g. observing pond life or onion epidermal cells*.  
 PERSONAL LEARNING
- I can identify and describe net diffusion as the phenomenon driving particles across membranes.  
 INFORMATION MANAGEMENT
- I can identify and describe osmosis as the special diffusion of water through semi-permeable membranes.
- I can predict and explain the effects of osmosis on cells of protoctists, plants and animals.  
 INFORMATION MANAGEMENT
- I can design and perform an experiment to investigate the effects of osmosis on plant cells.  
 CREATIVE LEARNING
- I can distinguish between a turgid and a plasmolysed plant cell and their effects on overall plant structure and function.
- I can compare the surface area to volume ratios of different organisms.  
 MANAGING LEARNING
- I can identify biological structures with a large surface area for increased passage of substances.
- I can use the concept of active transport to explain nutrient uptake against a concentration gradient.


17. I can explain that atoms are the constituents of molecules, which in turn can make up organelles, which in turn are the components of cells.
18. I can explain that cells can team up and form tissues, which in turn make up organs and systems, thus constituting organisms.  
 LEARNING TO BE
19. I can explain the functioning of a multicellular body through cell specialisation.  
 COMMUNICATING FOR DIVERSITY

### Subject Focus: Functions of Life Part 1: Processing Food and Metabolites

1. I can deduce why water is fundamental to life because of its solvent properties and high specific heat capacity, or the rate at which heat can be lost or gained by a substance.  
 LEARNING TO KNOW
2. I can describe lipids, proteins and carbohydrates as large molecules made out of many smaller molecules; the formation of the large molecule gives it specific properties *such as the fact that starch is insoluble in water but glucose is soluble*.
3. I can use the concept of difference in solubility in water to explain why carbohydrates *such as monosaccharides, disaccharides and polysaccharides*, have different uses, *e.g. energy, transport, for storage or structure*.  
 EXPRESSIVE LANGUAGE
4. I can relate the use of lipids, proteins, carbohydrates in life to some of their physical properties, *e.g. lipids in membranes due to their immiscibility with water*.  
 COGNITIVE LEARNING
5. I can describe symptoms of diseases deriving from a deficiency and excess consumption of carbohydrates, proteins and lipids *e.g. marasmus resulting from a deficiency in carbohydrates, diabetes from an excess of carbohydrates*.
6. I can explain why the properties of the 'chemicals of life' *e.g. solvent properties of water, polymerization or the joining of small molecules into larger molecule chains*.
7. I can use models or diagrams to distinguish between an amino acid, a polypeptide and a functional protein.
8. I can explain the concept of chemical reaction with reactants that join irreversibly to form products.
9. I can use the lock-and-key model of enzyme activity to explain the binding of the substrate to the enzyme active site.
10. I can describe a number of factors namely pH, temperature, and concentration that affect rates of reactions.
11. I can explain the effect of temperature on enzyme reaction rate using the Kinetic Theory of Matter.  
 EXPRESSIVE LANGUAGE
12. I can give everyday examples of how changes in temperature and pH change protein structure and function, *e.g. cooking proteins, hair straightening*.
13. I can describe the sources and functions of iron, calcium, sodium, potassium, phosphorus, nitrogen and magnesium in plants and vitamins A, B6, B12, C and D in the human diet.  
 LISTENING AND SPEAKING
14. I can describe some symptoms of deficiency of iron, calcium, sodium, potassium, phosphorus, nitrogen and magnesium in plants and vitamins A, B6, B12, C and D in the body.  
 LEARNING TO KNOW
15. I can deduce the function of dietary fibre in our diet from the fact that it is not digested by the human digestive system.
16. I can use experimental evidence to identify the presence of lipids, proteins, reducing sugars and starch in food.  
 CREATIVE LEARNING
17. I can describe enzymes as biological catalysts enhancing the speed of chemical reactions in living things and industry, *e.g. biological washing powders*.  
 INTERPERSONAL
18. I can enlist the chemical and biological properties of enzymes, as resulting from their catalytic and protein nature.

19. I can design simple experiments to investigate the effect of temperature, pH and concentration on the rate of enzyme catalysed reactions.
-  PRACTICAL
20. I can define photosynthesis as a chemical process in which inorganic material is converted into food using light as the energy source.
21. I can explain photosynthesis as a change from light to potential and chemical energy.
22. I can summarise photosynthesis using a chemical equation and point out the factors which are required for such a reaction to take place.
-  PLANNING AND REFLECTION
23. I can understand and analyse experiments to investigate the effects of light, temperature and carbon dioxide on the rate of photosynthesis of an aquatic plant, *e.g. Elodea*.
-  PRACTICAL
24. I can distinguish and describe ingestion, digestion, absorption, assimilation and egestion in holozoic nutrition.
25. I can distinguish the role of physical and chemical digestion.
26. I can explain the importance of following a balanced diet and discuss the implications of under- and over-nutrition, including eating disorders and lifestyle choices to general health problems.
27. I can summarise the reactions catalysed by digestive enzymes, especially amylase, pepsin and lipase.
28. I can distinguish and explain the importance of the components of saliva, gastric and pancreatic juice for digestion.
29. I can describe the functions of the liver for nutrient storage and processing, detoxification and deamination.
30. I can compare the role of bile in fat emulsification to physical digestion.
31. I can predict the implications of surface area to volume ratio in the need to develop specialised organs for nutrient absorption.
32. I can describe the fate of the soluble products of digestion after intestinal absorption, in relation to the size and shape of the concerned molecules. *e.g. amino acids for protein synthesis; glucose for glycogen and fatty acids and glycerol for triglycerides.*
33. I can relate the essential roles of mutualistic gut microbiota in digestion and immunity in humans and herbivores, more specifically, the importance of bacteria in cellulose digestion *i.e. fermentation and humans respectively.*
34. I can deduce the diet of an animal by observing features of its digestive system, *e.g. jaws in carnivores and herbivores.*
-  CREATIVE LEARNING
35. I can compare and describe the position and function of xylem and phloem tissue in angiosperm stems and roots as seen under the light microscope.
36. I can explain the process of transpiration and identify the transpiration streams as a means of water transport in vascular plants.
37. I can describe the transpiration stream as a process that creates negative pressure because of suction pressure *e.g. as happens when using a drinking straw.*
38. I can design, perform and use experimental data to investigate the effect of temperature, humidity, wind and light on the rate of transpiration.
-  MANAGING LEARNING
39. I can assess the consequences of transpiration on plants living in moist or arid conditions.
40. I can explain the fact that the xylem in plants has specific characteristics, namely the fact that they are dead, hollow, continuous tubes that give support to a plant and allows for transpiration stream.
41. I can link the characteristics of the xylem vessels with their capability to cause water to rise up into them by means of processes that describe the movement of water because of its specific physical characteristics *e.g. narrow tubes encourage water to rise up them by capillarity due to the surface tension properties of water.*
42. I can describe the functioning mechanism of the heart by explaining how its different components *such as blood vessels, atria, ventricles and valves,* work together.
43. I can explain the adaptations of the three different types of blood vessels to their function.
44. I can illustrate the interdependence between different body organs through a description of the circulation of blood between heart, lungs and body.


45. I can identify the concepts of diffusion, osmosis and active transport as the main processes of substance exchange across membranes.
46. I can give an account of the transport and immune functions of the components of the blood *e.g. some white blood cells produce antibodies and others perform phagocytosis.*
47. I can relate the structure of the red blood cell to its role in oxygen transport.
48. I can describe the role of the lymphatic system in immunity, maturation of some white blood cell types and transport of fats to the circulatory system.
49. I can define cellular respiration as the chemical process in which energy is released from food to be converted to ATP as the universal energy currency of cells.
50. I can classify the reaction of cellular respiration as a reaction which converts potential energy to a number of other forms of energy *such as heat, sound, kinetic etc.*
51. I can distinguish between the energy output and requirements of aerobic and anaerobic respiration using the chemical equation and taking into account the requirements for such reactions to occur *e.g. glucose and the presence/absence of oxygen.*
52. I can define an exothermic reaction as one where heat energy is released as a result of the reaction.
53. I can classify the reactions of cellular respiration as exothermic reactions.
54. I can understand breathing as a process leading to a gaseous exchange *e.g. resulting in a change in oxygen and carbon dioxide concentration in the alveoli and a concentration gradient.*
55. I can explain the economic importance of alcoholic fermentation in terms of the by-products of the process, namely carbon dioxide in bread making and alcohol in wine making.

 SELF AWARENESS


56. I can explain the economic importance of lactic acid fermentation *e.g. using yoghurt production.*
57. I can perform simple experiments to investigate the production of carbon dioxide by yeast and germinating seeds.

 COGNITIVE LEARNING



58. I can identify leaf features *e.g. general surface area of leaf, stomata, guard cells and loosely packed spongy mesophyll*, enabling gas exchange in plants.
59. I can describe the gross structure of the human respiratory system *such as trachea, bronchi, bronchioles, alveoli.*
60. I can predict the implications of surface area to volume ratio in terms of the need to develop specialised organs for gas exchange.
61. I can describe the process of ventilation in terms of the relationship between pressure and volume.
62. I can identify and relate the gaseous exchange system features which include a large surface area and high vascularity in fish gills to their effectiveness of gas exchange underwater.
63. I can relate the excess oxygen consumption after exercise to oxygen debt developed by muscles.
64. I can link the behaviour of carbon monoxide to its strong affinity to haemoglobin.
65. I can relate the affinity of carbon monoxide to haemoglobin to its lethality.
66. I can relate the components of tobacco products to addiction, the health of the lungs *such as increased risk of Chronic Obstructive Pulmonary Disease (COPD) and emphysema and increased risk of cancer.*

 LEARNING TO BE







## Subject Focus: Functions of Life Part 2: Maintaining Balance and Responding to the Environment



1. I can list water availability and temperature as two main conditions that affect life.
  2. I can define homeostasis as the maintenance of a constant internal state by organisms.
  3. I can explain the skin's thermoregulatory functions, through sweating, vasodilation, vasoconstriction, using physical principles of heat transfer and evaporative cooling.
-  COGNITIVE LEARNING
4. I can distinguish between ectothermic and endothermic vertebrates using temperature versus time graphs.
  5. I can deduce the need for osmoregulation in unicellular protocyst that have no cell wall.
  6. I can use the concepts of active transport, osmosis and diffusion to explain the excretory and osmoregulatory role of the human kidneys as performed by the nephrons *i.e. ultrafiltration, selective reabsorption.*











7. I can explain how a dialysis machine works and compare it to the operating mechanism of the kidney.  
 COGNITIVE LEARNING
8. I can list the three types of muscles in the human body and state their main function.
9. I can explain the fact that locomotion in the human body is brought about by a combination skeletal muscle attached to bone.
10. I can describe the principle behind the specialised structures that support the body of animals, namely the hydrostatic skeleton, a fluid-filled cavity, the exoskeleton, a deposition of chitin all over the body and the endoskeleton, as a formation of bony structures. No coverage of bone histology is required, within the body.
11. I can acknowledge the fact that exo- and endoskeletons also offer protection of internal organs.
12. I can relate positive or negative tropisms to plant survival in different environmental conditions.
13. I can use experimental evidence to explain the effect of auxin on phototropism and geotropisms in plant stems and roots.  
 CREATIVE LEARNING
14. I can explain the function of adrenaline in preparing the body for fight and flight. I can explain the function of the thyroid gland found in the neck as a source of production of growth hormones which regulates growth and development.
15. I can use blood glucose regulation by insulin and glucagon as an example of negative feedback in hormonal control.

### Subject Focus: Diversity of Life

1. I can link the diversity of life to the fact that living things have evolved over a long period of time in different environments on earth.
2. I can deduce how changes in the environment cause natural selection of populations, which, over long periods of time, result in evolutionary differences among organisms.
3. I can refer to the taxonomic and binomial systems as devised by humans to classify and name organisms.  
 SOCIAL CHANGE
4. I can explain evolution as change over time.
5. I can link evolution to factors *such as natural selection*.
6. I can quote the development of antibiotic resistance in bacteria and pesticide resistance in pests as an example of natural selection.
7. I can use the concept of selection to explain the loss of function of a vestigial structure, *e.g. appendix in humans*.
8. I can explain how the physical features of organisms enable them to survive in their habitat.  
 LEARNING TO KNOW
9. I can identify bacteria as ubiquitous, fast reproducing prokaryotes with a bacterial cell wall and genetic material not surrounded by a nuclear membrane.
10. I can compare the development of antibiotic resistance in bacteria and pesticide resistance in pests as a result of careless use of antibiotics and pesticides in terms of evolution by natural selection.  
 LEARNING TO BE
11. I can identify protocists as being the ancestors of multicellular organisms.
12. I can appreciate the diversity in the Kingdom protocista in terms of: cellular structure being unicellular and multicellular; feeding - autotrophic and heterotrophic; locomotion, using flagella, cilia and pseudopodia. *E.g. Cystoseira (bladder-weed), Amoeba, Euglena and Paramecium*.
13. I can appreciate the diversity of Fungi in terms of: cellular structure, multicellular/hyphae and unicellular and modes of reproduction *i.e. asexual spore formation and budding. E.g. Rhizopus and Saccharomyces*.  
 EXPRESSIVE LANGUAGE
14. I can explain that organisms are classified into taxa according to their main physical features using cnidarians, (radial symmetry), platyhelminthes, (flat body) annelids (body segments), molluscs (shell), arthropods (jointed appendages and exoskeleton), echinoderms (spines and pentamerous symmetry) and vertebrates (chambered heart, endoskeleton) as representative examples.  
 READING AND UNDERSTANDING
15. I can explain that organisms are classified into taxa according to their main physical features using cnidarians, (radial symmetry), platyhelminthes, (flat body) annelids (body segments), molluscs (shell), arthropods (jointed appendages and exoskeleton), echinoderms (spines and pentamerous symmetry) and vertebrates (chambered heart, endoskeleton) as representative examples.  
 COGNITIVE LEARNING


15. I can appreciate the diversity of arthropods in terms of: body segments *such as 2, 3 or many and number of legs i.e. 3, 4, 5 or a number of pairs and can differentiate between myriapods, arachnids, crustaceans and insects.*
-  **READING AND UNDERSTANDING**
16. I can appreciate the diversity of insects in terms of their life cycle either complete or incomplete *e.g. the diversity encompassed in the life cycle of grasshoppers and butterflies.*
17. I can appreciate the diversity of vertebrates in terms of: skin covering *i.e. thin scales, moist skin, waterproof scales, feathers and hair; respiratory surfaces such as gills, skin, and lungs and ability to regulate body temperature ectothermic and endothermic. E.g. the diversity of fish, amphibians, reptiles, birds and mammals.*
18. I can explain the fact that, through the process of evolution, animals developed features, namely tracheae or lungs, exo- or endoskeleton, appendages, that could support body weight and that enabled life to move from water to dry land.
19. I can appreciate the diversity of plants in terms of: presence of vascular structures; spore or seed formation and presence of seed in cones or fruit. *E.g. mosses, ferns, conifers and flowering plants.*
-  **LEARNING TO DO**
20. I can explain the fact that, through the process of evolution, plants developed features, namely the development of support and vascular tissue, that enabled life to move from water to dry land.

### Subject Focus: Life Relationships




1. I can distinguish between biotic and abiotic components of a local ecosystem, *e.g. garrigue, shoreline.*
2. I appreciate that there are many biotic and abiotic interactions within an ecosystem.
-  **LEARNING TO KNOW**
3. I can talk about the fact that competition between organisms is a major force in natural selection.
4. I can explain how predators and prey evolved adaptations *e.g. camouflage*, to increase their chances of survival.
5. I can represent feeding relationships in an ecosystem using food chains and food webs.
6. I can describe the general features of the different trophic levels in a local ecosystem.
7. I can distinguish the terms 'alien' 'indigenous' and 'endemic' and give local examples for each, *e.g. Geranium Bronze Butterfly, (Cacyreus marshalli) as an example of a local alien species; Carob tree (Ceratonia siliqua) as a local indigenous species and Maltese Wall Lizard (Podarcis filfolensis) as an endemic species.*
-  **LEARNING TO DO**
8. I can relate the success of angiosperms with the flower, particularly the insect-pollinated flower, especially their relationship with insects.
-  **LEARNING TO KNOW**
9. I can identify the main sampling unit as a quadrat.
10. I can use a sampling method to measure the population size of a plant.
11. I can determine different organisms in different ecosystems by observing species in the field.
12. I can explain how the biotic and abiotic components of a local ecosystem interact through competition, predation and organism adaptations in response to limited resources.
-  **LEARNING TO KNOW**
13. I can appreciate the diversity of lifestyles symbiosis, *e.g. mutualism, parasitism*, as affecting the life of most organisms, *e.g. gut microbiota, lichens.*
-  **LEARNING TO KNOW**
14. I can explain why the body of a parasite has evolved differently from other members of its phylum in response to its mode of life, *e.g. Fleas (Siphonaptera), mosquitoes, Culex pipiens, broomrape (Orobanche sp.).*
15. I can explain the exploitation of the mutualistic relationship between leguminous plants and nitrogen fixing bacteria in crop rotation.
-  **LEARNING TO DO**
16. I can recognise interactions between different organisms as processes where there is constant conversion of energy type.
-  **LEARNING TO KNOW**
17. I can define and link photosynthesis, consumption, respiration and combustion within the carbon cycle.
-  **MANAGING LEARNING**









# LEVEL 9

## Subject Focus: Functions of Life Part 2: Maintaining Balance and Responding to the Environment



1. I can distinguish between the structures and functions of a sensory, motor and interneuron.
2. I can attribute the flow of electrical impulse along a neurone to the movement of free moving charged particles or ions. Details of the mechanism of impulse transmission are NOT required.
3. I can explain the role of neurotransmitters in synaptic transmission as the release of a chemical messenger to fire an impulse in the relay/motor neurones.
4. I can distinguish between central and peripheral nervous systems.
5. I can explain the basic functions of the cerebrum, cerebellum and medulla in the human brain.
6.  SOCIAL LEARNING
6. I can link together the functions of a receptor, sensory, inter-and motor neuron.
7. I can explain what a reflex action is and its survival value.
8. I can label a simple diagram of a reflex arc.
9. I can explain the responses of the nervous system as arising directly or indirectly from stimuli detected by sensory receptors *such as those found in the skin*.
10. I can distinguish between nervous and endocrine control of the body.
11. I can explain that the nervous and hormonal systems can sometimes work together *e.g. adrenaline works in conjunction with the autonomic nervous system during times of flight or fight*.
12. I can use the effect of antidiuretic hormone on the nephrons *e.g. homeostasis*.
13. I can explain reflexes as the basis of control in simple animals and survival in advanced vertebrates.






## Subject Focus: Functions of Life Part 3: Promoting Future Generations

1. I can distinguish between sexual and asexual modes of reproduction.
2. I can distinguish between different forms of asexual reproduction across kingdoms; binary fission, budding, asexual spores, vegetative propagation.
3. I can deduce the need to copy genetic material before cell division.
4. I can distinguish between gametes and somatic cells.
5. I can distinguish between mitosis and meiosis.
6. I can distinguish between the challenges faced by flowering and non-flowering plants to disperse their reproductive structures, *e.g. spores, pollen, seeds* and link this with the adaptations of flowering plants to survival.
7. I can explain the process of germination as the generation of a plant from a seed.
8. I can design an experiment to investigate the importance of oxygen, water, and a suitable temperature for germination.
9.  CREATIVE LEARNING
9. I can identify the function of the basic parts of a flower.
10. I can describe pollination, fertilisation, seed and fruit formation in angiosperms.
11. I can deduce the method of seed dispersal from the fruit/seed structure.
12.  COGNITIVE
12. I can identify and explain the function of the basic parts of the male and female reproductive system.
13. I can link the male and female secondary sexual characteristics to the hormones that trigger their development.
14. I can describe the menstrual cycle as controlled by follicle stimulating hormone, luteinising hormone, oestrogen and progesterone.
15. I can describe copulation, fertilisation, implantation, foetal development, birth and parental care, *e.g. breastfeeding, in human reproduction*.
16. I can justify the requirements of nutrients especially folic acid, iron, calcium and vitamin D for healthy foetal development.
17.  PLANNING AND REFLECTION

17. I can compare the structure and functions of the placenta with the gas and nutrient exchange surfaces of the lungs and ileum respectively.
18. I can assess 'Family Planning Methods' which include natural and artificial methods of birth control in terms of their effectiveness in increasing the probability of, or preventing conception, as well as preventing transmission of sexually transmitted diseases.
19. I can define stem cells as being unspecialised units of a multicellular organism, which in isolation, can produce a replica of the whole organism.
20. I can list the advantages and disadvantages of cloning an organism.  
 SOCIAL CHANGE
21. I can identify the genetic material as a code describing the characteristics of an organism.
22. I can identify deoxyribonucleic acid as the molecule carrying genetic information in most living organisms.  
 COGNITIVE LEARNING
23. I can identify genetic variation arising from mutations as being the basis for natural selection which produces evolutionary change.  
 SELF AWARENESS
24. I can explain the advantage of genetic diversity for species' survival.  
 SELF AWARENESS
25. I can distinguish between DNA, allele, gene, chromosome and genome.
26. I can distinguish and give examples of diploid and haploid cells in the human body.
27. I can link the occurrence of conditions *such as Down's syndrome, haemophilia, thalassemia and cancer* to changes in DNA or chromosomes.  
 SELF AWARENESS
28. I can explain how many mutagens can lead to the onset of uncontrolled cell division as in cancer.
29. I can distinguish between homozygous and heterozygous genotypes.
30. I can distinguish between a genotype and a corresponding phenotype.
31. I can use a Punnet square or genetic diagram to describe and calculate probabilities of inheritance in a monohybrid cross, including sex determination.
32. I can determine the sex and presence of major chromosomal mutations, *e.g. trisomy 21*, from a karyotype.
33. I can analyse a family tree to find the probability of different genotypes and phenotypes in future generations.
34. I can list common examples of genetic engineered crops, *e.g. GM cold resistant strawberries or sweetcorn* and manufactured biological molecules *e.g. insulin*.  
 LEARNING TO DO
35. I can give an overview of insulin production by genetically modified *E.coli*. as a process involving the use of restriction enzymes to cut samples of DNA and linking vector DNA to host DNA to produce of recombinant DNA.  
 COGNITIVE
36. I can use objective criteria, *e.g. the results from independent research* to assess the implications of GMO usage for human and animal consumption.  
 LEARNING TO BE

### Subject Focus: Life Relationships

1. I can define what a disease is and am aware that there are different types of diseases *e.g. infectious, hereditary, degenerative - which can also be hereditary but can be caused by an unhealthy lifestyle e.g.type II diabetes*.
2. I can give examples of a viral disease, *e.g. Tobacco mosaic virus*, a bacterial disease, *e.g. Streptococcus causing sore throat* and a fungal disease, *e.g. Athlete's foot Tinea*.  
 LEARNING TO BE
3. I can distinguish between antibiotics and vaccination as being different measures against specific pathogens.  
 READING AND UNDERSTANDING
4. I can link the effects of pasteurisation to the safety of using milk products.
5. I can relate the standard symptoms of common ailments and causes *e.g. fever induced by infection, or heat exhaustion*.


6. I understand the polluting effect of some materials due to their chemical properties *e.g. carbon dioxide/monoxide and gases that produce acid rain.*
7. I can predict and debate the effects of air pollution *e.g. greenhouse effect caused by carbon dioxide, ozone layer depletion caused by CFCs*; land pollution *e.g. solid waste, urbanisation* and water pollution *e.g. eutrophication and oil spillages*, on species populations, diversity and their habitat.  
 LEARNING TO DO
8. I can describe how living things can be used to mitigate air pollution, *e.g. afforestation, carbon capture.*  
 LEARNING TO KNOW
9. I can link the changes in the earth's climate to challenges faced by agriculture *such as desertification, flooding and droughts.*  
 COGNITIVE
10. I can distinguish between chemical pesticides both persistent and non-persistent and biological pest control.  
 LEARNING TO BE
11. I can relate the presence of detritivores, *e.g. earthworms and nematodes*, and saprotrophs *such as fungi and bacteria*, with nutrient recycling in the soil.
12. I can link photosynthesis, consumption, respiration and combustion within the carbon cycle.
13. I can link nitrogen fixation, nitrification, assimilation and denitrification together within the nitrogen cycle.
14. I can distinguish between the effects of organic and inorganic fertilisers on the environment.  
 LEARNING TO BE



# LEVEL 10


## Subject Focus: Functions of Life Part 1: Processing Food and Metabolites

1. I can design simple experiments to investigate which brand of NPK fertilizers, from a choice of three, most enhances plant growth.

 LEARNING TO DO

## Subject Focus: Functions of Life Part 2: Maintaining Balance and Responding to the Environment

1. I can relate the fact that tobacco and coffee contain addictive compounds that can affect the nervous system.


 SOCIAL LEARNING

## Subject Focus: Functions of Life Part 3: Promoting Future Generations

1. I can calculate the size of the population given the length of a life cycle of an organism and the number of offspring produced in a given amount of time, *e.g. the number of bacterial cells after 24hrs from a single cell dividing every 30 minutes.*

 MANAGING LEARNING

2. I can identify the nucleotide as the building block of genetic material.
3. I can describe how genetic variation in offspring is introduced in the exchange of genetic material between maternal and paternal chromosomes during meiosis.
4. I can arrive at a well-informed opinion on IVF and the use or destruction of human embryos/foetuses, as in induced abortion, while being aware of the philosophical and ethical principles informing my opinion.

 SOCIAL CHANGE

5. I can explain that cancerous cells never specialise and keep on dividing indefinitely and that cells can become cancerous under the influence of a number of mutagens *e.g. X-rays and solvents or pesticides.*

## Subject Focus: Life Relationships

1. I can link eutrophication with excess nutrients, *such as from fertilisers or sewage*, in water bodies and subsequent deprivation of dissolved oxygen.

 LEARNING TO BE



# Pedagogy

## A. PEDAGOGY AND GOOD PRACTICE LEARNING

Educators need to keep up-to-date with the latest pedagogical strategies and concepts in order to be able to better understand and respond to learners' needs. Europe's *Education and Training 2020* strategy puts special emphasis on the teachers' role in the lives of their learners. Teachers play a crucial role in guiding their learners towards their goals and shaping their perceptions (European Commission, 2015).

Life Science is the study of life or living organisms and the interactions between them and their environment. The Life Science course aims to:

- discuss ethical issues
- be locally relevant
- improve the quality and standard of life
- connect to learners' everyday life
- where applicable, link concepts with other branches of science, namely Materials and Physical Sciences
- provide opportunities to apply theoretical concepts to relevant fields of work

Life Science is an important area of study because it provides insight into how the body works, as well as how the world works. The *Vision for Science Education in Malta* (2011) states that science subjects, should aim to 'provide all learners with the scientific knowledge and understanding necessary to help them function within the context of a dynamic world characterised by continuous change.' (Ministry for Education, Employment and the Family, 2011:23). Life Science, therefore, '[b]esides imparting knowledge ... should also develop skills and ways of thinking that are important for decision-making and problem-solving using an evidence-based approach... It should also provide a foundation for learners who wish to pursue a career in science and other science-related careers [both academic as well as vocational] that require them to focus on [Life] Science/Biology at post-secondary and tertiary levels' (2011:25).

### Suggested pedagogies for Life Science

- The main approach towards providing active learning is to use an inquiry-based approach, in which learners are presented not just with concepts but also with problems where the application of concepts is required in order for these problems to be addressed. Learners should be given opportunities to research, using various media and be shown how to evaluate this research. The programme should also adopt an approach with an accent toward linking knowledge to application in order to enhance thinking skills.
- The network of links between concepts from different foci of the programme, as well as between concepts of Life, Materials and Physical Sciences should also be pointed out. The evolutionary process described in the focus, 'The Diversity of Life' links directly with a number of physiology related aspects discussed in the foci 'Functions of Life' Parts 1-3. By seeing these links, learners will be more able to apply knowledge to problem-solving situations. This is the frame of mind scientists use when conducting scientific research.

- A constructivist approach is another suggested method for some aspects of this programme. Educators should assess the level of knowledge of the learners and scaffold this to the intended material or skills that learners should acquire. Learners should be asked, rather than told, facts – this should lead learners to acquiring the knowledge behind the required concepts as well as empowering them to apply this knowledge to a context as well as to unfamiliar situations. This implies moving away from simple (closed) questions requiring recall to questioning techniques that promote problem-solving, analysing and evaluating. Encouraging more learner initiated questioning as a routine procedure in the classroom should increase participation in the learning process.
- A Multisensory approach is also strongly suggested – lessons should accent the visual and the tangible. Learners are to be exposed to a wide range of illustrations, models, specimens and where possible real life situations in order to put facts into context. Other activities should include, hands-on experiences in the field and in the laboratory; the safe use of laboratory apparatus; the ability to be able to gather simple data or results; the ability to discuss and evaluate this data or results; the ability to represent data and results graphically which leads to the analysis and interpretation of the data.
- Learners can understand some concepts in the Life Science LOF better if they are taken to experience sites of biological importance such as: (a) community resources e.g. museums, industry and research laboratories, where they can observe first-hand the application of biological principles and (b) different natural habitats where ecological relationships can be observed. This activity can also be coordinated with other subjects such as Environmental studies and even Geography. This can help learners understand links between concepts covered in these subjects with others in the Life Science programme.
- The use of easily available online and computer technology e.g. games, simulations and relevant websites, is also suggested to enhance the learning process. If used appropriately, online and computer related material can enhance the multisensory approach to learning as well as promote active learning.
- The frequent use of group, pair and individual work will allow learners to engage in their studies. Some learners' work can be presented in school events such as local or even national science fairs.
- The programme should also cater for different learning styles such as kinaesthetic, visual and social.

The Life Science course should:

- allow young people to understand higher order concepts and the corresponding underlying principles.
- include less material to memorise, and instead provide opportunities for engaging with and exploring the natural environment by means of hands-on learning experiences, collaboration between learners and open inquiries.
- be based on a pedagogy which is innovative, varied and creative and which incorporates learner-based inquiries.
- cater for the individual needs of learners and draw on contexts which are familiar to both girls and boys.
- provide assessment opportunities which allow learners to show what they know and can do.
- allow learners to engage with science in a context relevant to everyday life experiences.
- provide opportunities for learning about Life Science and relevant scientists within a historical and cultural context.
- allow learners to gain an understanding of learning science and the processes of science within 'a learning community'.
- provide opportunities for learning Life Science in both formal and informal contexts.
- empower learners with skills that make them take analytical, critical, and able to adopt a creative approaches.
- link to simple mathematical concepts e.g. simple proportion, ratios and fractions as well as understanding the concept of variables and linear and other graph relationships, to anticipate consequences and recognise opportunities.
- help learners to be aware of the local biological context such as the local prevalent medical situation, local fauna and flora and local conservation issues.



Moreover, because Life Science is an optional subject, it should also provide a more in-depth knowledge of science to learners (than the Science course) and also aim at a career in science or a profession that requires a deeper knowledge of science.

A recommended approach to achieve the above mentioned goals is to implement Inquiry-Based Learning as the prevalent pedagogy for the course. Inquiry-Based Learning should 'help promote the ability to ask questions about objects, organisms and phenomena in the environment. Students learn to answer their questions by seeking information from reliable sources of scientific information and from their own observations and investigations' (Ministry for Education, Employment and the Family, 2011:33). Inquiry based learning should also provide opportunities for young people to:

- learn how to plan and conduct simple investigations.
- learn how to design and conduct simple and fair experiments to answer questions.
- learn how to investigate questions of personal interest.
- practice peer teaching.
- use equipment, including computers and calculators and tools to extend their senses and gather data.
- use data to construct reasonable explanations. This skill implies that learners develop a critical approach to data collection and hypothesis formation and testing.
- communicate, give a critique and analyse their work and the work of other peers.
- encourage learners to be able to think critically in order to enhance creativity and to enable learners to see long term consequences of action- solving problems etc.
- choose increasing degrees of exposure to science education based on their personal interest and abilities.
- follow specific directions that reflect personal preferences and/or possible future career inclinations and choices.

#### **Dos and Don'ts for this Subject:**

The Life Science course should not be presented as a list of inert facts, but should be connected to everyday life experiences and where relevant, also to other science subjects, even in instances where learners have not opted to study other science or related subjects such as geography and environmental studies having Life Science components.

The main aim behind the Life Science programme is to make learners aware of the principles and sequencing of life processes. Each focus has a narrative of ideas behind it. For example, for the Subject Focus: Principles of Life, when presenting this topic to the learners, the arguments behind this focus should be:

- Living things need to carry out the seven vital functions. They are also made up of cells.
- In order to function properly, cells have adapted to make use of particular processes such as osmosis, diffusion and active transport in order to meet the requirements to keep on living.
- In order to be able to function more efficiently, cells have teamed up and become specialised, eventually forming organisms.

When material is presented in this way, it will make learners aware of the links and the context behind the facts and give learners an awareness to use this knowledge actively.

Educators should direct learning towards a more learner-centred approach and allow for an active and participatory learning approach – thus motivating learners in their studies and giving them the skills to take control of their learning process.



### Learning to Learn Strategies

The following are examples of the strategies which form part of the ‘learning to learn process’, one of the eight competencies featured in the document *European Reference Framework Key Competencies for Lifelong Learning* (European Commission, 2007):

- Pedagogical discussions between learners where, on a voluntary basis, learners explain how they carried out a specific task and how they managed to overcome the difficulties encountered, resulting in an exchange of strategies and techniques in a cooperative environment.
- Teaching learners to make use of punctuation marks, pictures, additional information outside the text, such as accompanying explanation of difficult keywords and identification of keywords during reading/ comprehension tasks.
- Teaching and guiding on the different stages of essay writing and the different tools and methods which could be adopted during each stage.

### Subject Focus:

### Pedagogy and Assessment Guidance:

#### Principles of Life

When presenting this topic to the learners, the arguments behind this focus should be:

- Living things need to meet the strict requirements of the seven vital functions. They are also made up of cells.
- In order to function properly, cells have adapted to make use of particular processes such as osmosis, diffusion and active transport in order to meet the requirements to keep on living.
- In order to be able to function more efficiently, cells have teamed up and become specialised, eventually forming organisms.

Learners can:

- interact with a visualisation of net diffusion through situations which can be observed in the laboratory e.g. through gas, liquid and solid objects and through materials such as dialysis tubing, as well as computer simulations, to see the effect of changing variables of concentration and temperature.
- interact with a hands-on activity which investigates this concept e.g. studying the effect of osmosis on plant cells, or a visualisation of osmosis through a computer simulation while viewing the effects of osmosis on cells through a microscope.

Cell specialisation in a multicellular body can be compared to a successful football team or *to the historical development of a trade e.g. shoe making, starting off with the shoemaker – the analogy for the unicellular organism – who used to make a whole shoe himself, moving on to a group of shoemakers – the colony – working together to produce different shoes but still capable of producing a whole shoe, to a factory – the multicellular organism – where different people produce bits and pieces of a shoe – hence they have specialised in one particular aspect.*

Learning Outcome 9 (Level 8) has a potential link with both Materials and Physical Sciences.

*Note: In the case of Learning Outcomes with potential links, educators can make cross references to instances in materials or physical science, or both to instances where the same concept is revisited in the other sciences. In this way learners can see links between the separate sciences and view these as branches of one discipline rather than three separate unlinked subjects.*

**Functions of  
Life Part 1:**

When presenting this topic to the learners, the arguments behind this focus should be:

**Processing Food and  
Metabolites**

- Some compounds are required by living organisms because of particular properties they have which makes them useful in order to live.
- Plants obtain some of these compounds by making them in the leaves.
- Heterotrophic organisms take in readily available food; they break it down in order to absorb it.
- Both plants and animals need to transport food and metabolites across the body in order to assimilate it.
- Plant transport vessels make use of processes such as diffusion and the transpiration stream in order to transport materials across their body.
- Mammals use a pumping organ and blood vessels, the features of which promote rapid transfer of materials across the body.
- Organisms get their life energy from the breakdown of carbohydrates.
- The most primitive forms of carbohydrate breakdown produced compounds such as lactic acid and alcohol as by products.
- Eventually oxygen was used to break down carbohydrates more completely. This reaction is more efficient and releases more energy.

Learners can:

- be given an assignment to report on the effects of scarcity of potable water and human impact in the quality of water.
- research about the most common mineral and vitamin deficiencies and give explanations for why these nutrients are more likely to be deficient in others' diet compared to ours. Learners can research about the history of vitamin discoveries and report such findings in class presentations. This can be deduced by researching about the effects of malnutrition in developing countries.
- manufacture some 'cheeselets' in the lab, taking into consideration the costs of raw materials and assess how the method can become economically viable.
- research about common inhibitors used in insecticides available in grocery stores and suggest effects of accumulation of such insecticides in food chains.

*Note: Such insecticides can prove to be of potential harm to learners (e.g. could be carcinogenic) and should therefore not be used in high concentrations in the classroom.*

- be exposed to the chemical equation in order to be able to understand what is happening at a molecular level.
- be given the structure of the different kinds of vertebrate jaws and deduce what kind of diet the animal consumes and how its jaw enables its ingestion and physical breakdown.
- be assigned to use the evidence observed in the experiments to design a greenhouse with a high rate of productivity.
- be assigned to research or visit a local brewery or winery in order to see how the process of fermentation is used in industry, *without* requiring the knowledge of the steps of winemaking or brewing.
- use experimental data to investigate the effect of temperature, humidity, wind and light on the rate of transpiration.

Learning Outcomes 8, 10, 52, 53, 55 and 61 (Level 8) have a potential link with Materials Science.

Learning Outcomes 21, 37, 41, and 50 (Level 8) have a potential link with Physical Science  
Learning Outcome 11 (Level 8) has a potential link with both Physical

**Functions of  
Life Part 2:****Maintaining Balance  
and Responding to  
the Environmentc**

When presenting this topic to the learners, the arguments behind this focus should be:

- Organisms need to keep a constant body state in order to stay alive.
- Conditions which must be kept constant are temperature and concentration of water and solutes in the body.
- The skin and kidneys are the organs which are concerned with regulation of temperature and regulation of water and solute concentration.
- Organisms also need to respond to the environment.
- Animals use locomotory features in order to be able to move towards or away from a stimulus. Mammals use their skeleton and skeletal muscles in order to do this.
- Coordination of impulses across the animal body occurs by transmission of electrical impulses.
- The brain receives impulses from receptors and sends motor messages to other parts of the body to initiate a response.
- Hormones are chemicals which are produced in order to transmit messages in the body. In plants production of hormones regulates movement towards or away from stimuli.

Learners should be presented with a basic diagram of how the dialysis machine works and, in order for them to adopt an inquiry based approach, allowed to deduce how it works, using concepts of diffusion and osmosis to encourage them to deduce something with which they are not familiar. They could then compare the kidney with the dialysis machine. Learning Outcome 2 (Level 9) has a potential link with Materials Science.

**Functions of  
Life Part 3:**

**Promoting Future  
Generations**

When presenting this topic to the learners, the arguments behind this focus should be:

- In order to survive, organisms must find ways to make copies of themselves, hence the need for asexual reproduction.
- Primitive replication methods produced exact copies of previous generations, but these were not adapted to survive within ever-changing environmental conditions, hence the evolving of sexual reproduction that promotes variety.
- Flowering plants developed methods of producing pollen and ovules as special entities which, when fused produce a zygote (the seed) which is different from the parents.
- Flowering plants also developed methods of pollination and seed dispersal that made use of wind currents or animals.
- Animals produced special cells, or gametes, which when fused also produce a zygote.
- Mammals control the development of gametes and sex organs by means of hormones. In female mammals, hormones also control periodical changes in the uterus which houses the developing embryo, as well as the physical and emotional changes the mother would need to go through in order to take care of the offspring.
- In mammals the zygote is retained in the mother until it is fully developed.
- Humans make use of family planning methods to control conception.
- Humans have also been able to reproduce copies of whole multicellular individuals by means of cloning, though these methods have negative implications.
- Variety is attributed to sequencing in genetic code
- Reproduction ensures replication of this genetic code. While asexual reproduction is a form of cloning of parental cells, sexual reproduction induces variety because of the mix in maternal and paternal DNA.
- DNA units makeup sequences of genes that code for particular characteristics.
- These characteristics are inherited in particular patterns.
- Sometimes replication of DNA can go wrong and can have negative implications.
- Humans have managed to learn how to manipulate DNA replication and have been able to produce GMOs, with positive and negative implications.

Learners can:

- devise, as a group, a simple experiment, to investigate the effect of these factors on germination. Although all plants disperse their offspring, angiosperms have evolved the most diverse ways of seed dispersal, making use of all available moving forces – water, air, animals etc. Learners can be assigned to design a fruit that would effectively disperse their seeds, given the environmental factors surrounding the plant.
- be assigned to plot data using spreadsheet software and/or interpret graphs of population growth including lag, log, plateau, death phases.
- be presented with a brief history on how the theory of evolution by Natural Selection came to be accepted in science, with highlights on the need to listen carefully to others' views on any issue and base one's opinions on evidence-based inquiry.
- be assigned to present how technology is used in the control of various factors e.g. temperature, pH etc. in bioreactors and explain how such factors affect population growth of bacteria.
- be assigned to form their own arguments, based on facts and be able to debate e.g. on GMO foods, with individuals with different view-points.

**Diversity of Life**

When presenting this topic to the learners, the arguments behind this focus should be:

- Organisms are diverse in order to be able to survive the environment they live in.
- Changes in environment have enabled organisms to change or die out. This process is known as evolution.
- Successful organisms are selected if they show that they can adapt to the environment.
- Humans have devised methods which they have standardised in order to organize organisms and study them better. The current system of classification uses the binomial system and taxonomic groupings of organisms.
- Life originated when earth had no oxygen in its atmosphere but had water which was rich in nutrients. This led to the evolution of the first cellular units – bacteria. These organisms experimented with different lifestyles, autotrophic, heterotrophic, saprobic, and parasitic.
- The eventual abundance of oxygen (created as a by-product of photosynthesis) encouraged organisms to incorporate this gas in the process of respiration.
- Eventually, these cells became more efficient and developed a eukaryotic arrangement, as illustrated by Protoctista.
- Cells then grouped up because they could function better this way. Once this happened, cells started to specialize in order to perform specific functions.
- Multicellular arrangement of organisms gave rise to three distinct groups – fungi, plants and animals. Fungi have a particular cellular arrangement and lead a saprobic or parasitic lifestyle, plants developed features to support an autotrophic lifestyle while animals developed features suited for a holozoic lifestyle.
- With the development of sophisticated features in their body and with climatic and atmospheric changes (oxygen moved from the water into the atmosphere, where it became a component gas and led to the formation of the ozone layer), organisms shifted from life in the water to life on land. Plants were the first organisms to follow this strategy. Invertebrates followed and this led to the evolution of flowering plants. Vertebrates finally followed.

Learners can:

- work on a project where they can research ways how bacteria have become resistant to certain antibiotics in order to include terms such as mutations and frequent and irregular use of antibiotics. In this way evolution, diversity is linked to our daily actions.
- use identification keys provided by the educator to identify the names and physical characteristics of animal groups. Features should include: symmetry, sting cells, polyp and medusa forms for Cnidarians; segmented body for Annelids; soft body and presence of shell for molluscs; exoskeleton, jointed appendages and grouped body segments for arthropods; backbone and internal skeleton for vertebrates.
- be asked to think about why declining bee populations are affecting the world's food supply and more importantly, why bee populations may be declining in the first place.



**Life Relationships**

When presenting this topic to the learners, the arguments behind this focus should be:

- Organisms interact with the biotic and abiotic factors in their environment.
- Interactions between organisms include competition, predation, and mutualism.
- The study of ecosystems involves the knowledge of a series of quantitative techniques.
- Food and energy flow along different feeding levels from producers to consumers to top carnivores.
- Energy transfer from one feeding level to another involves conversion into different forms, and a fraction is always lost to the environment, although never destroyed.
- Nutrients are recycled by decomposers.
- Organisms are at times introduced naturally or artificially to new environments, with devastating effects, due to the fact that they pose unparalleled competition since they have no natural enemies.
- Some viruses, bacteria and fungi act as pathogens and cause diseases which can be serious or even fatal pathogens can affect humans.
- Pathogens can be controlled in different ways through either preventive or immunity methods.
- Humans have managed to upset the ecological balance by a number of negative practices such as pollution and global warming. These practices can have a permanent effect on world climate change.
- Agricultural practices such as chemical pest control can also have negative impacts on the environment.
- Humans however also try to preserve the environment by practices such as afforestation, crop rotation, and biological pest control.

Learners can:

- be introduced to nitrogen fixation through the history of development of crop rotation, which when introduced, dramatically increased crop production and was, and still is, an important aspect of sustainable agriculture.
- research and report information on undulant fever due to its national relevance.
- relate symbiosis as seen in the living world to different situations of interdependence in society. This interdependence is sometimes being broken by human interference.
- assess the methods of pest control during a site visit to a local agribusiness.
- form a scheme or concept map from a description of biogeochemical cycles, or vice-versa.

Learning Outcome 16 (Level 8) has a potential link with Physical Science.

Learning Outcome 6 (Level 9) has a potential link with Materials Science.

The Subject Learning Outcomes (SLOs) have been written in a way which helps educators to adopt engaging, enterprising and active learning approaches in a variety of contexts to promote and enable learner-centric teaching and learning strategies. Curriculum planners at all stages should regularly consider the opportunities presented by the SLOs to develop active learning throughout the levels in the Learning Outcomes Framework. Planning should be responsive to, as well as encourage participation by, the learner who can and should influence and contribute to the process.

To support curriculum planning and to ensure that all learners have access to an active, enterprising learning environment, a coherent approach to planning learning, teaching and assessment and to sharing information about progress and achievements is needed. In undertaking this type of curriculum planning, it is important not to see the SLOs as limiting factors containing the learning potential of learners and preventing any deviation of learning beyond that contained within the SLOs. This view fails to take into account the scope and flexibility provided by the learning outcomes approach. How, where and when the outcomes are taught and learned is at the discretion of the educator. The SLOs are there to demystify the assessment process by setting out straightforward learning expectations. In doing so, assessment is bound to evidencing the meeting of these same expectations.

Once the learning expectations are set educators can begin to introduce the flexibility in curriculum design and delivery that has been difficult to do up to this point. The learning outcomes approach allows educators to lean towards learner-centric teaching and learning strategies. This will mean knowing the many ways in which learners are different from one another, which of the many ways of learning are significant to the learning at hand and how to deal with this variance in ways that are supportive of the individual learners and allow them to progress. Section C: Reaching different learners within each level offers guidance on how this can be done.

## B. EMBEDDING THE DELIVERY OF THE CROSS CURRICULAR THEMES

Across Europe there has been a shift from an exclusively subject-based approach to a more cross curricular, thematic, inter-disciplinary and collaborative approach that reflects real life situations and encourages transfer of skills from one learning area to another. Through a cross curricular approach, many curricular areas have been given a higher profile and a number of transversal competences have enhanced their status (European Commission, 2012). The CCTs connect the subjects by highlighting common learning objectives which are also reflected at in the school ethos (Ministry for Education and Employment, 2012: 31, 39).

The Cross Curricular Themes (CCTs) have been introduced in the LOF to ensure that all learners, as they progress through the levels, come into continual contact with the types of knowledge, skills and understanding needed to participate actively, prosper and contribute to Maltese society.

The embedding of the CCTs in the Subject Learning Outcomes offers access to a new learning identity that goes beyond the subject; learners will value the CCT learning when they see that it is an integral part of the Learning Outcomes Framework and that it is vital in helping them become holistic learners.

Each CCT is presented as a set of additional learning outcomes that young people need to encounter and develop a knowledge and understanding of as they progress through the Learning Outcomes Framework.

### The Cross Curricular Themes are:

Digital Literacy



Education for Diversity



Education for Entrepreneurship, Creativity and Innovation



Education for Sustainable Development



Learning to Learn and Cooperative Learning



Literacy



The Cross Curricular Themes can be found in the Appendix and online at <http://www.schoolslearningoutcomes.edu.mt/en/category/cross-curricular-themes>

The CCTs need to be embedded within the learner's learning journey and experiences, the main point being that the CCT knowledge and understanding needs to be learned, consolidated and secured within a context. The context is important in order to add meaning and purpose and to reinforce the usefulness of the CCT. There is no one effective way of organising the embedded learning of the CCTs. However, directly linking a CCT outcome to an appropriate practical task within an SLO and then ensuring that there is an opportunity for CCT support at the time the practical task is undertaken is a particularly effective way of embedding a CCT.

Embedding is not just about interlinking different curricula. Mapping where the CCT content might fit in with SLOs or Subject Foci is only a starting point. The educator needs to establish how the CCT content adds value to the SLOs being taught and how something greater than just the sum of the different parts can be achieved. In essence, the CCT learning adds value in the establishment of key transferable knowledge, skills and understanding by starting with meaningful 'situated' engagements with the learning.

### Embedding as a process

There are three main ways to approach the delivery of the knowledge, skills and understanding addressed in the CCTs in the learning process. These are:

- through delivery of and the learning associated with the SLOs
- by choosing particular teaching methods and strategies over others to deliver the SLOs.
- undertaking specifically constructed cross curricular or whole school activities.

This process implies an important shift in the way teachers approach the teaching of the subject content in the classroom. Integrating the cross curricular learning outcomes in the teaching of separate subjects requires teachers to step outside their traditional boundaries and work in close collaboration with one another to develop their approach to the CCTs and to exchange information about the learning development of specific learners in relation to the CCTs (European Commission, 2012:25).

### Delivering CCTs through the SLOs

The first approach to the delivery of CCT content is by integrating the CCT learning with that of particular SLOs. The framework provides guidance on the best opportunities to do this. Where a particular SLO presents a good opportunity to address learning related to a Cross Curricular Theme a CCT icon appears after the SLO. This indicates that the SLO:

- creates a naturally occurring opportunity to begin to look at learning and skills development associated with a particular aspect of a CCT.
- can be enhanced or enriched by introducing a particular aspect of one of the CCTs.

To guide the educator to the specific learning outcomes of the CCT that are most relevant, the CCT icon which is attached to the SLO in question also includes a heading to identify which particular aspect of the CCT is the 'best fit', i.e. the part of the CCT content that is most closely linked to the knowledge, understanding and/or skills addressed within the SLO.

Although only one CCT has been identified this does not necessarily mean that other CCTs are not relevant. The identification of a particular theme merely suggests that the educator may find the one identified to be the most relevant, most appropriate or easiest to embed at that particular point, allowing the educator to teach the subject and the CCT in an integrated way.

Examples of this type of embedding in Life Science include:

- I can distinguish between living things and non-living things by identifying and discussing the characteristics common to all organisms.



COGNITIVE LEARNING

Taken from Level 8, Subject Focus: Principles of Life

- I can distinguish between antibiotics and vaccination as being different measures against specific pathogens.

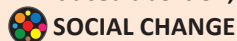


READING AND UNDERSTANDING

Taken from Level 9, Subject Focus: Life Relationships

### Example: Finding opportunities to address CCT learning in Life Science SLOs

- I can arrive at a well-informed opinion on IVF and the use or destruction of human embryos/foetuses, as in induced abortion, while being aware of the philosophical and ethical principles informing my opinion.



**SOCIAL CHANGE**

Taken from Level 10, Subject Focus: Functions of Life Part 3: Promoting Future Generations

The kind of learning and subject matter connected to this particular SLO provides a naturally occurring opportunity to look at some of the learning, knowledge and skills associated with the CCTs, particularly Education for Diversity and the focus on Social Change. The subject matter may well be contentious and can provoke a strong reaction but at the same time it will allow learners to demonstrate tolerance and respect for others' views. The types of attitude and behaviour behind the CCT expectations will have to be learned, rehearsed and applied in appropriate situations. The specific outcomes from this focus within the Equality and Diversity CCT which will help enrich the learning process, discussion and group work and enrich the eventual SLO performance are:

- I respect the different religious and humanist convictions, morals and beliefs that inform people's conceptions of right and wrong.
- I challenge expressions of prejudice and intolerance towards minorities such as racist, sexist and homophobic names, anecdotes and comments.

### Addressing CCTs through use of particular teaching methods and strategies

CCTs can be used to inform the creation of Science Departmental policies and strategies, for example, by deliberately structuring learning to maximise the use of digital technologies. At the departmental level the following CCTs may be particularly suitable to help inform the pedagogy choices and delivery styles selected to maximise the flexibility introduced by the LOF:



Learning to Learn and Cooperative Learning



Digital Literacy



Education for Diversity

Educators may find that the following CCTs have a role to play in the choice of topics to stimulate interest and debate:



Education for Sustainable Development



Education for Entrepreneurship, Creativity and Innovation.







It will become evident that some of the CCTs are naturally suited to particular learning and teaching styles. Section *C Reaching different learners within each level* provides guidance on how particular CCTs can equip learners to thrive in particular learning environments. Deliberately choosing particular teaching strategies involving active and/or experiential learning and problem solving approaches where a certain degree of learner autonomy as well as team work is required will help frame learning in ways conducive to the introduction of the Digital Literacy and Learning to Learn and Cooperative Learning CCTs.

For example, the Learning to Learn and Cooperative Learning CCT comprises a category of learning outcomes on Personal Learning and, by addressing the learning related to this category of the CCT, learners will be developing the learning skills to bring to any task where a degree of autonomy and self-management is required. Similarly, the Social Learning category within the same CCT can help learners develop a framework of skills, attitudes and behaviours that will help them make the most of group or team work and other social learning strategies.

The Digital Learning CCT will help learners develop the competencies related to managing learning, sourcing, manipulating, communicating and presenting information. Having these types of learning skills embedded in the learning before they are most heavily used or required will help the learner approach the tasks with greater confidence in both the process of learning about SLOs and in demonstrating achievement of the outcomes themselves.

#### Addressing CCTs through cross curricular or whole-school activities

All the CCTs can be used as whole-school strategies for creating a high quality learning environment that values all learners and sets high expectations for all. Schools may see the benefit in having whole-school policies on the advancement of:

-  Literacy
-  Digital Literacy
-  Education for Diversity
-  Education for Sustainable Development

These types of CCTs can be used to help inform whole-school policies as well as add real value to the learning within the classroom. However, other CCTs may be used to form the basis of whole Year Group activities, or wider all-learner school initiatives around environmental issues. For example:

- The Education for Sustainable Development CCT could be used to form the basis of whole-school extra-curricular activities related to the Eko-Skola type of initiatives or low energy use initiatives. Fundraising activities to help with a school pursuit of renewable energy sources might bring together learning from this CCT with that of the Education for Entrepreneurship, Creativity and Innovation CCT.
- The Education for Entrepreneurship, Creativity and Innovation CCT could be used to underpin the learning and experiences associated with activities ranging from a 'learner-owned' tuck shop to a school event or whole-school initiatives about the world of work.

## C. REACHING DIFFERENT LEARNERS WITHIN EACH LEVEL

One of the benefits of working within a Learning Outcomes Framework (and at the same time one of the challenges) is the ability to allow learners to progress at their own speed and to be able to adapt the teaching methodology and curriculum to meet their learning needs. The SLOs clearly show where the learning ‘finish line’ is at each level for each learner but educators need to acknowledge and plan for those learners who will reach this point quicker than some and also for those who may need more time and more scaffolding to be able to get to the standard required.

The Subject Foci are not rigid or restrictive and do not have to be delivered in a particular sequence or as discrete content areas taken in isolation. Subject Foci can be overlapped and blended into larger (or smaller) learning programmes. Educators may prefer to approach the learning contexts in a different order depending on the situation, or to deliver aspects of the learning through preferred topics.

### Diversity of learners

The NCF embraces diversity and requires that this be promoted through an inclusive environment.

The NCF addresses the needs of:

- gifted and talented learners for whom the process of learning needs to be sufficiently challenging to engage and motivate them to develop their talents.
- learners with special educational needs for whom the curriculum should be written in a way that allows the teachers to appreciate how every student can access the same curriculum in every learning area and allows for the assessment of a continuum of ability.
- learners with severe disabilities for whom the curriculum should offer an education based on a continuum of abilities expressed in terms of developmental phases.
- learners from disadvantaged social backgrounds for whom the school, in collaboration with key local and institutional stakeholders in the community, needs to up-skill and support families and the local community to provide an environment that is educationally rich and stable.
- learners from diverse social, cultural and linguistic backgrounds including children of refugees and asylum seekers for whom the curriculum should include access to an educational programme which is embedded within an emotionally and psychologically supportive environment that respects their individual circumstances.

*A National Curriculum Framework for All, Ministry for Education and Employment (2012:41)*

All classrooms, even where setting is used, will comprise a range of abilities. This is because learners will have different strengths and limitations and will develop at different rates. To define a ‘mixed ability’ class simply as a group of learners with a range of abilities is overly simplistic. What about the range of learning styles and preferences, interest levels and home backgrounds, which all impact on the learning experience? Each learner will show strengths at different times depending on the topic being studied and the learning style being used. When they are outside their learning comfort zone they will perform less well. It is unrealistic to expect any group of learners, whatever their ability, to progress through a body of work at exactly the same pace. Two thirds of learners in a classroom will be working outside their learning style unless the task is varied.

One of the most effective ways to ensure that different learners are reached within each level and throughout the LOF is to teach learners to think for themselves. Some of the CCTs provide the toolkit of knowledge and skills for learners to be able to become more effective, resilient, resourceful and autonomous learners.

### Progression and differentiation in learning

The principles of diversity and inclusion which underpin the NCF imply that at all stages learners of all aptitudes and competences should experience success, challenge, and the necessary support to sustain their effort. They need flexible learning programmes providing diverse learning experiences that cater for a wide spectrum of learners and allow for different rates of progression as children and young people work through their school years. Different approaches are needed to address different learning needs. With the focus increasingly on the learner, and with more mixed-ability classes in schools, differentiated approaches are becoming more important and teachers need to adopt strategies that build on children's and young people's previous learning and help them progress.

*A National Curriculum Framework for All, Ministry for Education and Employment (2012:40)*

### Strategies for teaching a mixed ability class

The teacher in the classroom must start by making a connection with each learner in their classes on a personal level by knowing and using their names and getting to know what interests them. Incorporating areas of interest into the learning can be a good way to engage learners. Similarly, using this type of knowledge when setting homework or individual class work can be a useful motivator and may help keep learners engaged.

#### Personal Learning:

- I can identify the support and resources I need to learn.
- I am aware of my preferred way to learn and can use this to plan my own learning.
- I manage goals and time efficiently in learning.
- I feel competent in managing my own learning.
- I am open to feedback from others and am able to consider it.
- I reorganise myself by explicitly changing my assumptions over time.
- I am able to follow my own interests as this helps me to reflect on 'who I am'.
- I am pleased when I succeed at difficult tasks.

Taken from the Learning to Learn and Cooperative Learning CCT

### Ways to empower learners and make them more able to thrive within the LOF

Create a dynamic learning environment by:

- managing the classroom and creating opportunities for learners to work individually, in pairs and in groups.
- changing the layout of the classroom to match the learning taking place.
- providing a choice of differentiated activities, allowing learners to select their level of engagement and challenge. This will help with the 'ownership' suggestion listed further down.
- using carefully selected and differentiated resource banks.
- presenting different ways to learn the same thing.

Engage learners by:

- creating a sense of learner ownership of the learning process by, for example, allowing learners to choose their own project.
- allowing learners to demonstrate their understanding in different ways, for example through self-selected means, be it a visual representation, an oral presentation or physical demonstration.
- building in the higher order thinking skills using Bloom's taxonomy (at all levels) and working with the SLOs to keep learning tasks interesting, providing useful stretch and challenges as SLOs are given added dimensions or are approached from different directions. This can be done by giving learners problem-solving tasks with the opportunity to transfer and apply their knowledge to a new context.

Turn learners into resilient learners by:

- at an early stage introducing the learners to the key learning strategies encompassed by the Learning to Learn and Cooperative Learning CCT.
- discussing the learning objective in each lesson with learners, making them aware of what they are expected to achieve by the end of the lesson. The SLOs (written in the first person) are directed at the learner.
- making learners aware of different learning styles; teaching learners techniques for learning new content using visual, auditory and kinaesthetic modes of learning and varying teaching strategies to cater for visual, auditory and kinaesthetic learners.
- teaching learners how to be less dependent on the teacher. For example, how do they get themselves 'unstuck' if they are stuck?

Use group work to:

- allow for reinforcement and extension (by using flexible groups).
- encourage learners to engage in Social Learning and to appreciate diverse viewpoints and personalities; build confidence in discussing their views with others; collaborate with other learners as part of their learning; seek out guidance and support from other learners; talk with others about learning; listen to others talk about learning and discuss various subjects and learning strategies with peers (by using mixed ability groups).

An inclusive approach to teaching and curriculum planning needs to be ensured. While the school will want to create an ethos of achievement for all learners, valuing a broad range of talents, abilities and achievements, the teacher will need to work out what that means in their classroom. At a basic level this starts with promoting success and self-esteem by taking action to remove barriers to learning, thus making sure that all learners in all groups thrive in the classroom. Teachers can overtly promote understanding and a positive appreciation of the diversity of individuals in their class and use the Diversity CCT as a catalyst for this approach extending it to include the learner directly.

**Values- based education**

Education is as much about building character as it is about equipping students with specific skills. The way forward for the implementation of the framework is through values-based education. Values-based education refers to any explicit and/or implicit school-based activity which promotes student understanding and knowledge of values and which develops the skills and dispositions of students so they can enact particular values as individuals and as members of the wider community. It ensures that those leaving school should have qualities of self confidence, high self esteem, optimism and commitment to personal fulfilment as a foundation for their potential life roles as family, community and employees. Furthermore they should have the capacity to exercise judgement and responsibility in matters of ethical and social judgements.

Adapted from *Respect for All Framework*, Ministry for Education and Employment (2014:10)

Schools should have a vibrant and progressive culture, promoting well-being and respect, with ambition and achievement for all learners as its focus. This type of approach needs to be taken in each classroom. A great school is a caring school that supports every single person, irrespective of background or learning need. Such schools work in an atmosphere of unconditional positive regard. They work tirelessly to promote healthy and productive attitudes to learning, to life and to work. Developing an ethos of achievement and ambition defines the aspirational nature of successful schools, making the connection between expectation and success - success which covers all aspects of developing skills for life, for work and for learning - a hallmark of excellence.

From the perspective of the classroom, an inclusive approach addresses learners' needs through a variety of approaches including: early intervention strategies and a curriculum and approaches to learning and teaching which are designed to match the needs of all learners. Educators should have high expectations of their learners because they need to be encouraged to have high aspirations and goals for themselves. It is imperative that educators ensure that their learners know where they are in relation to their learning and how they can improve. Learners should be praised regularly, selectively and effectively to keep motivated.

As learners progress within the levels and between levels they should be encouraged to reflect on, take increasing ownership of and assume more responsibility for their own learning. Educators should start to introduce techniques to allow learners to make increasingly greater use of self-assessment to identify their strengths and development needs from the evidence of their efforts and act on feedback given from peers as well as educators in order to plan their next steps.

## D. TEACHING DIFFERENT LEVELS WITHIN ONE YEAR GROUP

There will be learners within each class that need more time to be able to achieve the learning needed to demonstrate achievement of the SLOs. As learners progress through their learning journey they may move to a new year and start a new level but still have areas of unsecured learning from the previous level. The first important factor here is clarity of information on progress following this learner that makes it clear to their new teacher what support or additional work they may need to ensure that they can progress on to the new level.

**Section C** *Reaching different learners within each level* referred to the use of a range of strategies designed to respond to the different learning preferences of each learner. Where learners are entering the class in need of support to secure some aspects of the previous level it is important that:

- there is clear information about where the areas in need of support are.
- it is clear how these areas relate to progression and achievement in the new level.
- there are a range of strategies and learning devices available to match the learning style to the learner preference to assist with early progression.
- conversation with the learner about areas in need of support or reinforcement remains positive, learner-affirming and constructive.

One of the benefits of the LOF structure is that Levels 7 and 8 are delivered across two-year curriculum windows allowing time to develop learning programmes and deploy a range of learning methods to help learners progress and achieve.

There are a few models to consider when looking at introducing a measure of stretch for learners able to achieve SLOs well within the delivery time associated with the level. Educators may want to consider:

- exploring the SLOs in a broader and/or deeper way, perhaps looking to transfer or apply learning associated with the SLOs in new contexts.
- using more exacting or challenging texts.
- adding stretch by setting more challenging or complex tasks which exposes the learner to more challenging texts and vocabulary or introduces new Subject Foci or new areas of existing Subject Foci, remembering that the SLOs do not set a ceiling on the learning.
- looking at opportunities offered by the CCTs as sources of inspiration for introducing new areas of content to provide additional curriculum content that both enhances the subject learning experience and looks at CCT content in perhaps different or more challenging ways.

One other key source of material related to provision of additional challenge or stretch is the Subject Foci and SLOs from the level above. While it may not always be appropriate to begin to address these directly, educators may want to look at the contextual learning or preparation work that serves as a good introduction to learning at the next level. The focus here is on looking at the bridges between the learning in each level and how the learner can begin to access this learning. In this type of approach, as with the other areas of extension work, it will be important to keep a proper record of achievement to be able to inform teaching staff working with the learners when they move formally to the next level.

Although the above suggestions will help educators address the challenges of differentiation, it is nevertheless acknowledged that it is hard to implement differentiated instruction in a heterogeneous classroom, especially if educators are not supported or they do not know what they are differentiating – the curriculum or the instructional methods used to deliver it. It is hence important to give teachers clear guidance and support on what they need to do to differentiate instruction and be responsive to the needs of each learner by taking into account what they are teaching and who they are teaching. Time should also be factored in for teachers to assess their learners' needs, interest and readiness levels and to plan and design appropriate activities for each learner. These concerns can be addressed through effective professional development that strongly encourages teachers to apply their skills and which provides coaching throughout the process of using differentiation as a teaching approach.



## E. TEACHING ONE LEVEL ACROSS TWO YEAR GROUPS

Within the LOF, Levels 7 and 8 have an added additional layer of challenge in curriculum planning and design in that both levels run across two different years. For example, Level 8 SLOs sit across Years 9 and 10. This means that educators need to consider how they might want to structure the delivery programmes needed to achieve the SLOs that will allow learning to take place in a meaningful and coherent way across two years that capitalises on any progression opportunities within the level. However, this wider window to reach the standard of a level also helps deal with some of the challenges discussed in the previous chapter.

When looking at the content shaped by the SLOs within a level, educators may be able to identify SLOs that are considered to be prerequisites for others in the same level and structure the curriculum accordingly. Some Subject Foci may naturally be delivered before others or educators may look to design and implement a curriculum that has more of a spiral curriculum progression feel to it. Educators may even feel that there are different ways to work with the Subject Foci, wrapping them up and addressing the SLOs by creating new subject areas incorporating the Subject Foci.

There are at least three obvious potential approaches that educators may wish to consider:

- Developing a period of ground work or preparation style learning before proceeding on to the curriculum directly associated with the SLOs.
- Developing a developmental approach across the existing SLOs where some suitable Subject Foci and corresponding SLOs are addressed before others with these supporting the learning of the SLOs to be covered in the second year.
- Developing a curriculum and learning programme approach that exhibits a mixture of the above two approaches.

There are also the more ambitious approaches where the Subject Foci and SLOs are absorbed into a more locally designed approach that may meet the strengths and interests of the staff and learners in a better way. Educators have the freedom to decide if there is a more integrated way to deliver and learn the subject. The LOF allows educators this measure of control and innovation to the benefit of their learners. Whichever the method selected, curriculum planning, resource selection and the selection of teaching strategies will all be important.



# Assessment

## A. METHODOLOGIES THAT WILL ENSURE FIT FOR PURPOSE ASSESSMENT

There should be a variety of modes of assessment. There should be both assessment of learning and assessment for learning and therefore should include both summative and formative approaches to assessment. Formative assessment methods could give accreditation to cumulative work done by learners, perhaps the group and individual projects and presentations. The acquisition of hands-on practical skills (both laboratory skills as well as others that involve analysing data appropriately, discussing and inferencing) could also be assessed by formative methods. It is important that the assessment of these skills is standardized. Other assessment methods could include:

- peer and self-assessment,
- reflective journals,
- inquiry-based projects,
- portfolios.

### Assessment

Assessment is an integral part of the learning and teaching process, providing students and their parents with continuous, timely and qualitative feedback about their children's progress, giving teachers' information about their practice and providing schools and colleges with information about their curriculum planning, learning and teaching.

Assessment *for* learning (assessment for formative purposes) is a process carried out as learning is taking place. Learners and their teachers use the outcomes to find what learners know and are able to do in relation to learning.

Assessment *of* learning (assessment for summative purposes) is carried out at the end of a unit, mid-year or at the end of the year.

Assessment *as* learning (ongoing assessment) is the use of ongoing self-assessment by learners in order to monitor their own learning.

In subjects that are taught as modules, assessment of learning will take place at the end of a module. Information and judgments about learning are pulled together in a summary form for purposes of reporting to parents and sharing information with other teachers in the next class or school. If learners are fully aware of what is expected of them (the learning intentions) and the success criteria against which their learning will be evaluated, they will develop the self-evaluation skills which will help them become self-directed learners.

Well-designed and appropriately implemented, classroom assessment processes can:

- support learners to use self-assessment to gauge their learning, identify their strengths, their learning needs and their next steps.
- encourage learners to support one another's learning through peer assessment.
- help teachers to understand children's learning better, use evidence to monitor learners' progress, reflect on their practice and adapt or match their teaching to their learners' needs.
- help teachers plan for the learning of individuals and groups and ensure that all children receive appropriate attention.
- support parents to share their children's learning experiences, interpret assessment information and follow their children's educational development.
- promote the reporting on individual progress and achievement in an incremental manner.

Colleges and schools are required to develop an assessment policy. The policy should seek to address the quantity and quality of assessment practices as well as reporting to parents and other stakeholders.

Adapted from *A National Curriculum Framework for All*, Ministry for Education and Employment (2012:41-42) and *Assessments as learning*, Lam (2015:1)

Learners and others involved in their learning need timely, accurate feedback about what they have learned and how much and how well they have learned it. This helps to identify what they need to do next and who can help them build up their knowledge, understanding and skills. A learner's progress should be assessed in ways and at times appropriate to their learning needs. Judgements made about this learning should be based on evidence from a broad range of sources, both in and out of school and by reference to a learner's progress over time and across a range of activities.

By planning for ongoing assessment opportunities and periodic testing, particularly where learners use their skills in an integrated way, educators will allow learners to demonstrate, over time, *how much* and *how well* they have learned.

A balance of ongoing and periodic assessment opportunities will require learners to demonstrate a body of learning built up over time and to apply their knowledge and skills in different contexts. Mixing a range of learner controlled formative assessment opportunities will allow the learners themselves gauge how they are progressing against individual or grouped SLOs.



Educators should seek to gather a range of quality pieces of evidence to show progression in learning from both ongoing formative assessment opportunities and periodic, summative assessments. The amount and range of evidence should be sufficient to build up a profile of the learner's achievement. The evidence should show that the learner has understood a significant body of knowledge, has responded consistently well to challenging learning experiences and has been able to apply what they have learned in new and unfamiliar contexts.

Learning, teaching and assessment should be designed in ways that reflect how different learners progress in order to motivate and encourage them in their learning. To support this, all learners should be involved in planning and reflecting on their own learning, through formative assessment, self and peer evaluation and personal learning planning. Once learners are given the chance to interact with their peers and receive constant feedback from their educator, they are ultimately guided to make decisions on how to improve their Life Science knowledge and skills. The learners are thus given the chance to play an active role in self-assessment which encourages them to seek out personal goals for learning Life Science. These types of assessments can be planned at particular points, such as the end of a thematic unit, whereby the learners can judge and review their own performance by means of a grid stating the intended learning outcomes vis-à-vis the level which they have attained.

Educators will need to have a clear understanding of how their own learners are progressing in relation to others in their school and in other schools in Malta, against the outcomes and experiences at different levels. Regular, planned opportunities for dialogue are to be facilitated by Education Officers to help educators reach a shared and consistent interpretation of meaning as they apply the SLOs.

In each skill, the learner does not have to be secure in every outcome at one level in order to move on to the next. When appropriate, the learner should have the opportunity to engage in learning experiences at the next level. Educators should plan to give learners experience of all the outcomes but should take a holistic view. When learners have had a deep learning experience at one level, they should move on to the next.

Educators must ensure that their view of what a learner has achieved is supported by sound evidence. Their evaluation of this evidence must be consistent with the evaluations of colleagues in their own, or another department or centre. Centres should plan together and use their professional judgement in coming to a shared understanding of what it means to achieve a level. Emerging national guidance will support this process. Moderation is particularly important at times of transition from one level to the next and in transitions between Middle and Secondary Years.

Improving the quality of teaching and learning also implies fostering a culture which ensures the transparency of quality assessment outcomes and having in place approaches, structures and roles played by internal and external school evaluation systems.

*Quality assurance in education can be understood as policies, procedures, and practices that are designed to achieve, maintain or enhance quality in specific areas, and that rely on an evaluation process ... [that is] a general process of systematic and critical analysis of a defined subject that includes the collection of relevant data and leads to judgements and/or recommendations for improvement. The evaluation can focus on various subjects: schools, school heads, teachers and other educational staff, programmes, local authorities, or the performance of the whole education system.*

*Assuring Quality in Education: Policies and Approaches to School Evaluation in Europe,*  
European Commission (2015a:13)

Schools will need to begin to develop new quality assurance procedures, while enhancing existing ones, to support the introduction of the LOF and to secure its successful implementation in classrooms. This will need to be part of a whole-school implementation and quality strategy that could include opportunities for:

- Senior Management Teams taking an active interest in teacher CPD, monitoring teacher confidence levels and learner progress, e.g. sampling learners' work and leading whole-school self-evaluations.
- Heads of Schools creating shared preparation and planning time to help facilitate collaborative working.
- standards and expectations sharing through displaying learners' work aligned to levels to show progression, for example in work displayed on a 'learning wall'.
- staff engaging children and young people in discussions about progress and target-setting as part of planning to meet their learning needs.
- development of whole-school approaches to learning and assessment of CCTs.
- clear reporting strategies for feedback on progress within the school and outside the school, e.g. parents and guardians.

In Science Departments (in addition to the activities listed above), educators will need to be engaged in:

- regular departmental meetings to plan learning, teaching and assessment in a coherent way, with colleagues sharing effective strategies which they see as improving learning and achievement of learners.
- collaborative planning with other teachers, peer review and discussion of standards and expectations when teaching learners at the same level.
- cross-marking end of topic tests, periodic assessments and other internal assessments by marking learner work from other classes or groups, educators can engage in professional dialogue about the nature of the assessment, its fitness for purpose and the learner results.
- design of assessment materials, marking schemes and reporting strategies in collaboration with other teachers within the department or with appropriate staff in neighbouring schools.
- adopting strategies to avoid pre-judging outcomes, for example marking learners' work without knowing who the learner is.
- professional dialogue around learners' work that has been pre-marked to help reach an agreed view on quality and standards.
- Communities of Practice to share and/or strengthen their professional practice, focusing on sufficiency in assessment, consistency in interpreting SLOs, reporting progress to learners, parents and guardians and other teachers.



The Directorate for Quality and Standards in Education (DQSE) will ensure that:

- Education Officers carry out quality assurance visits to validate accuracy of each school's self-evaluation evidence and sample quality and consistency of the learning, teaching and assessment.
- staff members collate and analyse a range of local and national data to be used as the basis of discussion with Heads of Schools, Deputies and Faculty Heads/Principals to inform planning for improvement of learners' achievements.
- where good practice is identified, Education Officers, School Management Teams and other key personnel organise good practice events for staff across schools within the authority to disseminate good practice.

It is here being acknowledged that any feedback coming from schools, including that yielded from assessment, should reflect the wider objectives of education. Moreover, Quality Assurance conclusions will not automatically impact on the performance of schools. Schools need more than information on their performance – they also need guidance on how to improve and support, while attempting such improvement. The ultimate aim of quality assurance procedures should be to provide schools with an appropriate, coherent and comprehensive evaluation strategy which has a positive impact on the school leadership team and on the quality of teaching and learning.

## B. INCLUSIVE ASSESSMENT METHODOLOGIES

To help allow vibrant and diverse classrooms to thrive and demonstrate their learning potential educators need to ensure that assessment in the classroom is fair and inclusive, allowing every learner to show what they have achieved and how well they are progressing. Educators can ensure that assessment meets all learners' needs by providing each learner with appropriate support, employing a range of assessment methods and options and, in doing so, affording all learners the best chance of success. This will mean using performance and assessment information from a variety of sources to monitor progress and to inform what needs to happen next in the learning journey.

Educators need to be aware of, and work to, the relevant legislative frameworks that support learners experiencing barriers to learning. Barriers may exist as a result of family circumstances, disability or health needs and social or emotional factors. Where these circumstances occur, learners are entitled to have their additional support needs recognised and supported at the earliest possible stage – by the school, educational authorities and / or the state. Assessment strategies will be effective when educators use a range of assessment approaches flexibly to identify strengths, learning and support needs for vulnerable, disengaged and hard-to-reach learners in their classrooms.

### Supporting vulnerable learners

Supporting vulnerable learners may mean using planning tools such as personal learning plans or multi-agency coordinated support plans. Educators need to place the learner at the centre to ensure each learner with additional or diverse learning needs can achieve positive and sustained educational outcomes.

While schools need to consider which approaches will be most effective in helping to remove barriers to learning resulting from social and emotional circumstances including, for example, challenging behaviour, educators need to consider how these whole-school policies translate into action in the classroom.

Assessment planning and the resulting approaches taken (and instruments and methods used) need to ensure that all learners have an equal opportunity to demonstrate what they have learned and what they can do. Educators also need to consider what 'reasonable adjustments' to assessment approaches for disabled learners may look like in assessing ability. This may involve using appropriate assistive technologies. Given that good assessment practice is a key feature of teaching and learning, approaches used to help assess an individual learner's progress need to be as far as possible consistent with those used in the learning itself.

The principle of the continuum of achievement should be such that it allows a learner to follow the best pathway that will allow him or her to reach the maximum of his or her potential - irrespective of whether the student is a high flyer, has average abilities, basic abilities and/or has a disability. In this regard the NCF sought to establish a framework that ensures that, as far as possible, no student becomes a casualty of an education system that is unable to identify those learners who require encouragement and guidance. Equally importantly, the NCF allows for the introduction of different pathways that will truly allow a learner to develop his or her abilities in the manner best suited for him or her.

*Adapted from A National Curriculum Framework for All, Ministry for Education and Employment (2012:5)*

## C. RELIABLE AND VALID WAYS OF ASSESSMENT

Assessment will involve planning high quality interactions with learners and will be based on thoughtful and probing questions drawn from the SLOs and designed to ascertain the extent to which the outcomes have been achieved. Learners will be clear about the kind and quality of work required to achieve success in the SLOs. The methods of assessment used need to reflect the nature of what is being assessed.

In the periods between formal assessment interventions individual learners should be encouraged to ask for and should be given timely feedback about the quality of their work that they can understand, reflect on and ask questions about. Educators should strive to encourage the learner's active engagement in discussion about their work and progress, and suggest the steps they can take to improve their performance.

Educators should seek to empower learners to develop the skills to evaluate their own and each other's work against the SLOs, encouraging them to develop an appreciation of their own learning needs, how well they are progressing towards achieving the standard exemplified by the SLOs and the types of action they need to take to improve their progress.

The SLOs have been written in a way that is designed to ensure that the learning expectation is clear. They also act like an anchor for any and all related assessment activity by defining the learning that is in scope for assessment activity and by omission being clear about what is not in scope. This makes the assessment process and assessment expectations more transparent for the learner. At times SLOs involve an additional layer of detail delivered through the use of exemplification to illustrate the nature of the challenge within the SLO or through a clear statement of what must be included as a minimum in addressing the learning associated with the SLO.

Where there is exemplification, the example given is designed to be indicative of the degree of difficulty or challenge expected to be reached in the SLO. The example adds a further layer of detail and clarity so the educator knows the standard the learner should be looking to achieve.

What the assessment should really be trying to establish is whether the learners have reached the standard of the SLO. Can they do what the SLO says they can do? Can they demonstrate the ability to do what the SLO claims for them and can they do it routinely, confidently and comfortably? Here the educator's professional judgement and the professional agreement on what constitutes achievement is important.

The assessment standard is not necessarily what is stated in the SLO. The standard is the shared and consistently applied interpretation of what acceptable learner performance in response to the SLO looks like. In order to reach this judgement, educators will need to work within the subject teaching community to agree what achievement looks like at each of the levels (e.g. Level 8), at the level of the Subject Foci within a level and at the level of an SLO where this is not immediately apparent and there is scope for ambiguity or interpretation.

Assessment within the LOFs will need to be subject to robust quality assurance procedures that are designed to instil confidence in teachers' assessment judgements and assure parents, guardians and other stakeholders that all learners will receive appropriate recognition for their achievements in line with the agreed national standards and that learners are making the appropriate progress in line with expectations.

Where assessment is for high stakes qualifications and external certification, particular safeguards are required to guarantee fairness to all young people and to provide assurance to parents and guardians, MCAST, the University of Malta and employers that the system is robust. To that end MATSEC will produce clear assessment plans for Level 9 and 10 assessment, detailing the balance between high-stakes external assessment and internal assessment procedures and quality assurance.

As learners approach points of transition (for example, across Levels) it is important to have rigorous and robust assessment and related quality assurance procedures in place in order to ensure that there is a reliable system for sharing information about progress and achievements. Again, MATSEC and/or DQSE will be responsible for producing the guidance documentation detailing the policy and procedures for any transition assessment arrangements involving high-stakes or external assessment.

#### **Working the room: Measuring the impact of the teaching**

This whole class assessment technique can be used with Level 8 and 9 learners. Challenge stations are set up around the room, a sufficient number of learners is required to split the class into groups of 3-5 with a different challenge presented to each group. The challenges should be related to what has recently been taught in class and should be based on two or three distinct learning outcomes. The groups should be balanced out evenly in terms of ability with the addition of the elements of time and reward to keep motivation up and maintain the competitive spirit. The assessment of the activity will provide a good idea of how the whole class understands what has been taught.

Adapted from *Designing Effective Activity Centers for Diverse Learners: A Guide for Educators At All Grade Levels and for all Subject Areas* (Hilberg, Chang and Epaloose, 2003)

## D. ASSESSING CROSS CURRICULAR THEMES

The embedded CCTs within the SLOs are for guidance purposes only. As already indicated, the teacher may have better ideas of where, when and how to embed particular aspects of the CCTs.

The CCT icon in embedded SLOs is followed by a sub-heading from the CCT. This indicates the particular area of content that seems most appropriate for embedding within the delivery of the SLO.

The guidance about CCTs also describes how CCTs can be addressed through the choice of pedagogy or delivery style, classroom activity or approach to learning. Some may also be addressed through the introduction of whole-school or year group, curriculum enrichment activities or the adoption of particular sets of behaviours within the school community. The flexibility and freedom to decide upon and select which methods, opportunities and aspects of the CCTs are addressed when, where and how is entirely a subjective one. The aim is to ensure that the learners, through the course of their learning journey through the LOF, come into contact with the key learning associated with all the CCTs in significant and meaningful ways. The role of the CCTs is to yield resilient, adaptable, empowered young people with the robust, transferable skills the country needs to remain caring, inclusive, competitive and productive. This needs to be kept in mind when looking at the overall implementation and embedding of CCTs in the curricula.

This open and flexible approach to where, when and how CCTs are addressed is a challenge when it comes to trying to prescribe assessment approaches. While the lack of uniformity and consistency of when, where and how to embed CCTs in the LOF and in each subject area is attractive from a flexible delivery viewpoint, it represents a challenge in assessment from a standardisation standpoint.

The guidance around assessment of CCTs is simply to ensure that:

- the impact of the embedding strategy adopted at the classroom, departmental and school level is known and understood in terms of what has been learned.
- there is communication between schools, tutors and class teachers about the progress learners have made in coverage and acquisition of the CCT content.
- learners engage with each of the six CCTs with sufficient frequency, meaning and depth to allow them to achieve the key competencies they cover and to benefit from the new learning and skills each CCT introduces.

In each subject, educators may find it most beneficial to work with peers to determine the best-fit CCT opportunities, creating a support community to share development of resources and to help agree a consistent approach to teaching and assessment expectations when it comes to embedding the CCTs. Within this support community one can attempt to:

- agree which teaching approaches lend themselves to particular CCTs.
- share ideas and resource development.
- develop project-based approaches to SLO delivery that are enhanced by CCT inclusion.
- standardise assessment expectations around CCTs.

## E. REPORTING PROGRESS

### Learner and Parent/Guardian Reporting

Reporting on learning and progress should offer learners, parents, guardians and teachers insight into what learning expectations have been set, how the learner is progressing in relation to these learning expectations and how the learner can do what needs to be done to ensure continued progress and improvement as they go forward with their learning. Reporting should always be constructive, insightful and able to be used to stimulate meaningful discussion between the teacher, learner and their parent or guardian. It should, at the same time, be reflective, looking back at achievement, and forward-looking, focusing on improvement.

The LOF offers local flexibility for schools to decide how best to report information on learner progress, achievements and next steps within a clear set of national expectations. How frequent and what form such reporting takes are also decisions to be taken at the school and college level.

#### National expectations for reporting

Reporting will provide the learner, their parents or guardians with information on progress and achievement in each subject that includes:

- constructive, insightful and clear feedback throughout the learning experience.
- feedback on the learner's particular strengths, areas for development and completed achievements.
- feedback on the different curriculum areas.
- the particular support the learner is receiving to help them progress.
- attitude of the learner to learning.
- how home can play an active part in supporting the learning process.
- an opportunity to capture the learner's voice.
- an opportunity for parents/guardians to respond directly to the reporting feedback.

It is important that the reporting structure used is manageable for teachers.

Reporting is based upon the assessment of progress and there is a balance to be struck between how often assessment of progress is made and how often this progress is recorded and communicated to the learner and the parent/guardian. The reporting needs of the two groups are different:

- Learners should be receiving feedback on progress on an ongoing basis as a routine part of the learning and assessment process. The use of formative assessment (often called Assessment for Learning) should be a routine part of any assessment strategy. This makes this type of reporting frequent and continual.
- Parents and guardians need to be kept informed of their child's progress at key points in the learning journey where there needs to be feedback given around achievement and a discussion instigated between home and school about how further progress and improvement can be made. This makes this reporting much less frequent but recurring. At the very least, achievement of a level should be reported every time a level is achieved.



### Reporting process

It is important to set up a process by which learners can take some ownership of what is reported. Educators should consider working with learners to determine which evidence should be drawn upon to summarise learning and progress for the purposes of reporting. This will invite reflection and dialogue about their learning and will be a useful opportunity to help the learner engage more deeply and meaningfully in discussion about their own learning. This type of dialogue will not restrict or impinge upon educators' professional judgements but will offer them some insight into the learner point of view and may help deepen their understanding of the impact of their own learning strategies.

The LOF offers the ability to report progress within the subject at different levels of detail. Each subject is broken down into levels, containing Subject Foci and each Subject Focus is further broken down into SLOs. With the SLOs making the outcomes of learning explicit, it will be important to establish what the learner, parent/guardian needs to know about progress against the SLOs and what can feasibly be shared, how often and when. Educators will first need to separate out internal reporting needs to chart a learner's progress, so that this can be shared with other teachers as they progress in other subjects, to benchmark progress more widely. Different audiences will need different details about learner progress.

The school and the relevant department need to set the policy on how they intend to report.

### Internal Reporting

In order to maximise the opportunities that the LOF brings in terms of flexibility and freedom to help learners progress towards the learning expectations, the teacher will need to have a detailed appreciation of what the learner has already achieved and just how they relate to the learning expectations that the teacher is responsible for teaching. The teacher who comes next will also expect an appraisal of learner performance. It will be important to establish, through discussion with colleagues, how best to manage this internal communication and reporting in order to ensure a balance between what is helpful and insightful in assisting with the transition process and what is unwieldy, onerous and unmanageable.

It is important to remember that the detail that can be created around individual performance does not necessitate or promote an individualised teaching programme for each learner. Instead it is there to be used to facilitate a more responsive approach to curriculum design and more appropriate selection of teaching strategies and resource selection within the class.

As learners progress through the LOF, moving from level to level, year to year and class to class they will progress at different rates. This represents a challenge if learning is to remain fluid and continuous and progression is to be uninterrupted. That said, the Subject Foci and SLOs allow teachers to profile progress and achievement and to communicate that progress in a regular manner, indicating where the learner sits in relation to the overall expectations of a level, even indicating where there is some achievement beyond the level. The school is given the flexibility to decide how best it wants to communicate learner progress within the school and between those responsible for their learning and progression. Within the subject teaching team it will be important to identify an approach that is functional and clear within the subject and will ultimately maximise the Learning Outcome Framework's ability to chart progress in detail and in a personalised, learner-centric way.

A simple Achieved/Not Yet Achieved is clear feedback, yet it does not convey how close or far from being able to demonstrate achievement of the SLO the learner is. Educators may find it useful to come up with a convention that does more than just use a binary method of reporting achievement. Communicating more information about how a learner is relating to a particular level helps instigate discussion of where there may be particular learning challenges or where a learner has only started the learning associated with particular Learning Outcomes.

Evidence informing reporting should be drawn from a range of sources, including formal and informal assessment interventions, and educators should apply their professional judgement to a sufficient and robust body of evidence that allows them to report with confidence about progress made against a significant body of learning. Formal summative assessment interventions need to be subject to collaborative design and development and feature a measure of quality assurance and moderation to ensure what is reported is benchmarked against a wider understanding of the national standard.

#### How it is done elsewhere

The Scottish *Curriculum for Excellence* frames progression in relation to the learning expectations as developing, consolidating or having secured the learning objectives. These are not rigid categories but signposts indicating where the learner sits in relation to the expectations.

Typically, a learner who has started to engage in the work of a new level or area and starting to make progress in an increasing number of outcomes is at the Developing stage.

Once the learner has achieved a measure of breadth across the Subject Foci; can apply the learning in familiar situations; is beginning to show increased confidence by engaging in more challenging learning; and is starting to transfer their learning to less familiar contexts, they are engaged in a process of Consolidation.

Once significant achievement across the Subject Foci and outcomes has been recorded and there has been consistent success in meeting the level of challenge within the outcomes; learners are engaged in more challenging work; and are confidently transferring their learning and applying it in new and unfamiliar situations, their position in relation to expectations is viewed as Secure.

Adapted from *Building the Curriculum 5, A Framework for Assessment: Reporting*,  
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# Appendix



## Digital Literacy

Digital literacy has become essential for learning and life. Besides cutting across various disciplines it must now be considered as being a discipline of its own such as music, art, science and literature. Digital literacy education seeks to equip learners with the competencies (knowledge, skills and attitudes) in the use of digital technology needed to access learning opportunities, to pursue their chosen careers and leisure interests and to contribute to society as active citizens. It also aims to provide them with knowledge of the principles underpinning these technologies and a critical understanding of the implications of digital technology for individuals and societies.

Digitally literate learners learn to become independent, confident and discerning users of technology. Subsequently they acquire and develop critical and analytical attitudes to appropriately choose the right digital tools according to specific needs.

Digital literacy includes five categories of digital competencies, namely: Information Management, Communication and Collaboration, Digital Media, Using Digital Tools for Learning, Management of the Internet.

The competence in information management enables learners with the means to access, evaluate and analyse and hence make an informed choice from a range of available data and information sources. Competencies relating to Communication and Collaboration empower learners to learn to communicate, collaborate and network with others. Competencies in Digital Media enable learners to analyse messages mediated by digital media and to express themselves creatively across a range of digital media.

Digital literacy also involves competence in using digital tools in various media and in different modes of learning (autonomous, collaborative, exploratory, designing). Digitally literate learners will learn to be responsible and competent in managing the internet, keeping themselves safe and secure online, making informed choices over privacy, taking responsibility for their actions, respecting intellectual property, abiding by the terms and conditions of systems they use and respecting the rights and feelings of others. In teaching digital literacy, teachers should look for authentic, meaningful and socially inclusive learning opportunities which allow learners to apply and develop their skills, knowledge and understanding across the curriculum. Digitally literate learners should be able to undertake challenging creative projects, both individually and collaboratively comprising aspects from different competence categories.

## Theme Learning Outcomes:

### Information Management

- I am able to identify and articulate my information needs.
- I can find, select, use and combine information from a range of sources.
- I can safely and critically navigate between online sources and select information effectively
- I can navigate between online sources and select information effectively.
- I can create personal information strategies.

### Communication

- I can communicate through a variety of digital devices and applications.
- I can adapt my communication modes and strategies according to the people I am communicating with.
- I can use different digital tools to share knowledge, content and resources.
- I can help others to share knowledge, content and resources.
- I know how to quote other people's work and to integrate new information into an existing body of knowledge.
- I can engage with on-line learning communities effectively.
- I can use digital technologies to participate in online citizenship.

### Collaboration

- I can use technologies and media to work in teams and collaborate in learning.
- I can collaborate with others and co-construct and co-create resources, knowledge and learning.
- I can function well in digitally mediated Communities of Practice

### Use of Digital Media

- I can review, revise and evaluate information presented in a range of digital media.
- I understand both how and why messages in digital media are constructed and for what purposes.
- I can examine how individuals interpret messages in digital media differently.
- I understand how values and points of view are included or excluded and how digital media can influence beliefs and behaviours.
- I understand the ethical / legal issues surrounding the access and use of digital media, including copyright, ownership, licensing and use of proprietary content or software.
- I can work creatively across a range of digital media and multiple systems to present information effectively to a given audience.
- I can edit and improve content that I had already created or that others have created, respecting and acknowledging the rights of the original author.
- I can express myself through digital media and technologies.

### Managing Learning

- I can use various tools to manage my own learning.
- I can use various tools and approaches to collaborate with others in learning.
- I can use various tools to explore ideas, theories, relationships and procedures.
- I can use various tools to learn by designing digital objects.
- I can use various tools and approaches to reflect on learning.
- I can use various tools and approaches to evaluate what I have learnt.
- I can build and assess e-portfolios.
- I can work on multiple eLearning management systems and platforms.



### Managing Internet Use

- I understand how the internet and the world wide web work and can use them for communication and collaboration.
- I am aware of and abide by the principles of netiquette.
- I know what constitutes plagiarism.
- I can protect my devices from online risks and threats.
- I can protect myself and others from possible online dangers (e.g. cyber bullying) by following appropriate privacy and confidentiality procedures.
- I am able to consider the social, cultural, religious and ethical implications of digital technology and can confidently communicate, share information, access and distribute content without infringing upon other peoples' intellectual property.
- I am aware of cultural diversity online.
- I can develop active strategies to discover inappropriate behaviour.
- I can create, adapt and manage one or multiple digital identities.
- I can protect my e-reputation.
- I can manage the data that I produce through several online accounts and applications to avoid health risks related with the use of technology in terms of threats to physical and psychological well-being.
- I recognise Cloud Computing as a converging technology on which I can work and save my material.



## Education for Diversity

The National Curriculum Framework (NCF) acknowledges Malta's cultural diversity and values the history and traditions of its people. It acknowledges and respects individual differences of gender, colour, ethnic and social origin, language, religion or belief, political or any other opinion, membership of a national minority, birth, ableism, age or sexual orientation and geographical location. A curriculum that acknowledges the fact that diversity is a feature of Maltese society, as it is of nations across Europe and the world, that can contribute to national prosperity and social cohesion.

As a member state within the United Nations, Malta is a signatory to international human rights instruments including the Universal Declaration of Human Rights (1948), the European Convention for the Protection of Human Rights and Fundamental Freedoms (1950), the International Covenant on Civil and Political Rights (1966), the International Covenant on Economic, Social and Cultural Rights (1966) and the UN Convention on the Rights of the Child (1989). As a member of the European Union, Malta is legally bound by the EU Charter of Fundamental Rights.

These instruments set out international standards and commit Malta's government and people to democracy and to acknowledging that citizens and other residents have, and should enjoy, human rights without discrimination.

Consequently the NCF aims to help children acknowledge social justice and solidarity as key values in the development of the Maltese society and encourage young people to uphold fundamental democratic values and promote social justice.

Education for Diversity promotes an inclusive educational culture and challenges various educational processes such as decision making within schools, languages of instruction, methodologies used, learner interaction and learning resources. Education for Diversity ensures the inclusion of multiple perspectives and voices within the learning environment, provides spaces for learning about the languages, histories, traditions and cultures of non-dominant groups in a society, encourages team work and cooperative learning in multicultural, multi-ethnic and other diverse contexts, combines traditional and local knowledge and know-how with advanced science and technology and values the practice of multilingualism. In doing so, it encourages an understanding of global issues and the need for living together with different cultures and values.

### Theme Learning Outcomes:

#### Self Awareness

- I am a person committed to democracy and understand that this means ensuring people of different views and cultures have their say and work together for a better society.
- I have a principled and ethical approach to life.
- I am committed to social justice and a democratic and inclusive society.
- I reserve judgement so that it may be made on a fair and rational basis.
- I strive to strike a balance between my rights and duties and those of others.

### Social Change

- I uphold fundamental democratic values and work to promote social justice.
- I respect the different religious and humanist convictions, morals and beliefs that inform people's conceptions of right and wrong.
- I recognise unfairness, injustice and preferential treatment in daily life situations including racist, sexist and homophobic language and behaviour.
- I challenge expressions of prejudice and intolerance towards minorities such as racist, sexist and homophobic names, anecdotes and comments.
- I claim my rights and act on my duties knowing that my fellow learners and teachers have equal entitlement to their rights.
- I appreciate that the notion of 'identity' is complex and changing and limited as a concept in capturing who I am and that the idea of 'identities' is a more powerful way of understanding who I am and who others are.
- I attend and respond to my teachers and fellow learners and accept that they may have different points of view.

### Communicating for Diversity

- I communicate with, work with and respect all of my fellow learners, teachers and adult helpers.
- I communicate with people who are different to understand how we are the same and to understand myself better.
- I strive to communicate effectively with others in a constructive, supportive and self-determined way.
- I can use effective language to challenge injustices and inequalities.
- I approach differences of opinion and conflicts of interest through dialogue, non-violent communication and consensus; where this fails, I am willing and able to use mediation.



## Education for Entrepreneurship, Creativity and Innovation

While entrepreneurship, creativity and innovation can potentially be seen as being discrete attributes, it is perhaps more strategic to consider them as mutually reinforcing features of a more cohesive and singular aim: to ensure that the future citizens of Malta have the wherewithal to contribute to the sustainable prosperity of the nation in an increasingly competitive global economic and social contexts. The goals include the four main competence areas of personal and interpersonal skills, practical and cognitive skills. This more strategic vision reinforces the need for an approach to Entrepreneurship, Innovation and Creativity that permeates all aspects of the curriculum, while being clearly signposted to ensure that learners' entitlements are being met and that learning and teaching in relation to these themes can be quality assured.

The overall goals of entrepreneurship education are to give learners the attitudes, knowledge and capacity to act in an entrepreneurial way and to acquire the skills that will promote their lifelong employability in a rapidly changing commercial, economic and social environment. This includes becoming entrepreneurial citizens in other spheres beyond industry or employability. These goals require the development of the 'soft' generic personal and interpersonal skills fundamental to becoming entrepreneurial, as well as the fostering of the more discrete entrepreneurial knowledge and understanding required to pursue entrepreneurial endeavours and to possess an entrepreneurial mindset which is both creative and innovative.

Creativity is generally recognised as both an innate yet often under-developed quality in young people, as well as a practical skill that helps to unlock an entrepreneurial disposition. It is a skill that can be taught and that everyone can aspire to. It involves opening up young peoples' thinking processes in ways that help them to look at familiar things with a fresh eye, to identify and frame a problem and to generate solutions whilst using their imagination, knowledge and skills to explore new possibilities rather than established approaches.

The ability to be innovative and the confidence to look for innovative responses to opportunities or problems encountered is best nurtured in a safe, supportive environment where this type of approach is encouraged, recognised and rewarded. Such a pedagogy requires allowing learners time to reflect on a situation and tap their resources and imagination to develop plans and solutions. It also requires time for implementation of new processes and the application of new ideas. Teaching and learning for innovation might even include space to 'learn from failure'.

### Theme Learning Outcomes:

#### Personal

- I can work effectively on my own.
- I am resilient and can persevere.
- I understand the importance of nurturing a positive self-image, self-esteem and self confidence.
- I recognise the importance of integrity and ethical values.

#### Interpersonal

- I know how to communicate my proposed strategies to others effectively.
- I am able to contribute to a team.
- I am able to take the lead.

**Cognitive**

- I am able to solve problems imaginatively and laterally.
- I am able to think critically.
- I am able to consider different perspectives.
- I can recognise that entrepreneurship and innovation should be underpinned by ethics and values relating to social justice and sustainability.

**Practical**

- I can turn creative ideas into action.
- I have a basic set of research skills.
- I am able to audit my own skills and interests in order to consider future academic and vocational career choices.
- I appreciate the importance that creativity and entrepreneurship have played in the development and progress of human society.



# Education for Sustainable Development

Education for Sustainable Development (ESD) helps learners to develop the necessary competences (knowledge, skills, values, attitudes and behaviour) that enable them to become sustainable citizens. ESD empowers individuals to actively participate in decision making processes which are compatible with living within the environmental limits of our planet in a just, diverse, equitable and peaceful society.

ESD seeks to ensure that learners:

- Develop a sense of identity and belonging to their local, national, regional and global community.
- Are empowered to adopt their roles and responsibilities within a globally interdependent world.
- Understand and are empowered to address the real causes and consequences of unsustainable behaviour within the context of an interdependent and globalised world.
- Develop a future-oriented perspective that highlights the significance of their decisions, choices and actions on the quality of life of present and future generations.
- Are exposed to diverse learning environments using a broad array of educational experiences.
- Develop a holistic concept of the environment involving natural, social, economic, physical and cultural perspectives.
- Value and respect social, cultural and ecological diversity.
- Are committed to action to bring about change.

ESD should be achieved through a whole-school approach that involves the reorientation not only of the curriculum, but also of the school culture, the school campus management, the school community and the wider local community in line with sustainable development.

Learners should experience ESD through transformative pedagogies that facilitate ESD teaching and learning experiences that promote the acquisition of the knowledge, skills, values, attitudes and behaviours necessary to become active global citizens.

ESD should be a lifelong learning process involving a blend of learner-centred processes, such as participatory/ collaborative learning; problem-based learning; inter-disciplinary learning; multi-stakeholder social learning; critical and systemic thinking-based learning; action learning; learning outside the classroom; experiential learning; reflective evaluation and using relevant real-world contexts.

## Theme Learning Outcomes:

### Learning to Know

- I can explain how the natural, social, cultural and economic systems work and are interrelated.
- I can describe my role as a citizen within the local, national, regional and global context.
- I can recognise the relationship between understanding others and the wellbeing of all in the present and the future.
- I can identify the root causes of inequality and injustice and actions that lead to a better quality of life, equity, solidarity and environmental sustainability.
- I can justify the importance of identifying problems, reflecting critically, thinking creatively and having a wider vision in order to plan for the future and become an effective agent of change.
- I can recognise the importance of lifelong learning and use such learning experiences to approach new challenges and be in a better position to take informed decisions and evaluate their consequences.



### Learning to Do

- I can communicate my ideas and present my opinions in thoughtful and informed discussions and decision making processes.
- I can critically assess processes of change in society and envision a more equitable and sustainable world.
- I can identify priorities and evaluate potential consequences of different decisions and actions.
- I am able to collaborate with people having different perspectives on dilemmas, issues, tensions and conflicts from different disciplines/places/cultures/generations.
- I can use the natural, social and built environment that surrounds me, as a context and source of learning.
- I can involve myself and others in real-world issues to bring about a positive difference.

### Learning to Be

- I am a critically reflective person and am able to evaluate decisions, choices and actions.
- I am responsible for my actions and capable of anticipating, adapting to and facing change.
- I can reflect upon the consequences of my actions on present and future generations.
- I am sensitive to divergent disciplines and perspectives, cultures and minority groups, including indigenous knowledge and worldviews without prejudices and preconceptions.
- I am motivated to make a positive contribution to other people and their social and natural environment, locally and globally.
- I am able to creatively and innovatively take considered action and challenge assumptions underlying unsustainable practice.

### Learning to Live Together

- I can live in harmony with myself, others and the natural world at a range of levels from the local to the global.
- I respect and value diversity and challenge social injustice.
- I have a future-oriented perspective for how I live my life as a citizen of the world.
- I actively engage myself with different groups across generations, cultures, places and disciplines.
- I can actively participate in processes and encourage negotiations for alternative sustainable futures.
- I will help others clarify diverse worldviews through dialogue and recognize that alternative frameworks exist.
- I will challenge unsustainable practices across educational systems, including at the institutional level.



# Learning to Learn & Cooperative Learning

The aims of Learning to Learn are for learners to:

- Focus on learning processes as well as final performances.
- Hold a rich conception of learning and based on a personal conviction to manage own learning.
- Acquire a wide range of strategies for learning.
- Develop strategies to plan, monitor and review their own learning.
- Become competent in self-assessment.

## Theme Learning Outcomes:

### Social Learning

- I can appreciate diverse viewpoints and personalities.
- I am confident in discussing my views with others.
- I can follow the ideas of others and comment on their views.
- I can follow group discussions and collaboration and summarise what is being said or done.
- I collaborate with other learners as part of my learning.
- I learn by designing products with others.
- I seek out and am open for guidance and support from peers and adults.
- I am able to talk with others about learning.
- I listen to others talk about learning.
- I can discuss various subjects and learning strategies with peers.
- I can debate and support my argument without being judgemental while still empathising with others.
- I can learn about my needs to make the right choices.

### Personal Learning

- I can identify the support and resources I need to learn.
- I am aware of my preferred way to learn and can use this to plan my own learning.
- I manage goals and time efficiently in learning.
- I feel competent in managing my own learning.
- I am open to feedback from others and am able to consider it for my personal improvement.
- I reorganise myself by explicitly changing my assumptions over time.
- I am able to follow my own interests as this helps me to reflect on 'who I am'.
- I am pleased when I succeed at difficult tasks.
- I believe that effort can lead to success.
- I reflect on my mistakes and learn from them.

### Cognitive Learning

- I am able to remember by recalling, recognising and locating information.
- I am able to link new information to my existing knowledge.
- I am able to analyse information that I come across.
- I evaluate knowledge in terms of my learning objectives and my preferred way of learning.
- I am able to solve problems on my own and in collaboration with others.
- I am able to assess myself as this helps me to understand what I know and who I am.
- I assess myself to analyse and further develop my ideas.

- I assess my peers to compare what I know to what others know, gaining knowledge of what mental models others hold of a particular concept and how these mental models can evolve for understanding to happen.
- I am able to focus on the main subject and summarise important points.
- I am able to apply my knowledge and understanding in differing contexts.
- I can manage my own learning to improve important skills including literacy and numeracy skills.
- I understand that learning involves different processes.

### **Creative Learning**

- I take initiative in designing new products.
- I am able to think about new ways of making good use of objects.
- I am able to use my imagination and creativity.
- I prefer to move on to challenging tasks rather than stay on easy ones.
- I am able to face new, challenging experiences and learn from them.
- I learn by exploring events, life experiences and the physical environment.
- I am able to engage in unplanned spontaneous play.
- I am able to engage in planned, purposeful play.
- I understand that I can improve and learn and that if I am stuck I can think upon my difficulties, solve my problems and move forward.



## Literacy

One of the most important aspects of literacy in Malta is the implication that a literate person is fluent in both Maltese and English. An essential factor to ensure that Malta remains a bilingual country is making sure that its learners develop equal competences in reading, writing, speaking, listening and comprehending in both official languages from the early years, preferably from kindergarten. Another is ensuring that learners develop the skill to switch easily from Maltese to English (or vice versa) depending on the situational need. Achieving bilingual literacy in our education means that all our young people feel comfortable and confident using both languages.

Literacy development will require a whole-school approach that is clearly reflected in school policies where there is a conscious effort in which a community for literacy is promoted throughout the curriculum. Literacy for learning is an intrinsic part of school life and every subject domain can serve as a context whereby literacy skills development could be enhanced. Furthermore, schools should strive for a literacy rich environment using technology as a platform.

The relevance of reading aloud and presenting ideas to an audience and the opportunities for contextualised language and play acting (drama) should be clearly identified as components of spoken literacy across the curriculum. Stressing the importance of oracy is key to encouraging active learning cultures and communities.

With regard to reading, the fun and interactive aspect of reading is very important; the purpose of reading should initially be for fun/interest and communication. The value of entertainment in reading, which is closely linked to attitude and disposition to language, is crucial especially in the Early and Junior Years. Critical and creative thinking, where the learner increasingly takes control of texts in different domains and gains awareness, will follow.

### Theme Learning Outcomes:

#### Listening and speaking

- I can converse in a range of situations, both formal and informal, matching register and language to the situation and audience.
- I can listen to and understand spoken text well and respond or apply the information appropriately with comments and/or questions.
- I can use language to present my thinking logically and clearly and can talk to engage an audience while analysing and evaluation through an open-ended approach.
- I can use spoken language to share my ideas in a collaborative way, appreciating the social elements of conversation such as waiting for my turn and listening to what others have to say.

#### Expressive language

- I can use expressive language to develop my own thinking, using words to explore, clarify and confirm ideas.
- I can use expressive language to develop my thinking and the thinking of others by contributing to the explorative talk of my peers and the dialogic talk of my teachers.
- I can use expressive language to organise and rehearse ideas, arguments and language structures in order to synthesise and evaluate before writing and while editing.

### Reading and understanding

- I can decode print effectively and successfully establish multisensory linking and phonemic awareness between grapheme and phoneme.
- I can read text in a fluent manner and understand what is written, gain knowledge and enjoy the process.
- I can select real, virtual and multimedia texts to entertain and inform me, constructing meaning from text, using words and visual or audio information to confirm, complement or change what I already know while discarding the superfluous.
- I can approach texts purposefully: I am aware of what I hope to gain from them and am able to use retrieval devices, cross references and links to follow themes or ideas through various means including texts accessed via technology.
- I can select appropriate texts for my purposes, taking account of implied readership and provenance as well as subject matter and format.
- I can identify and follow the different reading conventions of my academic subjects, regarding the place and purpose of reading texts in learning and in questioning or accepting the authority of these texts.

### Writing

- I can draw on what I have read, what I have done and what I have felt at home, at school and at play to inform my writing.
- I can convey my thoughts powerfully and eloquently through speech and text.
- I can select the appropriate language, register, genre and medium for the texts I write.
- I can use writing in both manuscript (handwritten form) as well as digital form in order to inform, to persuade and to entertain other people.
- I can use writing to consider ideas and to reflect on and consolidate my own thinking and learning. I can follow the writing conventions of the genres and subjects I am studying.

### Accuracy

- I can write accurately using language conventions and rules such as those established by Standard English / Kunsill Nazzjonali tal-Ilsien Malti / l-Akkademja tal-Malti.
- I can use my knowledge of morphology as well as my phonological awareness and visual memory to attempt to spell unfamiliar words and recognise correct spelling.
- I can use a range of punctuation marks to make my meaning clear to a reader.

### Planning and reflection

- I can plan my written work and think what I want to communicate before I start to write.
- I can understand the need for drafting; I can edit and proofread my work and allow sufficient time in which to complete a piece of work.
- I can reflect about my writing and think about how I learn best.









## Learning Outcomes Framework

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