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Prerequisite of Using the Assessment Framework

This Assessment Framework (AF) provides theory and structured conceptual map of how the learning outcomes of a programme of study should be assessed at the primary school level. It contains guidelines and principles of assessment as well as several practical examples to illustrate the application in the classroom.

The framework can be considered a blueprint of an assessment programme at the primary school level. As with all assessment frameworks, its enactment in schools and classrooms will require professional judgement guided by the following prerequisites.

Teacher and Head Teacher Development – Where needed, teachers and head teachers would require short courses on a. formative assessment, b. the progressive notions of cyclic purposeful assessment and their need in Pakistani context, and, c. the importance and conduct of formative feedback, which facilitates learners' progression from lower-order thinking skills to higher-order thinking abilities. They may also need to learn how to read the curriculum maps and tables of specification to plan for authentic and valid assessment.

School Based Assessment Planning – School based yearly assessment programmes and monthly assessment schemes must be developed taking into account the principles, guidelines and examples from the AF. The framework contains schedules of assessment and assessment weightage. These need to be considered for school level planning.

School Based Mentoring – There is a need to develop mentors who can work with teachers and head teachers in the selected schools to help them translate the AF into various schools' realities. Pakistan has schools of varying systems – from public to private to madrasah; varying contexts - from rural to urban to semi-urban; varying socio-economic background – from schools for high-income group to low income groups to middle-income groups. Therefore, mentors will be required for at least the first year of the implementation of the AF.

CHAPTER ONE

INTRODUCTION

Chapter One

Introduction

This chapter introduces the National Assessment Framework (NAF), developed as an integral component of the National Curriculum Framework (NCF). By drawing on essential information from different national policy documents and from the relevant international literature, the chapter discusses the philosophical positioning of the assessment framework. It presents a brief overview of the quality of education and the need for developing a uniform national assessment framework. It further outlines the basic structure and the principles of various forms of assessment for General Science grades IV to V.

Quality of Education

The basic purpose of any initiative taken at policy and practice level is improving the quality of education imparted by schools to young learners. Quality as a complex and contested notion does not have a single definition; the understanding and the provisions of inputs into quality in education vary from society to society and context to context. National Curriculum Framework (NCF) (Government of Pakistan, 2018b) refers to quality of education as a set of elements containing input, process and output of the education system. Quality also entails all the desirable characteristics of learners, processes, learning materials, content, governance and management, and learning outcomes. Elaborating on the definition, NCF (2018b, p.1) further argues, “Quality education satisfies basic learning needs and enriches the lives of learners and their overall experience of living.” Policy document on Minimum Standards for Quality of Education in Pakistan (Government of Pakistan, 2018a) refers to the definition used in Education for All (EFA) Global Monitoring Report 2005, which draws on two principles. The first principle identifies learners' cognitive development as the major explicit objective of all education systems, and the second emphasizes education's role in nurturing creative and emotional development for promoting the values and attitudes of responsible citizenship. The document on Minimum Standards for Quality of Education (2018) explains the concept of quality in terms of education that is “meaningful, relevant and responsive to the needs of individuals and the society as a whole.” (Government of Pakistan, 2018c, p.5). Similarly, the National Educational Policy (NEP), 2009 recognizes six pillars of quality, which include curriculum, textbooks, assessment, teachers, learning environment and relevance of education to practical life.

The Need for an Assessment Framework

As noted in the definition above, assessment is an integral part of the quality of education offered to the students. Assessment is an essential part of processes at input level, as well as serves as a tool to measure outputs and outcomes of processes and practices. As reflected in

these definitions, assessment, as an important practice in education, is to play a central role in translating the key ideas in the quality definition into practice.

Assessment, as defined by Erwin (1991 cited in NCF (Government of Pakistan, 2018b) is:

> …the process of defining, selecting, designing, collecting, analysing, interpreting, and using information to continuously increase students' learning and development. It is the systematic collection, review and use of information about educational programmes to improve student learning. Assessment focuses on what students know, what they are able to do, and what values they have when they receive their education… Assessment is concerned with the collective impact of a series of lessons on student learning. (p.69)

The above definition of assessment implies that on the one hand assessment provides evidence of students' learning of academic content (academic domain) and development in other domains (psychosocial/psycho-emotional, language and affective domains). On the other hand, it supports the collection of relevant information for various purposes such as informing teaching and learning, determining students' progress on an ongoing basis, measuring achievement, and providing information needed for monitoring individual and institutional accountability. These all lead to informed decision-making about improving students' learning outcomes and enhance the overall quality of education focusing on efforts at classroom, school and system levels.

Despite the paramount importance of the student assessment system and the promises made in the successive education policies, Pakistan has not been able to put in place the kinds of policies, structures, mechanisms, processes, practices, and tools that contribute to creating a strong and effective student assessment system in the country. In Pakistan, programmes and efforts of projects (e.g. setting up NEAS, PEAC, conducting standardized tests/exams at Grade 5 & 8) made to improve student assessment have proved to be weak. There is a need for a comprehensive and coherent national policy framework to guide and support education systems, schools and teachers in bringing about improvement in student assessment on a sustainable basis. As pointed out in the policy document on Minimum Standards for Quality Education in Pakistan (Government of Pakistan, 2018a, p.2), "the absence of clearly articulated and agreed upon minimum national standards for quality education leaves the education system without a basic framework for setting targets and for evaluating attempts at improvements in education quality."

NCF (Government of Pakistan, 2018b), considering assessment as an integral component of the teaching process, emphasises on developing different assessment mechanisms to assess students' competence as per curricula through different forms of assessments than the use of conventional methods considering them sporadic and unreliable. Therefore, it calls for a more valid and reliable system that not only addresses the deficiencies in the current assessment and

penalize unfair means in large-scale public assessment, but ensures standardized execution of formative, summative, classroom based assessment, school based assessment and large scale assessment across the board in the country.

Thus, a robust and coherent national assessment system will help in the realization of the aims, goals and purposes of education articulated in NCF and other policy documents.

The Purpose of Developing Assessment Framework

Considering the fact that the use of older and rigid forms of assessment is a hindrance to quality teaching and learning and may impair the effectiveness of NC, a different assessment framework is developed to provide the basis for reliable, valid and useable for all types of assessment, grades and subjects. The National Assessment of Educational Progress (NAEP) also confirms that creating a nationwide assessment framework will provide all the actors with a blueprint for the content and design of different types of assessments. The framework may further provide a starting point for constructive discourse about high-quality educational standards and assessments.

The purpose of developing an assessment framework is to ensure the standardized implementation of different forms of assessment that includes formative and summative school-based classroom assessments and large-scale assessment. It encompasses a paradigm shift from the traditional ways of assessing to a competency-based assessment considering the implication for its utility, reliability and practicality in different contexts. Underpinning different purposes of assessments, the framework serves as guidance for all the stakeholders in the learning system in developing, implementing and using assessments methodically to instate stronger teaching and learning practices.

The Purpose of Developing General Science Assessment Framework

The General Science curriculum is designed to help students become scientifically literate and to encourage them to develop a critical sense of wonder and curiosity about scientific and technological endeavours through inquiry to critically address social, economic, ethical, and environmental issues related to science and technology. Furthermore, the curriculum enables students to use science and technology to acquire new knowledge and to create opportunities to solve problems, so that they may improve the quality of their own lives and the lives of others.

Aligned with the General Science curriculum, General Science Assessment Framework is developed to provide different forms of formative and summative assessment along with the purpose with which each assessment is being introduced.

General Science Assessment Framework is constructed in the form of tasks that involve taking into account the developmental levels of students. The General Science Assessment

Framework is a multi-dimensional framework and it provides a variety of assessment tools to gather information from multiple sources to make sense of what students understand and what scientific ideas are still developing in three different strands, that is, life science, physical science, earth and space sciences. It will also present a table of specification along with the structure of formative and summative assessment, schedule of assessment and guidelines for providing feedback for improving performance. The framework also provides samples/ examples of selected and constructed items for summative and formative tests including marking guidelines, examples of authentic tasks and rubrics as well as examples of effective feedback.

Assessment

The above discussion signifies that the assessment needs to be purposeful. It is a broad process of collecting, synthesising and interpreting information to support student learning and to report on the amount learned. The supporting function is known as formative assessment and the reporting function is known as summative assessment (as shown below)

Assessment Type	**Formative**	**Summative**
	Looking back and preparing forward. Feeding back and feeding forward.	Feeding back. Providing a snapshot.
Assessment Objectives & Outcomes	**Assessment *as* and *for* Learning**	**Assessment *of* Learning**
	Focusing on constructive feedback from the teacher and on developing students' capacity to self-assess and to reflect on their learning to improve their future learning and understanding.	Making judgments about what the student has learned in relation to the teaching and learning goals; should be comprehensive and reflect the learning growth over the time period being assessed.

Source: (Chappuis & Stiggins, 2017)

The Cyclic Assessment

Purposeful assessment is cyclic. There are many versions of cyclic assessment. The one presented here is adapted from Margaret Heritage's model.

Source: Adapted from Greenstein, 2016

The cyclic model illustrates how purposeful assessment systematically supports learning by tracking and enhancing student growth towards standards following the seven steps. The seven step model will be unpacked in the subsequent sections of the framework.

CHAPTER TWO

PRE-ASSESSMENT

Chapter Two

Pre-Assessment

Curriculum Mapping: A Pre-Assessment Strategy

An important consideration in assessment is how well students have mastered the SLOs, what knowledge, skills and attitudes they have acquired in a particular learning area during an academic year and where they are expected to be at the end of teaching and learning (Greenstein, 2016). The first stage in planning for assessment is, therefore, to develop curriculum maps illustrating the alignment between the SLOs for science concepts understanding for grades 4 and 5 with the various cognitive domains aligned with TIMSS a project of International Association for Evaluation of Educational Achievement, i.e., Knowing: Knowledge; Applying: Understanding and Application; and Reasoning: Analysis, Synthesis and Evaluation. (see Appendix A).

The detailed curriculum maps have been developed for General Science grades 4 and 5 and are attached as appendices B and C. Curriculum mapping is based on TIMSS' Cognitive and Bloom's Affective and Psychomotor Domains. The following levels were used in each of the three domains:

The Cognitive Domain comprises six (03) cognitive dimensions, namely knowing, applying, reasoning and four (04) knowledge dimensions namely factual, conceptual, procedural and metacognitive. **The Affective Domain** comprises five (05) dimensions comprising receiving, responding, valuing, organising and characterising. **The Psychomotor Domain** comprises seven (07) dimensions namely, perception, set, guided response, mechanism, complex overt response, adaptation and origination.

The description, key words and sample assessment in each dimension are given in Appendices A, B and C. The sources from where the description and examples have been taken are also given underneath the tables in the different appendices.

Curriculum maps were used for the following four purposes:

- Develop topic wise or competency wise weightage
- Develop tables of specifications based on the weightage
- Group SLOs in terms of knowing, applying and reasoning they are trying to develop
- Develop assessment codes

Tables of Specification

Tables of specifications were prepared for each grade levels to align student-learning outcomes with key competencies or instruction units and calculate the number of assessed items.

Grade 4

Total Percentage Share of the Three Domains for Science

Domains	Share in Percentage
Cognitive	**88%**
Affective	**0%**
Psychomotor	**12 %**

General Science Domain wise Weightage

No	Domain	Cognitive	Affective	Psychomotor	Weightage
1	Domain A: Life Sciences	36%		4%	40%
2	Domain B: Physical Sciences	38%		8%	46%
3	Domain C: Earth and Space Science	14%			14%
	Total (100%)	88%	0%	12%	100%

Table of Specification

Competency Learning Domains	Domain A: life Science (40%)	Physical Science B- (46%)	Domain C: Earth and Space (14%)	Total 100%
Cognitive Domain				
Remember (36)	14	17	5	36
Understand (14%)	6	5	3	14
Apply (12%)	5	5	2	12
Analyze (14%)	6	6	2	14
Evaluate (9%)	4	4	1	9
Create (3%)	1	1	1	3
Psychomotor Domain				
Perception (1%)	1	1	-	2
Set (7%)	1	5	-	6

Mechanism (4%)	2	2	-	4
Total (100%)	40	46	14	100

Total Percentage Share of the Three Domains for Science Grade 5

Domains	Share in Percentage
Cognitive	**91%**
Affective	**0%**
Psychomotor	**9 %**

General Science Domain wise Weightage

Domain	Cognitive	Affective	Psychomotor	Weightage
Domain A: Life Sciences	35%			35%
Domain B: Physical Sciences	34%		9%	43%
Domain C: Earth and Space Science	22%			22%
Total (100%)	91%		9%	100%

Table of Specifications

Competency / Learning Domains	Life Science (35%)	Physical Science (43%)	Earth and Space Science (22%)	Total 100%
Cognitive Domain				
Remember (41%)	14	17	10	41
Understand (18%)	8	5	5	18
Apply (10%)	4	3	3	10
Analyze (13%)	6	5		13
Evaluate (0%)	.			
Create (9%)	3	4	2	09
Psychomotor Domain				
Set (2%)		2		2
Guided Response (6%)		5		5

Mechanism (1%)		2		2
Total (100%)	35	43	22	100

List of Assessment Codes, SLOs and Assessment Strategies

The following processes were used to develop codes.

- The first letters of **C**ognitive Domain "C", **R**emember Cognitive Dimension "R" and **F**actual Knowledge Dimension "F" to form the overall domain code as "**CRF**". Similarly, the first letters of the Cognitive Domain "C", **U**nderstand Cognitive Dimension "U" and **C**onceptual Knowledge Dimension "C" were combined to form the overall domain code as "**CUC**". In this way all the overall domain codes were generated for the cognitive Domain. The same strategy was used for Affective and Psychomotor Domains.

- The overall domain codes were combined with NC Reference to form specific codes for each SLO. For example, for the first SLO, "Understand that living things grow, take in nutrients, breathe, reproduce eliminate waste and die." falling in Domain A: Life sciences in CUC overall code, the specific code of CUCA-01 was developed. The same procedure was used for developing codes for all the SLOs falling in cognitive, affective, and psychomotor domains.

- Specific assessment strategies for each of the overall domain codes suited for assessing the specific SLO were also identified.

This exercise was important to identify the specific domain code in which the SLO was falling so that a valid assessment strategy could be used for assessing each SLO. The table below presents the overall domain code, NC reference, list of SLOs and assessment strategies for each grade level. The codes can also be used as a reference point in different types of assessments.

List of Codes, SLOs and Assessment Strategies

Grade IV

Cognitive Domain

Overall, Domain Code	NC Reference	SLOs	Codes	Assessment Strategies
CRF Cognitive Remember Factual	S-04-B-04	Properties of metals (appearance, texture, color, density, conduction of heat and electricity using daily life examples).	CRFB-04	Definition; MCQs; oral questions; short questions; CRQs; concept map; survey
	S-04-B-21	List uses of different types of force in our daily life.	CRFB-21	
CRC Cognitive Remember Conceptual	S-04-A-05	Describe the functions of different parts of flowering plants: Roots, stem/ trunk, leaves and flowers.	CRCA-05	Identify names, parts, and characteristics, Matching; quiz MCQs, Teacher observation, short questions.; concept map; poster presentation; peer learning (Experiments can also be added)
	S-04-A-07	Identify the parts of the plant transport system and describe their functions (stem, -leaf, -root).	CRCA-07	
	S-04-A-09	Identify the parts of a flower and describe their functions (limited to petals, sepals, anthers, filaments, stamens, stigma, style, carpel, and ovary).	CRCA-09	
	S-04-A-10	Describe seed germination and know that seeds require water and an appropriate temperature to germinate.	CRCA-10	
	S-04-A-11	Identify stages in the life cycles of common flowering plants.	CRCA-11	
	S-04-A-13	Identify various professions associated with this unit of science. E.g., botanists, farmers, gardeners, florists, etc.	CRCA-13	

	S-04-A-15	Identify that some animals (spider, crab, beetles) have an exoskeleton.	CRCA-15	Concept map; practical demonstration; experiement
	S-04-A-16	Describe some of the important functions of the skeleton.	CRCA-16	
	S-04-A-18	Recognize that humans have different types of teeth (molar, premolar, incisors, canine) and know their functions in digestion of food.	CRCA-18	
	S-04-A-21	Recognize the items of the first aid box.	CRCA-21	
	S-04-A-22	Recognize that ecosystems (e.g., forests, ponds, rivers, grasslands and deserts) consist of habitats that provide living things with what they need.	CRCA-22	
	S-04-B-02	Identify and describe three states of matter (i.e., a solid has a definite shape and volume, a liquid has a definite volume but not a definite shape, and a gas has neither a definite shape nor a definite volume).	CRCB-02	
	S-04-B-06	Recognize the basic forms of energy (light, sound, heat, electrical, and magnetic) as the ability to cause motion or create change.	CRCB-06	
	S-04-B-07	Describe the properties of light (travels in a straight line, travels very fast and in all directions).(C)	CRCB-07	
	S-04-B-11	Identify the different sounds on the basis of softness and loudness.	CRCB-11	
	S-04-B-15	Describe the ways to measure the temperature and its units.	CRCB-15	Concept map, practical

	S-04-B-17	Recognize that electrical energy in a circuit can be transformed into other forms of energy (light, heat, sound).	CRCB-17	demonstration, video playing related contents , rubric
	S-04-B-19	Describe different types of force (friction, resistance, muscular forces, applied, gravitational, magnetic, electric).	CRCB-19	
	S-04-B-23	Describe that an object may have multiple forces acting on it, even when at rest.	CRCB-23	CRQs; charts
	S-04-B-25	Recognize that simple machines, (e.g., levers, pulleys, gears, ramps) help make motion easier (e.g., make lifting things easier, reduce the amount of force required, change the distance, change the direction of the force).	CRCB-25	Class activity
	S-04-C-01	Define natural resources.	CRCC-01	
	S-04-C-02	Recognize that the Earth's surface is made up of land and water and is surrounded by a layer of air called the atmosphere which is a mixture of different gases (nitrogen, carbon dioxide, and oxygen, etc.)	CRCC-02	
	S-04-C-03	Describe the sources of water on earth.	CRCC-03	
	S-04-C-05	Recognize that most water on Earth is not pure and has dissolved substances in it.	CRCC-05	
	S-04-C-06	Describe the Solar System with the Sun at the center and the planets revolving around the Sun.	CRCC-06	
	S-04-C-08	Recognize that the Earth has a Moon that revolves around it, and from the Earth the Moon looks different at	CRCC-08	

		different times of the month (Phases of the Moon).		
CRP Cognitive Remember Procedural	S-04-A-2	Identify that many vertebrates have a digestive system similar to humans.	CRPA-02	Draw diagrams / tables and label them; concept maps, short answers. performing experiments, hands on activities
CUF Cognitive Understanding Factual	S-04-C-07	Understand that planetary systems can contain stars, planets, asteroids, and comets.	CUCC-07	MCQs; fill in the blanks; column matching; concept maps; videos; clay modeling
CUC Cognitive Understanding Conceptual	S-04-A-01	Understand that living things grow, take in nutrients, breathe, reproduce eliminate waste and die.	CUCA-01	Group Work/Cooperative Learning; experiment Close ended Constructed Reponses, CRQs, Choosing words, binary choice; MCQs visits/trips; observation
	S-04-A-02	Discuss that living things need energy to grow, live and be healthy, and plants get their energy from light (photosynthesis) while animals get their energy from eating plants and other animals.	CUCA-02	
	S-04-A-04	Classify the plants into two major groups (flowering, non-flowering), and give examples of each group.	CUCA-04	
	S-04-A-23	Recognize and explain that living things respond to environmental conditions.	CUCA-23	
	S-04-A-24	Describe how plants and animals adapt to environments	CUCA-24	

		that are hot, cold, wet and/or dry and describe common physical adaptations of plants (e.g., a thick stem, a waxy coating helps it survive with less water) and animals e.g., colours of animals help in camouflage.		practical demonstration; experiment
	S-04-A-27	Explain that when a habitat changes, organisms living in it are affected as well.	CUCA-27	
	S-04-B-12	Understand temperature as the degree of hotness or coldness of an object or place.	CUCB-12	
	S-04-C-10	Illustrate and explain how Solar and Lunar Eclipses occur.	CUCC10	
CUP Cognitive Understanding Procedural	S-04-A-17	Describe the Human Digestive System including the simple functions of the organs involved (mouth, esophagus, stomach, small and large intestine).	CUPA-17	Open ended CRQs Project Work Match, complete sentences Listening and responding, reading and explaining a text of an article/video in context; matching exercise; MCQs
CAC Cognitive Application Conceptual	S-04-A-24	Associate behaviors of animals with the environments in which they live and describe how these behaviors help them to survive (e.g., migration and hibernation).	CACA-24	
	S-04-B-09	Relate familiar physical phenomena (vibrating objects) to the behaviour of sound.	CACB-09	
	S-04-B-07	Relate familiar physical phenomena (shadow, reflection, rainbow) to the behaviour of light.	CACB-07	
CAP Cognitive Application Procedural	S-04-B-09	Demonstrate the production of sound.	CAPB-09	Role play, group project; role play

	S-04-B-13	Demonstrate that the warmer objects have higher temperature than cooler objects.	CAPB-13	Experiments; Conceptual multiple-choice questions, Practical demonstration with rubrics
	S-04-B-14	Demonstrate changes occur when hotter objects are brought closer to the cooler objects.	CAPB-14	
	S-04-B-16	Use various instruments (room thermometers, anemometer, clinical thermometer, etc.) and measure and record temperature using different scales.	CAPB-16	
	S-04-B-18	Demonstrate that simple electrical systems (e.g., a flashlight) require a complete (unbroken) electrical pathway.	CAPB-18	
	S-04-B-20	Investigate that friction can either be detrimental or useful under different circumstances (ways to reduce friction).	CAPB-20	
	S-04-C-04	Apply knowledge of changes of state of water to common weather events (e.g., cloud formation, dew formation, the evaporation of puddles, snow, and rain) and understand the Water Cycle.	CAPC-04	
CANC Cognitive Analysis Conceptual	S-04-A-14	Distinguish between major groups of animals with backbones (vertebrates:Fish, amphibians, reptiles, birds and mammals) and without backbones (invertebrates: Insects, snails, earthworm, jellyfish and corals) on the basis of their characteristics.	CANCA-14	Debate, mini research project; concept mapping; MCQs; CRQs
	S-04-A-19	Investigate the causes and prevention of tooth decay and gum diseases.	CANCA-19	
	S-04-A-26	Explore how human actions such as urbanization and	CANCA-26	

		population growth can affect a habitat.		
	S-04-B-22	Explore how force can move or stop objects, change direction, shape, & speed.	CANCB-22	
CANP Cognitive Analysis Procedural	S-04-A-03	Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow)	CANPA-03	Researching; portfolio; practical demonstration and class discussion/reflection; MCQs;CRQs; Fill in the Blanks; experiments
	S-04-A-07	Investigate the way in which water is transported within plants.	CANPA-07	
	S-04-A-09	Explore the role of flowers in the life cycle of flowering plants, including pollination, fruit and seed formation and seed dispersal.	CANPA-09	
	S-04-B-03	Compare and sort the materials on physical properties (mass, volume, density, states of matter, conduction of heat and electricity).	CANPB-03	
	S-04-B-05	Investigate the conditions that cause matter to change states (heating or cooling), and explain the processes associated with it (i.e., melting, freezing, and boiling).	CANPB-05	
	S-04-B-24	Compare the effects of force of different strengths in the same or opposite directions acting on an object.	CANPB-24	
	S-04-C-09	Investigate and describe how day and night are related to Earth's daily rotation about its axis, and provide evidence of this rotation from the changing appearance of shadows during the day.	CANPC-09	
CEC Cognitive	S-04-A-12	Relate as to why plants are vital to sustaining life on Earth.	CECA-12	Survey; group discussion

Evaluation Conceptual				
CCC Cognitive Creative Conceptual	S-04-B-01	Design models of sphere, cube, prism, cylinder and cone with clay or playdough/ environment friendly materials.	CCCB-01	Make predictions and hypotheses and deduce relationships
CCP Cognitive Creative Procedural	S-04-B-25	Design hammer, wheels, rollers and gears using clay or playdough/ cardboard/ environment friendly material.	CCPB-25	Create a new model
	S-04-B-27	Use scientific instruments/ apparatus in everyday life (e.g. thermometer, blood pressure apparatus, digital balance, stop watch, calculator, available digital devices).	CCPB-27	
	S-04-B-28	Use a plumb line to install a flagpole vertically.	CCPB-28	

Psychomotor Domain

Overall Domain Code	NC Reference	SLOs	Codes	
PP Psychomotor Perception	S-04-B-03	Compare and sort the materials on physical properties (mass, volume, density, states of matter, conduction of heat and electricity).	PPB-03-	Participation science activities
PS Psychomotor Set	S-04-A-03	Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow)	PSA-03	Demonstration; experiment; group discussion; MCQs; CRQs; debate; mini research project/portfolio
	S-04-A-07	Investigate the way in which water is transported within plants.	PSA-07	
	S-04-A-26	Explore how human actions such as urbanization and population growth can affect a habitat.	PSA-26	
	S-04-B-22	Explore how force can move or stop objects, change direction, shape, & speed	PSA-22	
	S-04-B-20	Investigate that friction can either be detrimental or useful under different circumstances (ways to reduce friction).	PSA-22	
PM Psychomotor Mechanism	S-04-B-27	Use scientific instruments/ apparatus in everyday life (e.g. thermometer, blood pressure apparatus, digital balance, stop watch, calculator, available digital devices).	PMB-27	Performance in an activity. Solving a problem, using pre-set procedures Constructed response question
	S-04-B-28	Use a plumb line to install a flagpole vertically.	PMB-28	Class/group activity
	S-04-B-25	Design hammer, wheels, rollers and gears using	PMB-25	

		clay or playdough/ cardboard/ environment friendly material.		

List of Codes, SLOs and Assessment Strategies

Grade V

Cognitive Domain

Overall Domain Code	NC Reference	SLOs	Codes	Assessment Strategies
CRF Cognitive Remember Factual	S-05-B-14	List the harmful effects of noise on human health.	CRFB-14	Definition; Fill in the blanks, True & False; oral questions Conceptual multiple-choice questions, concept map, study trip along with observation sheet Labeling; Conceptual multiple-choice questions, concept map, video playing / rubric (?) on functions of the heart, blood vessels and blood.
	S-05-B-15	State the role of humans in reducing noise pollution.	CRFB-15	
	S-05-A-01	Identify that the human has a number of systems, each with its own function.	CRFA-01	
	S-05-A-02	Recognize the integration of the different systems (Respiratory, and Circulatory) in carrying out life processes.	CRFA-02	
	S-05-A-01	Identify by name the main parts of the Human Circulatory System, and briefly describe the functions of the heart, blood vessels and blood.	CRFA-01	
	S-05-A-05	Identify that many animals have a circulatory system similar to humans.	CRFA-05	
CRC Cognitive Remember Conceptual	S-05-A-08	Define and describe main groups of microorganisms (bacteria, virus and fungi) and give examples of each.	CRCA-08	MCQs;CRQs; Fill in the blanks; Identify names, parts, and characteristics, Matching, quiz
	S-05-A-09	Recognize some common diseases of each group	CRCA-09	

		(bacteria, virus and fungi) caused by microorganisms.		
	S-05-A-10	Recognize that microorganisms get transmitted into humans and spread infectious diseases.	CRCA-10	
	S-05-A-14	Recognize the advantages of microorganisms.	CRCA-14	True & False; identify names, parts, and characteristics, Matching; quiz
	S-05-B-16	Describe food chains as being made of producers and consumers, and classify consumers as herbivores, omnivores, carnivores, predators, and/or prey.	CRCB-16	
	S-05-B-17	Describe a food web and its relation to a food chain.	CRCB-17	
	S-05-B-19	Identify that some substances in our environment can be toxic and these substances can move through the food webs/ chains and can be harmful for living things.	CRCB-19	MCQs; CRQs; Concept maps; demonstration
	S-05-B-05	Matter can be changed from one state to another by heating or cooling.	CRCB-05	
	S-05-B-08	Identify natural, artificial light sources.	CRCB-08	
	S-05-B-10	Identify transparent, translucent and opaque objects.	CRC-10	
	S-05-B-19	Recognize the difference between a magnet and a magnetic material.	CRCB-19	
	S-05-C-1	Describe the structure of the Earth (i.e., crust, mantle, and core) and the physical characteristics of these distinct parts.	CRCC-01	
	S-05-C-2	Describe common features of volcanoes and know they are found at breaks in the Earth's crust.	CRCC-02	

	S-05-C-07	Identify various causes of soil pollution.	CRCC-07	
	S-05-C-15	Identify professions related to Earth Science i.e., paleontologists, seismologists, geologists.	CRCC-15	
	S-05-C-09	Know that a satellite is an object in space that orbits a larger object and a moon is a natural satellite that orbits a planet.	CRCC-09	
	S-05-C-10	Describe the natural satellites of the planets of the Solar System.	CRCC-10	
	S-05-C-11	Define artificial satellites and explain their importance in exploring the Earth and Space.	CRCC-11	
	S-05-C-12	Recognize the role of NASA (National Aeronautics and Space Administration); explore the contribution of SUPARCO in space exploration.	CRCC-12	
	S-05-C-14	Identify using secondary sources the key milestones in space technology in the past 10 years.	CRCC-14	
CUC Cognitive Understanding Conceptual	S-05-A-12	Relate the transmission of common communicable diseases to human contact.	CUCA-12	Group Work/Cooperative Learning Open-ended Constructed Reponses, CRQs, Choosing words, binary choice; conceptual MCQs, oral and written paper pencils tests, video showing and scoring , rubric
	S-05-A-13	Explain some methods of preventing the transmission of contagious diseases COVID-19 & Polio.	CUCA-13	
	S-05-B-18	Explain how human activities add toxic substances to an ecosystem.	CUCB-18	

	S-05-A-21	Explain the effects of water, air and land pollution. (Unclean/Toxic water, smoke, smog, excess CO/other gases, open garbage dumps, industrial waste, etc.) on the environment and life.	CUCA-21	Experiment; class demonstration; diagrams
	S-05-A-22	Discuss the effects of burning fossil fuels and releasing greenhouse gases in air.	CUCA-22	
	S-05-B-12	Describe the structure and discuss the mechanism of the conduction of sound waves.	CUCB-12	
	S-05-B-13	Describe the intensity of sound.	CUCB-13	
	S-05-B-16	Describe flow of electric current in an electric circuit.	CUCB-16	
	S-05-C-03	Understand that the Earth's crust moves and when parts move suddenly this is called an earthquake.	CUCC-03	
	S-05-C-04	Identify similarities and differences among the different types of soil and classify them based on their clay, sand, and organic content.	CUCC-04	
	S-05-C-06	Comprehend that soil composition can change, which can support, or hinder, plant growth.	CUCC-06	
CUP Cognitive Understanding Procedural	S-05-A-04	Describe the Human Respiratory System in terms of oxygen from the air moving into the blood in the lungs and know that many vertebrates have a similar respiratory system.	CUPA-04	Open ended CRQs Project Work Match, complete sentences.
CAP Cognitive Application	S-05-A-07	Use a first aid box to dress a wound.	CAPA-07	Class demonstration; group work; discussion-

Procedural				based questions
	S-05-A-03	Use a model to describe how we receive different types of information through our senses, process the information in our brain and respond to the information in different ways.	CAPA-03	Conceptual MCQs, Scoring on practical demonstrations; role-play
	S-05-B-11	Demonstrate that sound can travel through different states of matter with different speed.	CAPB-11	
	S-05-B-18	Demonstrate magnets have two poles (opposites attract and like poles repel).	CAPB-18	
	S-05-B-20	Relate properties of magnets (i.e., two opposite poles, attraction/repulsion, and strength of the magnetic force varies with distance) to uses in everyday life (e.g., a directional compass).	CAPB-20	
	S-05-B-22	Use scientific instruments/apparatus in everyday life (Use spirit level/water level to level different objects i.e., table, picture, frame etc.).	CAPB-22	
	S-05-B-23	Practice safety measures for earthquake and fire drill.	CAPB-23	
CANC Cognitive Analysis Conceptual	S-05-A-11	Differentiate between contagious and non-contagious diseases.	CANCA-11	Observation, inferences, compare and contrast, interview, conference, process description, checklists
	S-05-A-23	Differentiate between biodegradable and non-biodegradable materials and their impact on the environment.	CANCA-23	
	S-05-B-07	Compare physical and chemical changes.	CANCB-07	
	S-05-B09	Sort out luminous and non-luminous objects.	CANCB-09	

CANP Cognitive Analysis Procedural	S-05-A-15	Investigate the role of microorganisms in producing or breaking down/decomposing materials.	CANPA-15	Summarizing data in the form of graphs, pictures, tables etc. MCQ; CRQ; conceptual MCQs, marking/scoring practical demonstration through activities
	S-05-A-20	Explore the main causes of water, air and land pollution in the local and wider community.	CANPA-20	
	S-05-B-04	Observe the changes in materials that do not result in new materials (dissolving, crushing).	CANPB-20	
	S-05-B-06	Identify observable changes in materials that make new materials with different properties (e.g., decaying, such as food spoiling, burning, rusting).	CANPB-06	
	S-05-C-05	Investigate the composition and characteristics of different soils.	CANPC-05	
CANM Cognitive Analysis Metacognitive	S-05-C-13	Predict and comprehend how astronauts explore space, how do astronauts survive and research in space.	CANMC-13	Review of a written piece of work, oral discourse, video etc.
CCP Cognitive Creative Procedural	S-05-B-01	Design a model of a footbridge using the given specifications (e.g can sustain a given weight).	CCPB-01	Create a new model; experiment
	S-05-B-02	Design a model of a bookshelf using the given specifications (e.g can sustain a given weight, space, materials).	CCPB-02	
	S-05-B-03	Prepare LED light strings working with 2 volt battery.	CCPB-03	
	S-05-B-17	Draw circuit diagram with symbols.	CCPB-17	
	S-05-B-21	Construct a magnetic compass. (STEM/STEAM)	CCPB-21	

Psychomotor Domain

Overall Domain Code	NC Reference	SLOs	Codes	Assessment Strategies
PS Psychomotor Set	S-05-B-17	Draw circuit diagram with symbols.	PSB-17	Participation science activities.
PGR Psychomotor Guided Response	S-05-B-01	Design a model of a footbridge using the given specifications (e.g can sustain a given weight).	PGRB-01	Follow instructions to make a model using different directions or perform different activities.
	S-05-A-02	Design a model of a bookshelf using the given specifications (e.g can sustain a given weight, space, materials).	PGRA-02	
	S-05-B-03	Prepare LED light strings working with 2-volt battery.	PGRB-03	
	S-05-B-21	Construct a magnetic compass. (STEM/STEAM)	PGRB-21	
PM Psychomotor Mechanism	S-05-B-23	Practice safety measures for earthquake and fire drill	PMB-23	Performance in an activity. Solving a problem, using pre-set procedures Constructed response question

CHAPTER THREE

ASSESSMENT DURING INSTRUCTION

Chapter Three

Assessment during Instruction

Designing Classroom Assessment

The design of classroom assessment depends on how classroom learning is approached. The three commonly understood approaches to learning are surface learning, strategic learning and deep learning (Entwistle, 2000). Differences between deep, surface and strategic learners are summarised below.

Surface Approach	Strategic Approach	Deep Approach
Reproducing Intention – merely to cope with course requirements by: - Treating the course as unrelated bits of knowledge - Memorizing facts and carrying out procedures routinely - Finding difficulty in making sense of new ideas presented - Seeing little value or meaning in either courses or tasks set - Feeling undue pressure and worry about work	***Reflective Organising Intention*** - to achieve the highest possible grades by: - Putting consistent effort into studying - Managing time and effort effectively - Finding the right conditions and materials for studying - Monitoring the effectiveness of ways of studying - Being alert to assessment requirements and criteria - Using previous exam papers and assessments to predict questions	***Seeking Meaning Intention*** - to understand ideas by: - Relating ideas to previous knowledge and experience - Looking for patterns and underlying principles - Examining logic and argument cautiously and critically - Actively interacting with the course content - Reading and studying beyond the course requirements - Taking interest

Note: Adapted from Entwistle, 1988; Entwistle and Ramsden, 2015

It is the teachers' responsibility to foster deep and/or strategic learning so that students can engage with the subject with the help of purposeful assessment strategies.

Assessment Strategies

Literature abounds with the different types of assessment strategies. The important question that perplexes teachers is which strategy to use and for what purposes. The simple response is that teachers must align their assessment with the SLOs. However, this alignment is not easy. Chapter Two presents a list of codes aligned with the SLOs and sample assessment strategies.

This chapter presents an explanation and examples of selected formative and summative assessment strategies.

Formative Assessment for Deep Learning Approach – Meaningful Examples
Portfolio Assessment: Practical work in Science-Lab

A portfolio is a record of the development in learners' thinking and ideas. A portfolio enables learners to assemble examples of their work to tell stories of their learning over a period of time. It enables teachers to assess learners' progress in ideas and understanding that cannot be adequately measured in any other way (Chappuis & Stiggins, 2017; Crockett & Churches, 2017). A portfolio can include the following:

- Examples of students' work with feedback about quality – multiple drafts with revisions
- Students' self-assessment
- Student' reflections on their growth as learners

Portfolio Assessment in the Science Classroom – Example

Teachers can use portfolio to assess learners' growth and achievement in concept exploration as well as practical work done in science-lab. The following are the uses of portfolios to learners and teachers.

Benefits of Portfolios to the Learners
Portfolios offer opportunities for reflection and the development of self-awareness.

Learners develop a sense of ownership of their work through selection of portfolio contents, which leads to a sense of responsibility.

Learners can self-assess their performance with the help clear criteria and opportunity to revise their work.

Benefits of Portfolios to Teachers
Portfolio assessment becomes an integral part of the instructional process rather than a separate activity.
Portfolios give teachers more information about the learners' process than do scores or grades on final product/tests. The variety of texts within a portfolio can give teachers insights into learners' strengths and weaknesses (Murphy & Camp, 1996).

Essential Elements of a Portfolio

- Cover page
- Introduction to the portfolio
- Table of contents
- Entries with dates

- Drafts of your work (writing sample, essays, projects and assignments, science experiments/lab reports [Science-Lab work, problem-solving tasks], tests and quizzes
- Artefacts (awards and certificates, photos, images, concept maps etc.)
- Reflections

Adapted from: https://www.slideshare.net/ilovelagrosal/portfolio-assessment-42422639

A Sample of Introduction to the Portfolio

An Introduction to My Portfolio

Date: _____ I am in Class _____ at _____School

My name is _____ My teacher's name is _____

- You will find different things in my portfolio. These are _____

  _____

  _____

  _____

  _____

- I am making this project work because I want to (focus on learning target and the portfolio type)

  _____

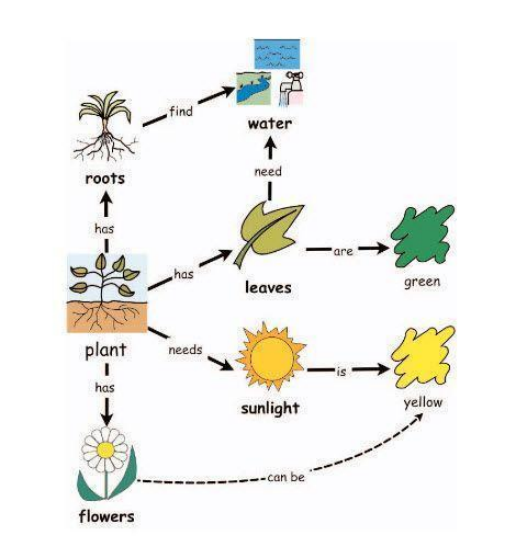
  _____

  _____

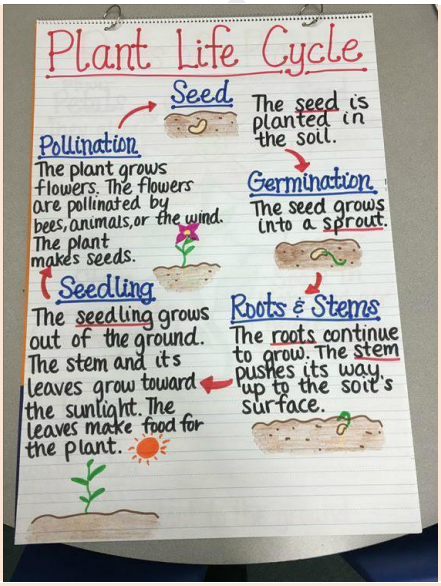
  _____

  _____

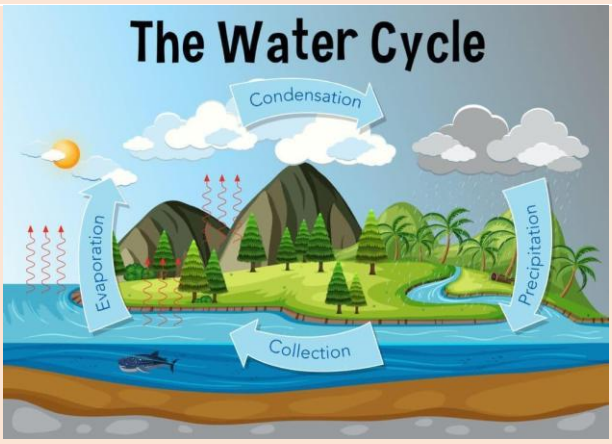
Student's signature: _____



https://www.pinterest.com/pin/508484614154945328/



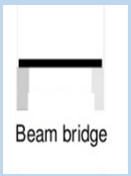
https://www.pinterest.com/pin/100275529187209082/



https://www.science-sparks.com/make-a-mini-water-cycle/	https://www.quora.com/What-are-some-project-topics-relating-to-electrical-and-electronics-engineering-and-chemical-engineering-fields

Learners can be encouraged to record the steps and process that they use to explore scientific concepts. These can be collected in their portfolio.

A Sample of Design Ideas for the STEM Challenge- Individual Plan

STEM Challenge Pedestrian Bridge Design Challenge	
Design Ideas (Draw the plan here)	**Why did I think it will work?**
# 1 	*I proposed a beam pedestrian bridge. I thought it will be very strong and durable for a busy signal free corridor in Karachi.*
# 2 	*I proposed a tied arch pedestrian bridge. I thought it will look beautiful and provide the needed strength.*
# 3 	*I proposed an arch pedestrian bridge. I thought it will provide the needed strength.*
Final Design Proposed to Team	*I proposed design # 1 to my team because I have seen many pedestrian bridges that use beam design and the reading handout also provided beam bridge's*

	key features that make it the best fit for this STEM challenge.

A Sample of Periodic Student Self-Reflection

Prompts to activate Self-Reflection

Portfolio Type	**Starters**
Celebration	I am happiest/proudest of _____ because_____ . I really liked doing _____ because _____ . What this portfolio says about me... I have learnt that_____ . I now understand_____ . I can now do_____ . I now feel_____
Growth	I have become better at_____, I used to _____, but now I_____ . Here is what has helped me improve:_____ . Here is what has helped me as a learner:_____ . Here is what I learned about myself as a learner:_____ . Here is what gets in my way as a learner:_____ . Here is what is difficult for me:_____ . This used to be hard, but now it is easy:_____ Here is what made it easier:_____ . Here are "before" and "after" pictures of my learning. The first one shows _____. The second shows _____ .

Project	Here is what I learnt about myself as a learner while doing this project: _____ _____ . I developed the following skills while doing this project: _____ Here is what I liked least/most about doing this project _____ . Here's why: _____ Here is how my thinking changed about_____ because of doing this project:_____ This project has affected my interest in _____. It has caused me to_____
Achievement	My selections have shown I have mastered _____. Here is how they show that _____ . My strength in (subjects or learning target) are _____ . I still need to work on _____ . Here is how I achieved mastery of _____(learning target):_____ . Here how I would change what I did if I had it to do over:_____ . Here is what doing _____ has taught me about myself as a learner: _____ .

Criterion Referenced Assessment

Criterion referenced assessment (CRA) is the process evaluating students' learning against some pre-specified qualities or criteria (Brown, 1998; Harvey, 2004). The criteria are presented to the students in the form of a rubric, so that they know what is being assessed. The teacher can also involve the students in developing rubrics.

Course Number(s):_____	Date Submitted: _____			
RUBRIC FOR PORTFOLIO-BASED ASSESSMENT				
Assessment Ratings	**1 Does not meet expectations (6 points)**	**2 Partially meets expectations (12 points)**	**3 Meets expectations (18 points)**	**4 Exceeds expectations (24 points)**	Score
Sources of Learning *Experiences relevant to learning outcomes*	Documentation and description of learning experiences related to course learning outcomes are ***lacking or substantially inadequate***	Documentation and description of learning experiences related to course learning outcomes are ***not effectively or completely presented***	Documentation and description of learning experiences related to course learning outcomes are ***appropriate and effectively presented***	Documentation and description of learning experiences related to course learning outcomes ***exceed expectations***	
Demonstration of Learning *Artifacts*	The portfolio's materials and artifacts are ***not appropriate and/or adequate***, and are not supported by the presentation	The portfolio materials and artifacts are ***not fully supported*** by or connected to the course's learning outcomes	The portfolio includes ***appropriate*** artifacts that support the demonstration of learning outcomes	The presentation of artifacts is ***convincing***, with ***strong support*** for the course's learning outcomes	
Evidence of Learning *Competencies*	The portfolio shows ***little or no evidence*** of learning tied to sound educational theory	The portfolio documents some, but ***not sufficient***, learning tied to sound educational theory (or grounded in appropriate academic frameworks)	The portfolio ***adequately*** documents learning tied to sound educational theory (or grounded in appropriate academic frameworks)	The portfolio provides ***clear evidence*** of learning tied to sound educational theory (or grounded in appropriate academic frameworks)	
Mastering Knowledge & Skills *Application of Learning*	The portfolio provides ***little evidence*** of the student's ability to use knowledge and skills for the course's learning outcomes in practice	The portfolio demonstrates the student's ability to use the knowledge and skills for the course learning outcomes in practice is ***limited***	The portfolio documents the ***acquisition*** of knowledge and skills for the course learning outcomes, with ***some ability*** to apply them in practice	The portfolio demonstrates the student has ***mastered*** the knowledge and skills for the course learning outcomes and can ***apply them in practice***	
Reflection on Learning *Aligned with course learning outcomes*	The portfolio provides ***little or no evidence of reflection*** to increase learning aligned with the course learning outcomes for which credit is being sought	The portfolio provides ***inadequate evidence of reflection*** to increase learning aligned with the course learning outcomes for which credit is being sought	The portfolio provides ***evidence of reflection*** to increase learning aligned with the course learning outcomes for which credit is being sought	The portfolio shows that the student has reflected with ***substantial depth*** upon how the prior learning experience is aligned to the course learning outcomes for which credit is being sought	
Presentation *Completeness and quality of the portfolio presentation*	Assembly instructions have ***not been followed*** with critical portfolio elements ***not*** included; the quality of written, visual and/or digital presentation ***does not meet postsecondary standards***	***Most of the expected elements*** are included; the quality of written, visual and/or digital presentation does not meet postsecondary standards with ***too many errors*** in spelling, grammar and punctuation	The portfolio is ***well organized*** with all critical elements included; the quality of written, visual and/or digital the presentation is ***competent*** with minor errors in spelling, grammar and punctuation	The portfolio is ***well organized*** with all critical elements included; learning is ***well-documented*** with writing and production skills that ***exceed*** those of most students	
Overall Assessment	The recommended cut score for a successful (i.e., passing) portfolio is 12 with a score of at least 02 in each of the six assessment criteria.				TOT

Name of Assessor (print):_____ Date: _____

Source: https://www.starkstate.edu/wp-content/uploads/2016/02/REVISED-MASTER-RUBRIC.pdf

Sample of Rubric for Communication Using Evidence Based Reasoning in STEM unit

Communication should have:	3	2	1	0
Description of your design and how your prototype meets client's criteria.	Describes and draws a picture/plan of the design labelling all parts. Explanation of all materials used.	Describes and draws a picture/plan of the design labelling some parts. Explanation of some materials used.	Describes and draws a picture/plan of the design labelling one part. Weak explanation of some materials used.	If any of the following are true: • No picture/plan • No labels • No materials
Explanation of prototype using disciplinary connections	Fully explains how science and math has enriched the prototype. Also, explains the technology & engineering connections	Partially explains how science and math has enriched the prototype.	Insufficiently explains some disciplinary connections.	Explanation totally lacks disciplinary connections.
Clear use of evidence	Uses three or more pieces of evidence.	Uses two pieces of evidence.	Uses one piece of evidence only.	No use of evidence.
Vocabulary from science, and mathematics content	Appropriate Vocabulary from science and mathematics content is fully included throughout the communication	Appropriate Vocabulary from science and mathematics content is mostly included in the communication	Appropriate Vocabulary from science or is mathematics is rarely included in the communication	No use of appropriate vocabulary from science and mathematics content in the communication.

Group Project Assessment

Group projects are based on cooperative learning goals, which are reflected in the illustration below.

In cooperative learning structures, a student can obtain his or her goal only when other students in the group obtain theirs (Arends, 2007). Project work is a very good example of group work.

According to the Buck Institute of Education (BIK, 2021), students' work on a project over an extended period of time – from a week up to a semester – that engages them in solving a real-world problem or answering a complex question. They demonstrate their knowledge and skills by developing a public product or presentation for a real audience. As a result, students develop deep content knowledge as well as critical thinking, creativity, and communication skills in the context of doing an authentic, meaningful project.

The assessment in the group project can be done at two levels – the whole group presentation and an individual student performance within the project. Rubrics for both levels are given below.

Multimedia Project and Performance Rubrics (Group Performance)

Criteria	Exceeds Expectations (24 points, 4 for each criteria)	Meets Expectations (18 points, 3 for each criteria)	Almost Meets Expectations (12 points, 2 for each criteria)	Does Not Meet Expectation (6 points 1 for each criteria)
Organisation	Students present information in a logical and creative sequence that the audience can follow.	Students present information in a logical sequence that the audience can follow.	Audience has difficulty following presentation because student does not consistently use a logical sequence.	Audience cannot understand presentation because there is no sequence of information.
Subject Knowledge	Students demonstrate complete knowledge by answering all questions with explanations and elaborations.	Students are at ease and provide expected answers to all questions but do not provide elaborations.	Students are uncomfortable with information and are able to answer only rudimentary questions.	Students do not have grasp of information and are not able to answer many questions.
Graphics	Students' graphics explain and reinforce screen text and presentation.	Students' graphics relate to text and presentations.	Students occasionally use graphics that rarely support text and presentation.	Student uses superficial graphics or no graphics.
Mechanics	Presentation has no misspellings or grammatical errors.	Presentation has no more than two misspellings or grammatical errors.	Presentation has three misspellings or grammatical errors.	Presentation has four misspellings or grammatical errors.
Eye Contact	Students maintain eye contact with audience, seldom returning to notes.	Students maintain eye contact most of the times, but frequently return to notes.	Students occasionally use eye contact but still read most of report..	Students read all of the report with no eye contact.
Elocution	Student uses a clear voice and correct, precise pronunciation of words.	Students' voice is clear and most of the words are pronounced correctly.	Students' voice is not very clear and they incorrectly pronounce most of the words.	Students mumble, incorrectly pronounce words and speak in a low tone.

From: Fisher and Frey (2007)

Rubric for Assessing Collaboration Fluency (Individual - Affective)

Criteria	Phase 1 (awareness, connection, remembering) (4 points)	Phase 2 (understanding, applying) (8 points)	Phase 3 (analyzing, evaluating) (12 points)	Phase 4 (evaluating, creating) (16 points)
Interacts with others to generate ideas and develop products	Listens to others' input and occasionally combines his or her own and peers' concepts to produce an understanding of the task, problem, or issue.	Frequently, listens to others' input and occasionally combines his or her own and peers' concepts to produce an understanding of the task, problem, or issue. Attempts to make sure team members contribute.	Listens to others' input and combines his or her own and peers' concepts to produce an understanding of the task, problem, or issue. Uses techniques to make sure team members contribute. Explains the task to the team members.	Listens to others' input and effectively combines his or her own and peers' concepts to produce an understanding of the task, problem, or issue. Uses suitable techniques to make sure all team members contribute. Uses effective probing questioning to develop a realistic understanding of the task.
Develops and implements effective plans	Shows an awareness of the process and the current stage of development.	Uses checkpoints to measure progress in the project. Describes problems and develops some solutions.	Uses regular checkpoints to measure progress in the project. Defines each person's tasks within the process.	Manages progress on the assigned task using regular checkpoints. Clearly defines each person's roles and responsibilities within each element of the process. Discusses problems and develops suitable solutions.
Works collaboratively toward a common, shared goal or objective	Sometimes works with peers. Is sometimes on tasks when working collaboratively.	Works with peers collaboratively or individually to achieve the group's goal.	Works with peers collaboratively or individually to achieve the group's goal. Analyses individual or group progress against the goals and objectives and sometimes offers appropriate critique.	Works with peers collaboratively and economically or individually to achieve the group's goal. Analyses individual or group progress against the goals and objectives and offers appropriate critique or undertakes suitable actions as required.
Revisits, reflects and revises group process	Sometimes reflects on overall progress. Struggles to accept feedback.	Reflects on overall progress. Often accept feedback. Sometimes offer useful reflection.	Reflects on overall progress and analyses his or her performance. Accept feedback, sometimes modifies behaviour. Sometimes offer useful reflection.	Reflects on overall progress evaluating his or her contribution and that of peers fairly. Accept feedback, modifying tasks, action and behaviours based on this. Offers critical reflection that are task focussed and appropriate, enabling growth and development.

Source: Adapted from Crockett and Churches (2017)

Summative Assessment for Measurement and Evaluation – Frequently Use Examples

This framework is proposing two teaching terms of four months in a year (see section on Balanced Assessment Schedule for details). There will be a school wide summative assessment at the end of each semester. The key purpose of these summative assessments is to obtain valid and accurate information for evaluating each student's performance. This evaluation is the basis of a student's academic progression.

Measurement accuracy is determined by *what* is being measured and the *instrument* used to make the measurements. For example, a teacher can obtain a more precise measurement of a students' knowledge of parts of speech rather than his or her creative ability.

In addition, the instrument used to make the measurements also determines measurement accuracy. Teacher made tests are the most common form of measurement instruments used at the school level. In the subsequent sections, the framework provides examples of the two most common types of test questions - Multiple Choice Questions (MCQs) from selected response and word problems from the constructed response category.

Selected Response - Multiple Choice (Objective Test Item)

Multiple Choice is the most common type of objective test question (Linn & Miller, 2005). They are easy to administer and analyse. Multiple choice questions consist of a stem (question or statement) with several answer choices (distracters). In science, distractors are thoughtfully designed to know student's misconceptions

The table below gives four guidelines of developing multiple choice items with an example and a non-example. These have been borrowed from Classroom Assessment course (2018) at https://fcit.usf.edu/assessment/selected/response.html

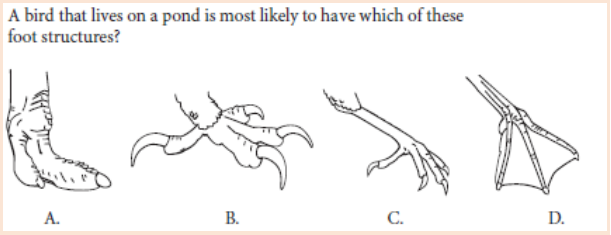
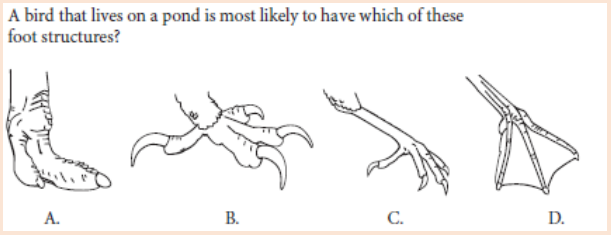
Guideline One - All answer choices should be plausible and homogeneous.	
Example	**Non-Example**
Bees must collect nectar from approximately how many flowers to make 1 pound of honeycomb? A. 10 thousand B. 2 million C. 20 million D. 50 million	Bees must collect nectar from approximately how many flowers to make 1 pound of honeycomb? A. 10 thousand B. 2 million C. 20 million D. Many flowers
Guideline Two - Answer choices should be similar in length and grammatical form.	
Example	**Non-Example**
Which unit is used to measure how warm or cool the air is? A. Grams	Which unit is used to measure how warm or cool the air is? A. Kilograms

B. Kilometers C. Degree Celsius D. Cubic Centimeter	B. Kilo meters C. Degree Celsius D. Thermometer

Guideline Three – List answer choices in logical (alphabetical or numerical) order

Example	**Non-Example**
The chart below shows how long it took a seed to sprout at three different temperatures. Temperature | Days needed to sprout 60° F | 15 65° F | 13 70° F | 11 Based on the chart, how long will it take for the same kind of seed to sprout at 75^0 F? A. 7 days B. less than 11 days C. 11 days D. More than 11 days	The chart below shows how long it took a seed to sprout at three different temperatures. Temperature | Days needed to sprout 60° F | 15 65° F | 13 70° F | 11 Based on the chart, how long will it take for the same kind of seed to sprout at 75^0 F? A. 7 days B. More than 11 days C. less than 11 days D. 11 days

Guideline Four – Avoid using "All of the Above" options

Example	**Non-Example**
 Ref: TIMSS 2011 release items i. A ii. B iii. C iv. D	 i. A ii. B iii. D iv. All of the above Bottom of Form

In addition, a checklist for reviewing one-best MCQ is also given.

One-Best MCQ Review Checklist

#	Overall	Yes*	No*
1	Is appropriate for the level of the learner		
2	Is aligned to the Student Learning Outcome and its number is referenced		
3	Exam specification number is referenced		
4	Concept to be tested is stated appropriately/ Item is aligned with the concept being assessed		
5	The item is conceptually correct		
6	The cognitive level of the item is identified appropriately		
7	The difficulty level of the item is identified appropriately		
8	Assesses an essential (Must Know) or an important (Good to Know) item		
9	Can be answered with the options covered (Cover Test)		
10	**Cannot** be answered with the stem/ case covered (Test for Cognitive Level)		
11	Item author's name is mentioned		
12	An authentic reference is mentioned		
13	There are **no** spelling or grammar mistakes		
14	Task can be completed by the students in the assigned time		
	Stem/ Case		
1	Clearly defined with no ambiguities		
2	Is contextual and relevant		
3	Contains all essential information; however, avoids irrelevant information		
4	Avoids abbreviations, uncommon terminologies and brand names		
	Lead-in		
1	Focuses on one feature or concept		
2	Avoids negative phrases such as 'Except' and 'Not'		
3	Is clearly understandable at the level of the students		
	Options		
1	Congruent with the lead-in		
2	Aligned with the lead-in in grammar		

3	Are of similar length		
4	Homogenous in content		
5	Distractors are plausible		
6	Listed in an alphabetical order		
7	Use generic and common terms		
8	Mutually exclusive (non-overlapping)		
9	Avoid phrases like 'all of the above' and 'none of the above'		
10	Avoid vague terms such as 'usually' and 'frequently'		
11	Avoids key terms from the stem or lead-in		
12	The key is clearly the best/ correct option for the level of the learners		
13	The key/ correct answer is identified		

Source: Aga Khan University Examination Board.

Constructed Response

Constructed response is a very useful way of testing students' higher order thinking skills. It requires students to organise the ideas they have learnt and respond accordingly. Test items can present a problem or a situation and ask students to construct their own response. In this way, students are expected to analyse, evaluate and synthesise.

Sample 1

Monkey

Crocodile

Grasshopper

Octopus

Answer the following questions using the animals shown above. Write the name for the correct animal in the spaces below.

A. Which animal has an internal skeleton and produces milk for its young?

_____

B. Which animal has an external skeleton and three pairs of legs?

_____

C. Which animal has a soft body and no skeleton?

_____

Ref: TIMSS 2013 release items

Sample 2

The pictures above show two ways of traveling around town.

A. Which way of traveling is better for the environment?

(Check one box.)

☐ Bicycle

☐ Motorbike

B. Explain your answer.

Ref: TIMSS released items 2013

Sample 3

Write what happens to plants and fish in a river when a factory pours large amounts pf hot water into the river

Ref: TIMSS 2013 released items

Sample 4 (From STEM Unit on Pedestrian Bridge Design Challenge for Assessing Cognitive Domain of Reasoning and Analysis)

Read the table below showing data on the facilities at four Signal Free Corridors (SFCs) in Karachi.

SFCs	Road Length in Km	Underpass	U-Turn	Pedestrian Bridge	Flyovers
Corridor I	11	3	4	8	6
Corridor II	19	1	45	15	3
Corridor III	28	-	44	19	7
Corridor IV	28	-	39	15	9

(Source: Zubair, S., Kazmi, J., Jooma, R., Ali, S., Akhtar, Z. (2015). Impacts of signal free corridors on the incidence of road traffic accidents in Karachi. Journal of Basic & Applied Sciences, 11(1), 244-254.)

Use evidence-based reasoning to respond to the questions below:

A. Which Signal Free Corridor provides the most facilities?

_____

_____

_____

B. Justify the statement: *Signal Free Corridor-IV has the greatest number of pedestrian bridges in relation to the length of the road.*

_____

_____

_____

Rubric for Assessing Constructed Response Question

Criteria	**Exceeds Expectations**	**Meets Expectations**	**Almost Meets Expectations**	**Does Not Meets Expectation**
Explanation	A complete response with a detailed explanation. Student can explain how to solve and WHY the chosen response/methods work.	Good solid response with clear explanation. Student can explain how to solve but not why the method works.	Explanation is unclear. Student can explain only a small part of the work.	Misses key points. Student does not explain the majority of the work.
Use Of Visuals	Clear diagram or sketch with some detail.	Clear diagram or sketch.	Inappropriate or unclear diagram.	No diagram or sketch.
Accuracy	No scientific errors.	No major scientific errors or serious flaws in reasoning.	May be some serious scientific errors or flaws in reasoning.	Major scientific errors or serious flaws in reasoning.
Plan	Student understands the problem, identifies key information for solving the problem, and develops a plan to solve.	Student understands the problem but can only identify some key information needed to solve or develops an inaccurate plan to solve.	Student understands the problem but cannot identify necessary information needed to solve or create a plan to solve.	Student does not understand the problem, does not create a plan to solve.
Process	Student's process is completely shown. Another student can easily follow the student's work.	Student's process is mostly shown, with a few steps combined. A teacher could easily follow the student's work.	Student's process is missing many steps. It would be difficult for another person to follow the student's work.	Little to no work is shown.
Check	Student self-checked their answer, and reworked the problem if necessary.			Student failed to self-check his or her answer.

Ref: https://paizymath.files.wordpress.com/2013/07/math-portfolio-rubric.docx

Sample General Science Test Paper

Grade IV

Max Marks: 30 **Max Time: 2 Hours**

Name: _____ Section: _____ Roll no: _____Date:_____

Instructions :

- Read the paper carefully
- Attempt all the questions

Q.1 Choose the correct answer by circling the appropriate alphabet.[7 Marks]

I. Which organ circulates blood to all parts of the body?
   A. Lungs
   B. Heart
   C. Stomach
   D. Brain

II. How many bones are there in human body?
   A. 206
   B. 216
   C. 226
   D. 260

III. Which of the following is not a type of teeth?
   A. Canines
   B. Molar
   C. Incisors
   D. Cavity

IV. Identify this body part?

   A. Brain
   B. Heart

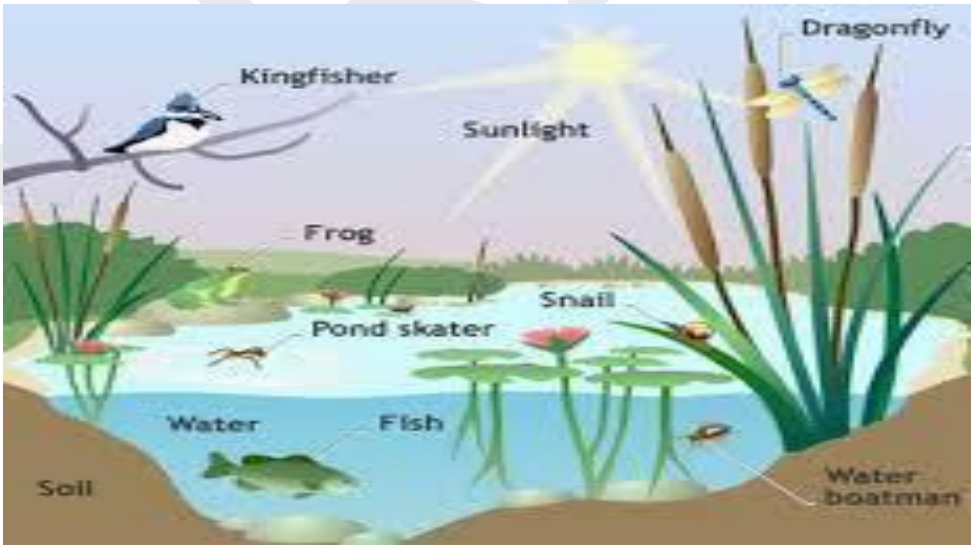
C. Kidney
D. Stomach

V. Which organ controls all functions of our body?
A. Heart
B. Brain
C. Stomach
D. Kidney

VI. What is the main source of energy in an ecosystem?
A. Air
B. Sun
C. Water
D. Soil

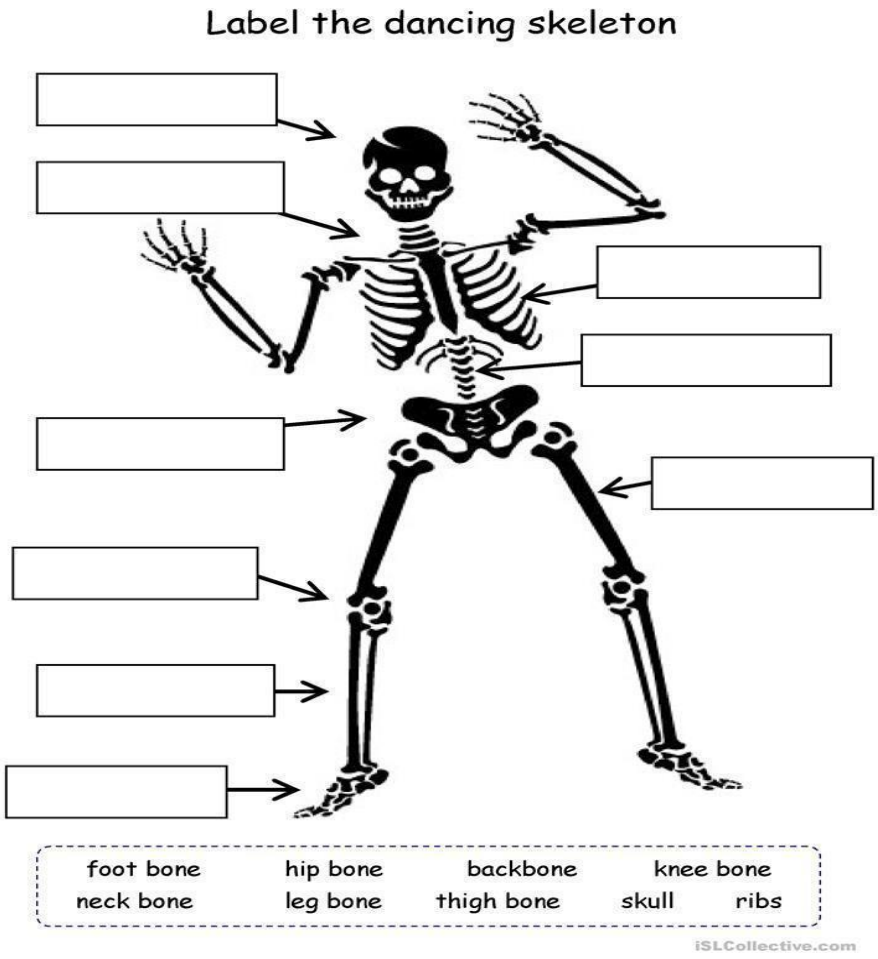
VII. Animals which eat other animals are called
A. Carnivores
B. Omnivore
C. Herbivores
D. Frugivores

Q.2 Identify two things in the picture that are biotic and two that are abiotic. **[4 Marks]**



Q. 3 What is a balanced Ecosystem? Why do you think it is important? [5 Marks]

Q. 4 Label any six (06) bones of the dancing skeleton **[6 Marks]**



Q. 5 World Earth day is celebrated around the world on 22nd April. In the space provided below make a plan of how you will celebrate the next World Earth day. **[8 Marks]**

Assessment Validity

The assessment must be valid, that is, it should actually measure what it is supposed to measure. There are three kinds of validity evidence considered during assessment. These are:

- Criterion
- Construct
- Content

Criterion and construct validity measures are beyond the scope of a class teacher's work. They should best be done by assessment experts. For purposeful assessment, content validity is extremely important and can be controlled by teachers.

Content Validity

As the name suggests, a valid assessment covers the content completed in the class. This means that a valid assessment covers all relevant parts of a subject. If any part, covered in the subject, is

left out or if any irrelevant part, not covered, in the subject is included then it is not a valid assessment. The entire purpose of developing a list of codes and tables of specification and aligning them with the assessment strategies was to ensure content validity of the assessment. The assessment should be written at the level of difficulty required by the standards and student learning outcomes covered in the term. The assessment must also be in a format that allows students to demonstrate the particular ability being assessment. For example, if a teacher wishes to assess how a student has improved her writing abilities, then MCQ is not the best option.

Ways to Improve Content Validity

Clearly defined objectives. Student learning outcomes should be clearly defined and operationalised.

Alignment. Assessment measures must be matched with student learning outcomes.

Review by Subject Matter Experts (SMEs). Subject experts may be asked to rate each question on a scale from very relevant/very essential to not relevant/not essential at all. The more SMEs agree that items are essential, the higher the content validity.

Objective Review. The test/assessment question/instrument can be reviewed by faculty at other schools to obtain feedback from an outside party who has not been involved in the instrument development.

Item Analysis. Item analysis is helpful in analyzing student responses to individual test/exam questions with the intention of evaluating test/exam quality.

Review and update tests frequently. Many tests that were valid two years ago, are not valid today. It is important to review and update or retire questions that are no longer relevant.

Item Bank. An item bank facility is important to manage and update questions.

CHAPTER FOUR

SUPPORTING RESPONSIVE TEACHING AND LEARNING THROUGH FEEDBACK

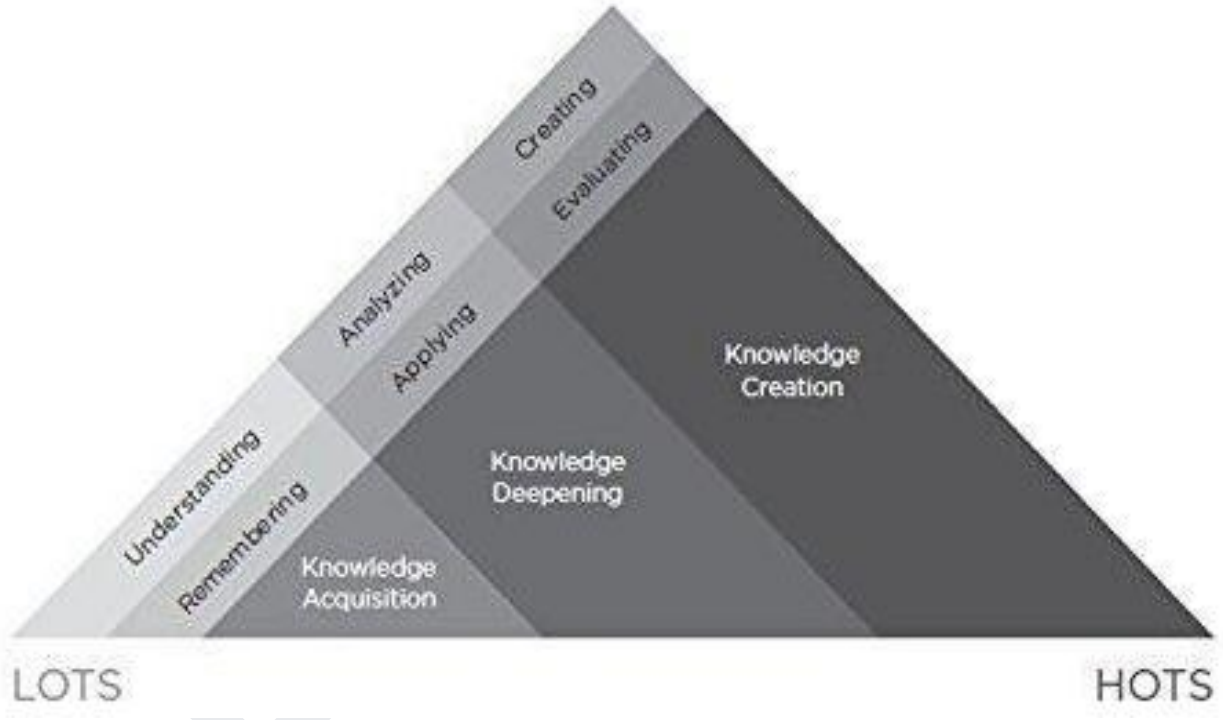
Chapter Four

Supporting Responsive Teaching and Learning through Feedback

Feedback

In order to help students succeed in the 21st century world, teachers must see their teaching as a response to learning, rather than seeing learning as an outcome of teaching (Crockett & Churches, 2017). This calls for the integration of classroom assessment processes into teaching in ways that enhances students' achievement and their motivation to learn.

The formative feedback cycle helps learners to know where they are now in terms of high quality work and where they ought to be. This gap analysis facilitates learners' progression from Bloom's lower-order thinking skills (LOTS) which focuses on knowledge acquisition to higher-order thinking skills (HOTS) where the learners are able to create knowledge.



Source: Crockett & Churches (2017)

Hattie's (2012) findings from his meta-analysis of hundreds of education papers indicate that providing formative evaluation and feedback has some of the largest effects on student learning. For an assessment to be formative, student must be receptive to the feedback and use it to adjust their learning. "Without feedback, assessment is not a learning activity; it is a compliance task." (Crockett & Churches, 2017, p. 21)

Churches (n.d.) outlines five characteristics of high-quality feedback. These are:

Timely: The end of the task is too late. Feedback must be provided often and in detail during the process.

Appropriate and reflective: Feedback must reflect the students' ability, maturity and age. It must be understandable.

Honest and supportive: Receiving a critique that identifies weaknesses of one's work can be very disheartening. The feedback must provide encouragement to continue and guidance on how to achieve the desired goals.

Focused on learning: The feedback should provide information which allows the learner to close the gap between the current and desired performance. The clarity and descriptive nature of the feedback the teacher presents are major influences on students' achievement (Hattie, 2012).

Enabling: Receiving feedback without the opportunity to act on it is frustrating, limiting, and counterproductive. Students must be able to learn from the formative assessments and apply the feedback and corrections.

One of the best models of feedback is developed by Dr. Jodie Nyquist (Crocket & Churches, 2017). This model of effective feedback has five stages going from weakest to strongest.

The teacher who provides feedback at the KCR+e and a specific action or ideally KCR+e and an immediate activity gives the learners opportunity to maximise their learning. Based on the above model, three specific criteria for good and bad feedback can be developed.

Criteria for Good and Bad Feedback

Good Feedback	Bad Feedback

• Being positive • Even when criticizing, being constructive • Making suggestions (not prescriptions or pronouncements)	• Finding fault • Describing what is wrong and offering no suggestions about what to do. • Punishing or denigrating students for poor work

Examples of Good and Bad Feedback

Feedback	Good or Bad?
Your answer is the best one in the class.	This is an example of bad feedback. It does not tell the student what is good about the answer.
Your details strongly support your claim that it is not necessary that the objects that have large volume also have high weight. That's great. How have you figured this out?	This is an example of good feedback. It confirms for the students that the work meets one of the targets (strong supporting details) and connects the success to students' effort (the student has find out the relationship, and the teacher noticed).
You are the last one in the class to answer and yet incorrect. You didn't put enough in it.	This is an example of bad feedback. It implies that the student is competing with others (as opposed to aiming for a learning target) and the reason the work is poor is that the student "did something bad." The student ends up feeling judged and not motivated to improve.
How did you arrive at this hypotheses? I would want to know more about the process that helped you to get the right answer.	This is an example of good feedback for a student who the teacher believes that process is more important than only knowing that student arrived at the right answer.
Your report is late. What is the matter with you?	This is an example of bad feedback. It may not inspire the student to complete his or her work and turn it in for assessment.
[Name], I do not have your answer sheet. Can you tell me what happened?	This is a better example than the previous one of feedback to deliver the message that the work is late.

(Front Page)

School's Name

School's Logo

Annual Report Card

[Month] 2022 – [Month] 2023

(First inside Leaflet)

Name: ABC_____ Term One:_[Date]_____

Class:_____

 Rarely  Sometimes  Most of the times  Always

Your child as a learner				
				
Interested in learning				
Listens carefully				
Works well independently				
Keeps trying even when tasks are difficult				
Teacher's Comment:				

Your child's social and personal development				
				
Happy at school				
Behaves well in the class				
Mixes well with other children				
Behaves well in the playground				
Manages and expresses own feelings well				
Teacher's Comments:				

(Second inside Leaflet – Sample for Grades IV)

	Key Themes	Child's Performance					
		Term I Marks			Term II Marks		
		Formative	Summative	Total	Formative	Summative	Total
1	Life Science	16	24	40	16	24	40

2	Physical Science	18	28	46	18	28	46
3	Earth And Space	6	8	14	6	8	14
Total Marks Obtained							
Out of Total Marks		40 Marks	60 Marks	100 Marks	40 Marks	60 Marks	100 Marks
Teacher's Comments (Term I):							
Teacher's Comments (Term II):							

inside Leaflet – Sample for Grades V)

	Key Themes	Child's Performance					
		Term I Marks			Term II Marks		
		Formative	Summative	Total	Formative	Summative	Total
1	Life Sciences	14	21	35	14	21	35
2	Physical Science	17	26	43	17	26	43
3	Earth and Space	9	13	22	9	13	22
Total Marks Obtained							
Out of Total Marks		40 Marks	60 Marks	100 Marks	40 Marks	60 Marks	100 Marks
Teacher's Comments (Term I):							
Teacher's Comments (Term II):							

[Same type of tables will be prepared for all the subjects)

(Last inside Leaflet)

Students Comment (My Learning in School)

Parents' Comments (How can you further support your child's learning)

Teacher's Overall Comment:	
Attendance	**Punctuality**

Teachers' Signature: _____ **Date: _____**

Principal's Signature: _____ **Date: _____**

Parent's Signature: _____ **Date: _____**

CHAPTER FIVE

POST ASSESSMENT: REDEFINED GOALS/CURRICULUM

Chapter Five

Post Assessment: Redefined Goals/Curriculum

Completing the Assessment Loop

This framework brings forth the philosophy, the principles, the policy and the practice of purposeful assessment for evaluating teaching and learning targets at the classroom level, the school and national level. However, unless the evaluation is constructively utilised to inform changes to curriculum, learning targets and teaching methodology in a balanced manner, its real purpose will not be achieved.

Balanced Assessment System

The success of any assessment system will depend on how formative and summative assessments are balanced to meet the needs of all stakeholders. The tables below summarizes the use of the two types of assessments across three levels – the classroom, school and district/province.

Elements of a Balanced Assessment System

Level of Assessment	Purpose of Assessment	User of Information	Type of Assessment
Classroom assessment	To measure level of student achievement on learning targets taught. To diagnose student strengths and areas needing further work.	Teacher Teacher student	Summative: To determine grades for reporting purposes Formative: To revise teaching plans for next year/semester. Formative: To plan further instruction Formative: To provide feedback to students. Formative: To self-assess and to set goals for next steps,.
School based exam	To measure level of student achievement on preset content standard.	Teacher School Leadership District Education Office	Summative: To evaluate achievement level of each student and summarise across students Summative: To determine programme or curriculum effectiveness Formative: To identify programme or curriculum needs.
District, provincial or national large scale assessments	To measure level of student achievement toward content standards and/or international standards. To identify students and/or portions of the curriculum needing additional/ different instruction.	Teacher School Leadership District Education Office	Summative: To evaluate programme effectiveness. Formative: to identify standards in need of more effective programmes. Formative: To plan interventions for groups or individuals.

Source: Chappuis and Stiggins, 2017

Implicit within this balanced assessment system is the cyclic approach to assessment, which emerges as a response to teaching and learning and further informs teaching and learning.

The following section presents schedules of assessment for grades I to V to illustrate how the three streams or levels of assessment can be employed in a balanced manner during an academic year. The schedule is also aligned with the SLOs.

Balanced Assessment Schedule for Grades Science IV and V

<table>
<tr><th>Overall Domain Code*</th><th colspan="6">Assessment Schedule</th></tr>
<tr><td></td><td>One Month</td><td>Term I (4 Months)</td><td>One Month</td><td>Term II (4 Months)</td><td>One Month</td><td>One Month</td></tr>
<tr><td>CRF</td><td rowspan="10">Pre-Assessment</td><td rowspan="10">Formative Assessment (40% Marks based on Ongoing)</td><td rowspan="10">School based Summative Assessment (60% Marks)</td><td rowspan="10"></td><td rowspan="10"></td><td rowspan="10">Post Assessment - One Month After Term II</td></tr>
<tr><td>CRC</td></tr>
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<tr><td>CRM</td></tr>
<tr><td>CUF</td></tr>
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<tr><td>CUC</td><td rowspan="13">Formative Assessment (40% Marks based on Ongoing)</td><td rowspan="13">School based Summative Assessment (60% Marks) And/or Large scale assessments wherever required</td></tr>
<tr><td>CUP</td></tr>
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<tr><td></td><td>Pre-Assessment</td></tr>
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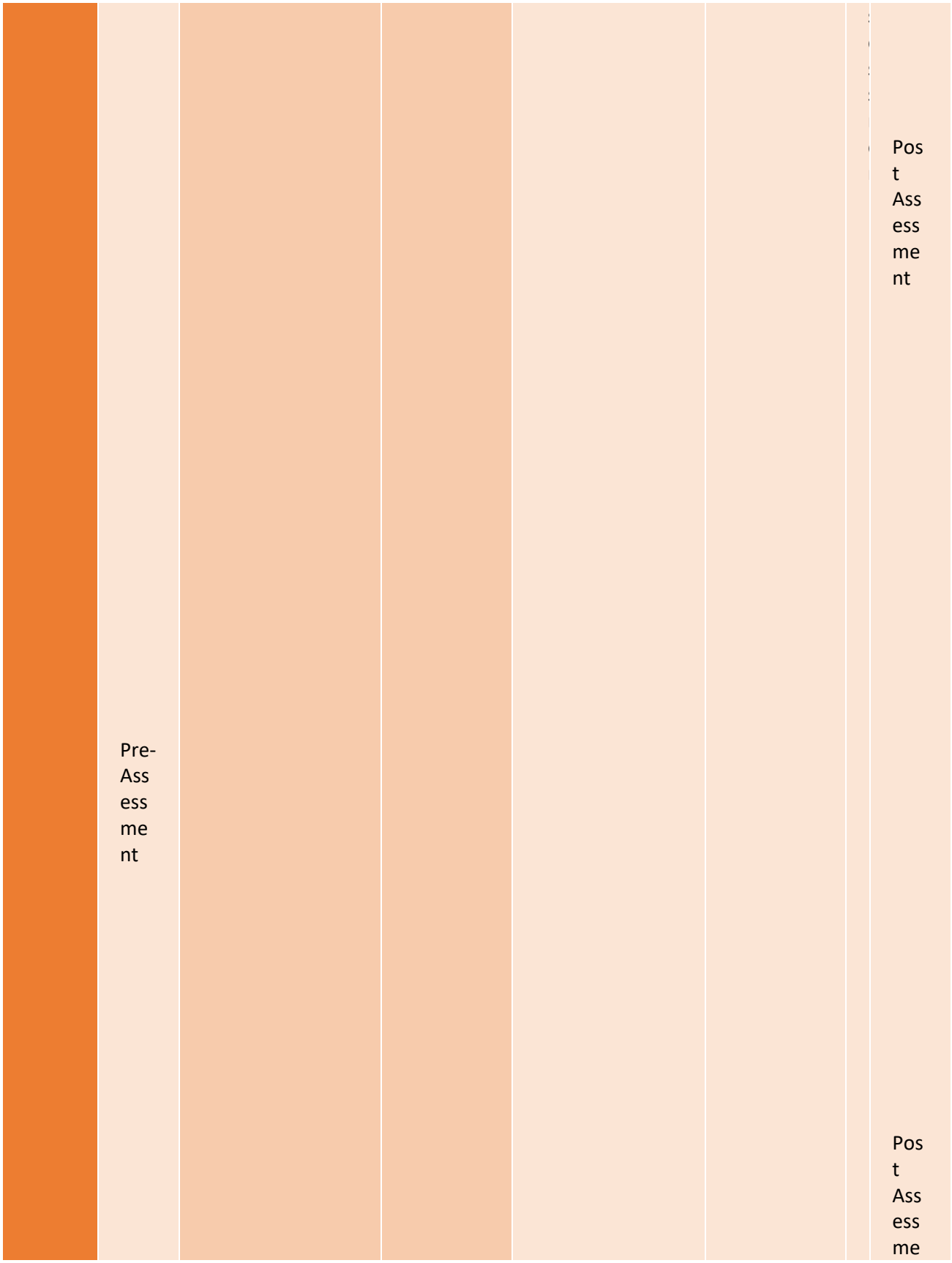
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	Pre-Assessment - One Month Prior to Term I Pre-Assessment						Post Assessment

	Pre-Assessment						Post Assessment
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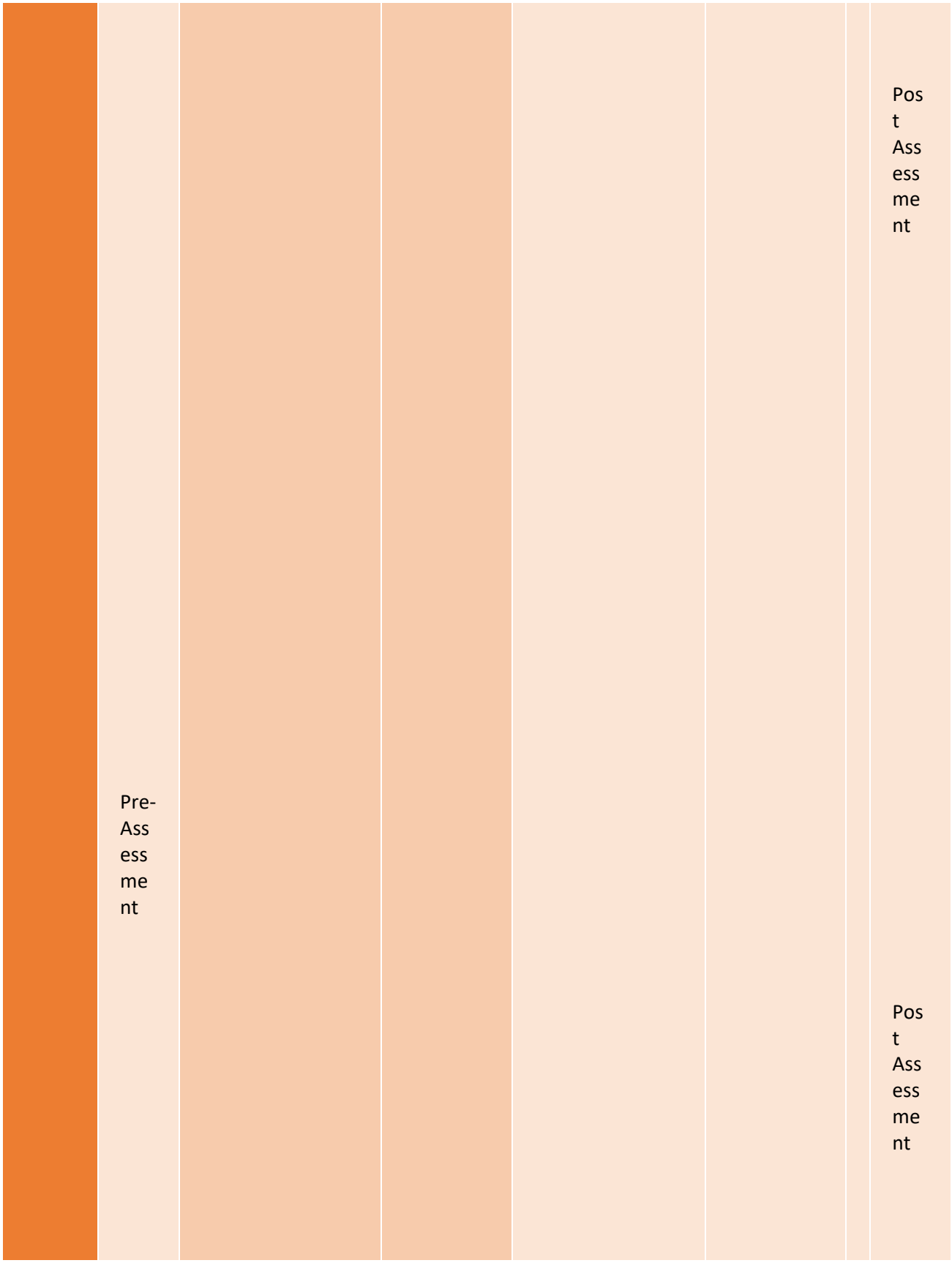
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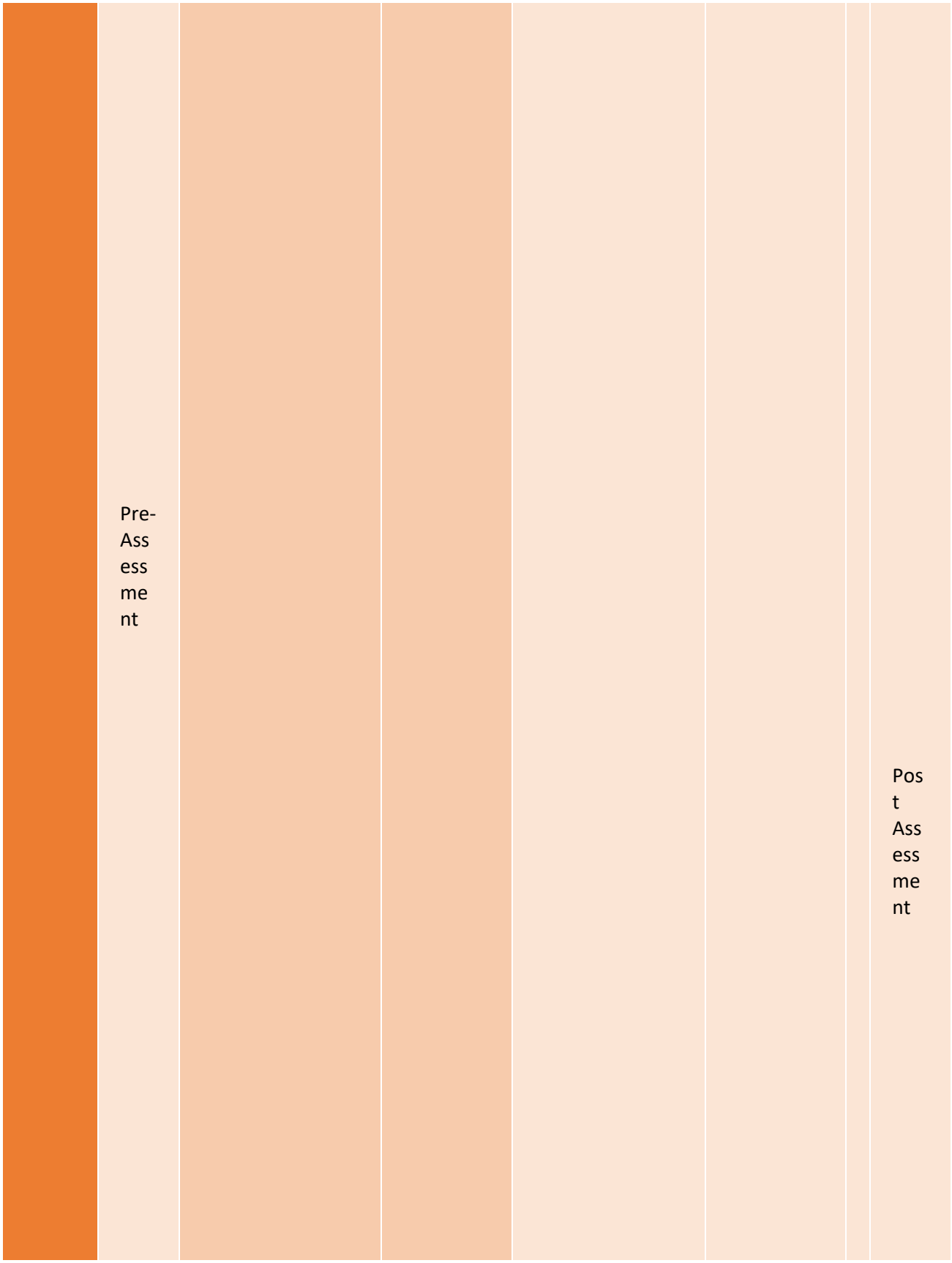
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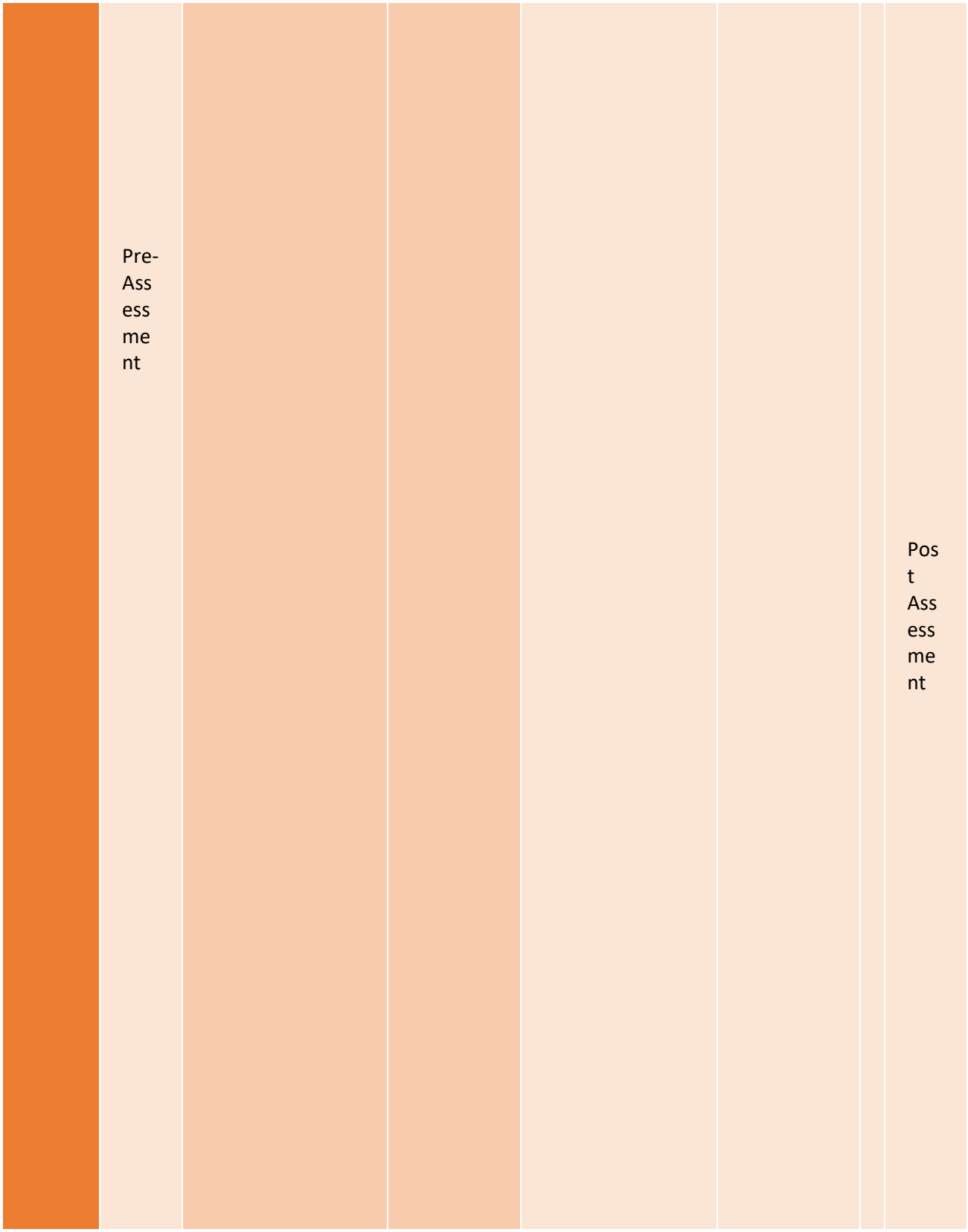
Pre-Assessment
Post Assessment

* This includes all the SLOs contained within the Domain Code

Concluding Remarks – Exit to the Next Cycle

The framework can be considered a blueprint of an assessment programme at the primary school level. It provides the broad overview of policy guidelines for assessment framework 2021 while guiding the alignment of student learning outcomes with assessment strategies. It identifies the learning targets, the deep learning approaches and the strategies for assessing the same. In doing this, it ensures that the assessments are interconnected and purposeful.

While the blueprint is necessary as an overarching guide, its enactment will require professional judgement. Its real purpose will be realised when teachers use it at the classroom level to modify their teaching to match students' learning needs, when school leaders use it to accomplish their goals more effectively by replacing some programmes or practices with better ones (Fullan, 2001) and when the public education departments use it to invest in practices that yield positive results. The education practices, redefined in this manner, are again put to the test and the process of ongoing purposeful assessment continues.

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Appendices

Appendix A

Bloom's Revised Taxonomy Model – Cognitive Domain

Cognitive Dimension	The Knowledge Dimension			
	Factual The basic elements a student must know to be acquainted with a discipline or solve problems in it.	**Conceptual** The interrelationships among the basic elements within a larger structure that enable them to function together.	**Procedural** How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods.	**Metacognitive** Knowledge of cognition in general as well as awareness and knowledge of one's own cognition
Remember Recall or retrieve previous learned information from long-term memory	**List** primary and secondary colors.	**Recognize** action words.	**Recall** how to perform a sum based on four operations.	**Identify** strategies for retaining information
Key Words (Verbs)	labels, lists, names, outlines, states	Defines, describes, identifies, knows,	Recalls, recognizes, matches,	reproduces, selects,.
Sample Assessment	Definition; MCQs; oral questions	Identify names, parts, and characteristics, Matching; quiz	draw diagrams / tables and label them; concept maps, short answers. performing experiments, hands on activities	Recall lab procedures; experiment; application of ideas
Understand Construct meaning from instructional messages, including oral, written and graphic communication.	**Summarize** features of a new product.	**Explain** the main ideas of a play or piece of literature.	**Explain** in one's own words the steps for performing a complex task.	**Predict** one's response to a performance.

Key Words (Verbs)	***Summarizing*** (abstracting, generalizing) ***Explaining*** (constructing models)	***Classifying*** (categorizing, subsuming) ***Exemplifying*** (illustrating, instantiating)	***Interpreting*** (clarifying, paraphrasing, representing, translating) ***Comparing*** (contrasting, mapping, matching)	***Inferring*** (concluding, extrapolating, interpolating, predicting)
Sample Assessment	Explain and describe characteristics of given objects and things, write missing information	Group Work/Cooperative Learning	Project Work	Recall lab procedures; experiment; application of ideas
Apply Carry out or use a procedure in a given situation.	**Respond** to frequently asked questions.	**Provide** advice to juniors.	**Divide** one whole number by another whole number, both with multiple digits	**Use** techniques that match one's strengths. **Use** class rules in situations in which it is appropriate.
Key Words (Verbs)	Demonstrates, discovers,	Constructs, relates,	Computes, demonstrates, manipulates, operates, prepares, produces, solves	Changes, discovers, modifies, predicts, uses
Samples Assessment	Responds to questions	Match, complete sentences	Solves sums; role play	Create a blog
Analyze Break material into its constituent parts & determine how the parts relate to-one another and to an overall structure or purpose.	**Select** the most complete list of activities.	**Distinguish** between relevant and irrelevant numbers in a mathematical ward problem	**Compare and contrast** four ways of serving foods made with apples and examine which ones have the highest health benefits.	**Determine** the point of view of the author of an essay.
Key Words (Verbs)	Focusing, selecting	Differentiating (discriminating, distinguishing)	Organizing (finding, coherence, integrating, outlining, structuring)	Attributing (deconstructing)
Samples Assessment	Library search	Developing an argument; debating	Summarizing data in the form of graphs, pictures, tables etc.	Review of a written piece of work, oral discourse, video etc.

Evaluate Make judgments based on criteria and standards.	**Select** the most complete list of activities.	**Determine** which kinds of apples are best for baking a pie, and why	**Judge** which of two methods is the best way to solve a given problem	**Reflect** on one's progress.
Key Words (Verbs)	Describes, explains	Checking (coordinating, detecting, monitoring, testing)	Interprets, justifies, relates, summarizes, supports	critiquing (judging)
Sample Assessment	Group discussion	Survey	Interpreting a graph, a picture etc.	Blogs; self-evaluation
Create Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure	**Generate** a log of daily activities.	**Compose** a story	**Design** an efficient project workflow.	**Inventing** a product
Key Words (Verbs)	Compiles, explains, reorganizes, summarizes,	planning (designing)	producing (construct)	generating (hypothesizing)
Sample Assessment	Game; network with others	Make predictions and hypotheses and deduce relationships	CCP	Create a learning portfolio.

Appendix B

Bloom's Revised Taxonomy Model – Affective Domain

Affective Domain			
Dimension	**Examples**	**Key words/Verbs**	**Sample Assessment**
Receiving The lowest level. Awareness of feelings, emotions, ideas, material and phenomenon etc. Passively paying attention.	Demonstrates a willingness to participate in a hands-on activity.	Asks, chooses, describes, follows, gives, holds, identifies, locates, names, points to, selects, replies, uses, acknowledge, attentive, courteous, dutiful, follows, listens, understands	Write one muddiest and one mightiest point of the lesson.
Responding The student actively participates in the learning process, not only attends to a stimulus; the student also reacts in some way.	Shows interest in the objects, phenomena, or activity by seeking it out or pursuing it for pleasure.	answers, assists, aids, complies, conforms, discusses, greets, helps, labels, performs, tells, practices, presents, reads, recites, reports, selects, writes.	Completion of class tasks/homework; participation in class/group discussion; presentation; response to questions; compliance with class rules and certain procedures. Reflect on your learning from the hands-on activity on 'Forms of Energy' (Portfolio Assessment)
Valuing The worth or value a person	Simpler acceptance could be being part of the team; while	appreciates, cherish, treasure, demonstrates, initiates, invites,	Write an opinion piece on 'Global Warming', explaining

attaches to a particular object, phenomenon, or behaviour. This ranges from simple acceptance to the more complex state of commitment.	more complex level of commitment may include being responsible for the overall improvement of the team.	joins, justifies, proposes, respect, shares Completes, differentiates, explains, follows, forms, initiates, invites, joins, justifies, proposes, reads, reports, selects, studies, works.	one's own stance and reasons supporting that stance. Seeking out information in popular media related to a particular topic. Proposing a plan to improve teamwork while doing STEM challenge.
Organizing Organizes values into priorities by contrasting different values, resolving conflicts between them, and creating an unique value system. The emphasis is on comparing, relating, and synthesizing values.	The student can put together different values, information, and ideas, and can accommodate them within his/her own schema; the student is comparing, relating and elaborating on what has been learned.	compares, relates, synthesizes, adheres, alters, arranges, combines, completes, defends, explains, formulates, generalizes, identifies, integrates, modifies, orders, organizes, prepares,	Read the given data to provide evidence-based reasoning (constructed response)
Characterizing Highest level. Internalizing values. Student has a value system that controls their behavior. The behavior is pervasive, consistent, predictable.	Shows self-reliance when working independently; cooperates in group activities (displays teamwork); uses an objective approach in problem solving; follows rules and regulations on daily basis.	acts, discriminates, displays, influences, modifies, performs, qualifies, questions, revises, serves, solves, verifies	Provide evidence of individual input in group work and group project. (Self-assessment tasks)

Appendix C

Bloom's Revised Taxonomy Model – Psychomotor Domain

Psychomotor Domain Domain			
Dimension	**Examples**	**Key words/Verbs**	**Sample Assessment**
Perception (awareness) **The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation.**	Detects non-verbal communication cues. Estimate where a ball will land after it is thrown and then moving to the correct location to catch the ball.	chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects.	Participation science activities.
Set **Readiness to act. Mental, physical, and emotional dispositions that make one respond in a certain way to a**	Knows and acts upon a sequence of steps in a process. Shows desire to learn a new process Attend project exhibition. Observe	Begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers.	Use body moment to follow the given instructions such as (i) to show the eagerness for activity (ii) follow the pattern (jump, jump and walk one step forward;

situation.	demonstrations through audio, videos, visuals. Set-up lab equipment for experiments.		jump, jump, jump, take one step backward)
Guided Response **The early stages in learning a complex skill that includes imitation and trial and error. Adequacy of performance is achieved by practicing.**	Performs a mathematical equation as demonstrated. Follows instructions to build a model.	Copies, traces, follows, react, reproduce, responds.	Follow instruction to make a model using different directions.
Mechanism (basic proficiency) **This is the intermediate stage in learning a complex skill. Learned responses have become habitual and the movements can be performed with some confidence & proficiency.**	Use a personal computer. Repair a toy. Drive a bicycle. Holding a pencil	Assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.	Performance in a game (football, hockey). Solving a problem, using pre-set procedures Constructed response question.
Complex Overt Response **Performs task or objective in a confident, proficient, and habitual manner**	Control and use correct movements when playing instruments; drawing with pencil and painting proficiently. Operate and run machines (e.g. computer) efficiently Use equipment with confidence	Assembles, builds, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches. NOTE: The Key Words are the same as Mechanism, but will have adverbs or adjectives that indicate that the performance is quicker, better, more accurate, etc.	Calibrate accuracy using the given criteria. (Self- assessment). Determine the density of a group of sample metals with regular and irregular shapes.
Adaptation **Skills are well developed and the individual can modify movement patterns to fit special requirements.**	Use tools for situations outside typical discipline Responds effectively to unexpected experiences. Modifies instruction to meet the needs of the learners.	Adapts, alters, changes, rearranges, reorganizes, revises, varies.	Field based tasks. Revise and improve procedures of movements; written responses Portfolio; Communicate the solution to a STEM challenge using evidence- based reasoning.

Origination **Creating new movement patterns to fit a particular situation or specific problem. Learning outcomes emphasize creativity based upon highly developed skills.**	Constructs a new theory/story. Develops a new teamwork approach. Creates a new project; a new programme	Arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates.	Project work; Creating different models; Redesign the prototype (solution of any STEM challenge) using the evidence gathered from testing the prototype and research.

Appendix D

Curriculum Mapping

Grade IV

COGNITIVE DOMAIN

Low Order Taxonomies (Cognitive)						High Order Taxonomies (Cognitive)						
Remember	**No of times**	**Understand**	**No of times**	**Apply**	**No of times**	**Analyze**	**No of times**	**Evaluate**	**No of times**	**Create**	**No of times**	**Total**
Domain A: Life Sciences												
Organisms - Characteristics and Life Processes of Living Things												
		Understand that living things grow, take in nutrients, breathe, reproduce eliminate waste and die. (C) Discuss that living things need energy to grow, live and be healthy, and plants get their energy from light (photosynthes	**01** **01**			Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow).(P)	**01**					**02** **01**

		is) while animals get their energy from eating plants and other animals.(C)										
Total Frequency			**02**				**01**					**03**
Organism-Structure & Functions (Plants)												
Describe the functions of different parts of flowering plants: Roots, stem/ trunk, leaves and flowers.(C) Identify the parts of the plant transport system and describe their functions (stem, -leaf,	**01** **01**	Classify the plants into two major groups (flowering, non-flowering), and give examples of each group.(C)	**01**			Investigate the way in which water is transported within plants. (P) Explore the role of flowers in the life cycle of flowering plants, including pollination, fruit and seed formation and seed dispersal. (P)	**01** **01**	Relate that why plants are vital to sustaining life on Earth.(C)	**01**			**0** **02**

-root).(C)												
Identify the parts of a flower and describe their functions (limited to petals, sepals, anthers, filaments, stamens, stigma, style, carpel, and ovary).(C)	**01**											**01**
Describe seed germination and know that seeds require water and an appropriate temperature to germinate. (C)	**01**											**01**

Identify stages in the life cycles of common flowering plants.(C)	**01**											**01**
Identify various professions associated with this unit of science. E.g., botanists, farmers, gardeners, florists, etc.(C)	**01**											**01**
Total Frequency	**06**		**01**				**02**		**01**			**10**
Organism-Structure & Function (Animals)												
Identify that some animals (spider, crab, beetles) have an exoskeleton.	**01**	Describe the Human Digestive System including the simple	**01**			Distinguish between major groups of animals with	**01**		**0**			**03**

(C)		functions of the organs involved (mouth, esophagus, stomach, small and large intestine).(P)				backbones (vertebrates :Fish, amphibians, reptiles, birds and mammals) and without backbones (invertebrates: Insects, snails, earthworm, jellyfish and corals) on the basis of their characteristics. (C)						
Describe some of the important functions of the skeleton. (C)	**01**											**01**
Recognize that humans have different types of teeth (molar, premolar, incisors, canine) and know their functions in digestion of food.(C)	**01**					Investigate the causes and prevention of tooth decay and gum diseases.(C	**01**					**02**

Identify that many vertebrates have a digestive system similar to humans. (P)	**01**											**01**
Total Frequency	**04**		**01**				**02**		**0**			**07**
Human health & disease												
Recognize the items of the first aid box. (C)	**01**											**01**
Total Frequency	**01**											**01**
Ecosystems												
Recognize that ecosystems (e.g., forests, ponds, rivers, grasslands and deserts) consist of habitats that provide living things	**01**	Recognize and explain that living things respond to environmental conditions. (P-C)	**01**	Associate behaviors of animals with the environments in which they live and describe how these behaviors	**01**	Explore how human actions such as urbanization and population growth can						**03**

with what they need. (C)		Describe how plants and animals adapt to environments that are hot, cold, wet and/or dry and describe common physical adaptations of plants (e.g., a thick stem, a waxy coating helps it survive with less water) and animals e.g., colours of animals help in camouflage. (C)	**01**	help them to survive (e.g., migration and hibernation). (C)		affect a habitat. (C)	**01**					**01** **01**

		Explain that when a habitat changes, organisms living in it are affected as well. (C)	**01**									**01**
Total Frequency	**01** **12**		**03** **07**		**01** **01**		**01** **06**		**00** **1**			**06** **27**
Domain B: Physical Sciences												
Identify and describe three states of matter (i.e., a solid has a definite shape and volume, a liquid has a definite volume but not a definite shape, and a gas has neither a definite shape nor a definite volume). (C) Properties of	**01**	Understand temperature as the degree of hotness or coldness of an object or place.(C)	**01**	Demonstrate the production of sound.(P) Demonstrate that the warmer objects have higher temperature than cooler objects.(P)	01 01	Compare and sort the materials on physical properties (mass, volume, density, states of matter, conduction of heat and electricity). (P) Investigate the conditions that cause	**01**			Design models of sphere, cube, prism, cylinder and cone with clay or playdough/ environment friendly materials. (C) Design hammer	**01**	**05** **01**

metals (appearance, texture, color, density, conduction of heat and electricity using daily life examples).(F) Recognize the basic forms of energy (light, sound, heat, electrical, and magnetic) as the ability to cause motion or create change.(C) Describe the properties of light (travels in a straight line, travels very fast and in all directions).(C)	**01** **01** **01**			Demonstrate changes occur when hotter objects are brought closer to the cooler objects.(P) Use various instruments (room thermometers, anemometer, clinical thermometer, etc.) and measure and record temperature using different scales. (P) Demonstrate that simple electrical	01 01 01	matter to change states (heating or cooling), and explain the processes associated with it (i.e., melting, freezing, and boiling). (P) Explore how force can move or stop objects, change direction, shape, & speed. (C) Compare the effects of force of different strengths in	**01** **01**		**0**	, wheels, rollers and gears using clay or playdough/ cardboard/ environment friendly material .(P)	**01**	**04** **02** **03**

Identify the different sounds on the basis of softness and loudness.(C)	**01**			systems (e.g., a flashlight) require a complete (unbroken) electrical pathway.(P)		the same or opposite directions acting on an object.(P)	**01**					**02**
Describe the ways to measure the temperature and its units.(C)	**01**				01							**02**
Recognize that electrical energy in a circuit can be transformed into other forms of energy (light, heat, sound). (C)	**01**			Relate familiar physical phenomena (shadow, reflection, rainbow) to the behavior of light.(C)	01							**02**
Describe different types of				Relate familiar physical phenomena (vibrating objects) to								

force (friction, resistance, muscular forces, applied, gravitational, magnetic, electric). (C) List uses of different types of force in our daily life.(F) Describe that an object may have multiple forces acting on it, even when at rest. (C) Recognize that simple machines, (e.g.,	**01** **01** **01**			the behavior of sound.(C) Investigate that friction can either be detrimental or useful under different circumstances (ways to reduce friction). (P)	01							**02** **01** **01**

levers, pulleys, gears, ramps) help make motion easier (e.g., make lifting things easier, reduce the amount of force required, change the distance, change the direction of the force). (C)	**01**											**01**
Total Frequency	**11**		**01**		**08**		**04**		**0**		**02**	**26**

Technology in Everyday life												
				Use scientific instruments/ apparatus in everyday life (e.g. thermometer, blood pressure apparatus, digital balance, stop watch, calculator, available digital devices). (P) Use a plumb line to install a flagpole vertically.(P	**01** **01**							**01** **01**
Total Frequency					**02**							**02**

	11		**01**		**10**		**04**		**0**		**02**	**28**
Domain C: Earth and Space Science												
Define natural resources. (C) Recognize that the Earth's surface is made up of land and water and is surrounded by a layer of air called the atmosphere which is a mixture of different gases (nitrogen, carbon dioxide, and oxygen, etc.). (C)	**01** **01**	Understand that planetary systems can contain stars, planets, asteroids, and comets. (F) Illustrate and explain how Solar and Lunar Eclipses occur. (C)	**01** **01**	Apply knowledge of changes of state of water to common weather events (e.g., cloud formation, dew formation, the evaporation of puddles, snow, and rain) and understand the Water Cycle.P	**01**	Investigate and describe how day and night are related to Earth's daily rotation about its axis, and provide evidence of this rotation from the changing appearance of shadows during the day. (P)	**01**					**04** **02**

Describe the sources of water on earth. (C)	**01**											**01**
Recognize that most water on Earth is not pure and has dissolved substances in it. (C)	**01**											**01**
Describe the Solar System with the Sun at the center and the planets revolving around the Sun. (C)	**01**											**01**
Recognize that the Earth has a Moon that revolves around it, and from the Earth the Moon looks different at	**01**											**01**

different times of the month (Phases of the Moon).											
Total Frequency	**06**		**02**		**01**		**01**				**10**
Overall Total	**27**		**10**		**09**		**10**		**07**	**02**	**65**

PHYCHOMOTOR DOMAIN

From Low Order Taxonomies to High Order Taxonomies													
Perception	**No of Times**	**Set**	**No of times**	**Guided Response**	**No of Times**	**Mechanism**	**No of Times**	**Complex Overt Response**	**No of Times**	**Adaptation**	**No of Times**	**Origination**	**No of Times**
Domain A: Life Sciences													
Organisms - Characteristics and Life Processes of Living Things													
		Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow)	**01**										**01**
Total Frequency			**01**										**01**
Organism-Structure & Functions (Plants)													
		Investigate the way in which water is transported within plants.	**01**										**01**

Total Frequency			**01**										**01**
Ecosystems													
		Explore how human actions such as urbanization and population growth can affect a habitat.	**01**										**01**
Total Frequency			**01** **03**										**01** **03**
Domain B: Physical Sciences													
Compare and sort the materials on physical properties (mass, volume, density, states of	**01**	Investigate that friction can either be detrimental or useful under different	**01**			.Design hammer, wheels, rollers and gears using clay or playdough/ cardboard/ environment friendly	**01**						**03**

matter, conduction of heat and electricity).		circumstances (ways to reduce friction). Explore how force can move or stop objects, change direction, shape, & speed.	**01**			material.							**01**
Total Frequency	**01**		**02**				**01**						**04**
Technology in everyday life													
						Use scientific instruments/ apparatus	**01**						**01**

						in everyday life (e.g. thermometer, blood pressure apparatus, digital balance, stop watch, calculator, available digital devices). Use a plumb line to install a flagpole vertically.(P)	**01**						**01**

Total Frequency					**0**		**2**						**02**
	01		**02**				**03**						**06**
Total overall	**01**		**05**				**03**						**9**

CURRICULUM MAPPING

Grade V

COGNITIVE DOMAIN

Low Order Taxonomies (Cognitive)						High Order Taxonomies (Cognitive)						
Remember	**No of times**	**Understand**	**No of times**	**Apply**	**No of times**	**Analyze**	**No of times**	**Evaluate**	**No of times**	**Create**	**No of times**	**Total**
Domain A: Life Sciences												
Organism-Structure & Function (Animals)												

Identify that the human body has a number of systems, each with its own function. (C) Recognize the integration of the different systems (Respiratory, and Circulatory) in carrying out life processes. (C) Identify by name the main parts of the Human Circulatory System, and describe briefly the functions of the heart, blood vessels and blood. (C)	**01** **01** **01**	Describe the Human Respiratory System in terms of oxygen from the air moving into the blood in the lungs and know that many vertebrates have a similar respiratory system. (P)	**01**	Use a model to describe how we receive different types of information through our senses, process the information in our brain and respond to the information in different ways.(P)	**01**							**03** **01** **01**

Identify that many animals have a circulatory system similar to humans. (C)	**01**											**01**
Total Frequency	**04**		**01**		**01**							**06**
Human health & disease												
Define and describe main groups of microorganisms (bacteria, virus and fungi) and give examples of each.(C)	**01**	Relate the transmission of common communicable diseases to human contact. (C) Explain some	**01**	Use a first aid box to dress a wound. (P)	**01**	Differentiate between contagious and non-contagious diseases. (C) Investiga	**01**					**04**

Recognize some common diseases of each group (bacteria, virus and fungi) caused by microorganisms. (C) Recognize that microorganisms get transmitted into humans and spread infectious diseases. (C) Recognize the advantages of microorganisms. (C)	**01** **01** **01**	methods of preventing the transmission of contagious diseases COVID-19 & Polio. (C)	**01**			te the role of microorganisms in producing or breaking down/decomposing materials. (P)	**01**					**03** **01** **01**

Total Frequency	**04**		**02**		**01**		**02**					**09**
Ecosystems												
Describe food chains as being made of producers and consumers, and classify consumers as herbivores, omnivores, carnivores, predators, and/or prey. (C) Describe a food web and its relation to a food chain. (C) Identify that some substances in our environment can be toxic and	**01** **01** **01**	Explain how human activities add toxic substances to an ecosystem. (C) Explain the effects of water, air and land pollution. (Unclean/Toxic water, smoke, smog, excess CO/other gases, open garbage dumps, industrial waste, etc.) on the environment and life.C Discuss the effects of	**01** **01**			Explore the main causes of water, air and land pollution in the local and wider community. (P) Differentiate between biodegradable and non-biodegradable materials and their impact on the environment. (C)	**01** **01**					**03** **01** **02** **01**

these substances can move through the food webs/ chains and can be harmful for living things. (C)		burning fossil fuels and releasing greenhouse gases in air.(C)	**01**									**01**
Total Frequency	**03**		**03**				**02**					**08**
	11		**06**		**2**		**4**					**23**
Domain B: Physical Sciences												
Matter can be changed from one state to another by heating or cooling. (C)	**01**	Describe the structure and discuss the mechanism of the conduction of sound waves. (C)	**01**	Demonstrate that sound can travel through different states of matter with different speed.(P)	**01**	Observe the changes in materials that do not result in new materials (dissolving, crushing). (P)	**01**			Design a model of a footbridge using the given specifications (e.g can sustain a given weight). (P)	**01**	**05**
Identify natural, artificial light sources. (C)	**01**	Describe the intensity of sound. (C)	**01**	Demonstrate magnets have two poles (opposites attract and like poles repel). (P)	**01**							**03**
Identify		Describe flow		Relate						Design a model of a	**01**	

transparent, translucent and opaque objects. (C) List the harmful effects of noise on human health. (F) State the role of humans in reducing noise pollution. (F) Recognize the difference between a magnet and a magnetic material. (C)	**01** **01** **01** **0**	of electric current in an electric circuit. (C)	**01**	properties of magnets (i.e., two opposite poles, attraction/repulsion, and strength of the magnetic force varies with distance) to uses in everyday life (e.g., a directional compass). (P)	**01**	Identify observable changes in materials that make new materials with different properties (e.g., decaying, such as food spoiling, burning, rusting). (P) Compare physical and chemical changes.C Sort out luminous and non-luminous objects.C	**01** **01** **01**			bookshelf using the given specifications (e.g can sustain a given weight, space, materials). (P) Prepare LED light strings working with 2 volt battery. (P) Draw circuit diagram with symbols.(P) Construct a magnetic compass. (STEM/ST	**01** **01** **01**	**05** **01** **02** **01** **03**

										EAM) (P)		**01**
Total Frequency	**06**		**03**		**03**		**04**				**5**	**21**
Technology in Everyday life												
				Use scientific instruments /apparatus in everyday life (Use spirit level/water level to level different objects i.e. table, picture, frame etc.). () Practice safety measures for earthquake and fire drill. (P)	**01** **01**							**01**
Total Frequency	**06**		**03**		**02** **05**		**04**				**5**	**02** **23**
Domain C: Earth and Space Science												
Describe the structure of	**01**	Understand that the	**01**			Investigat e the	**01**			Predict and	**01**	**04**

the Earth (i.e., crust, mantle, and core) and the physical characteristics of these distinct parts. (C) Describe common features of volcanoes and know they are found at breaks in the Earth's crust. (C) Identify various causes of soil pollution. (C) Identify professions related to Earth Science i.e., paleontologists, seismologists,	**01** **01** **01**	Earth's crust moves and when parts move suddenly this is called an earthquake. (C) Identify similarities and differences among the different types of soil and classify them based on their clay, sand, and organic content. (C) Comprehend that soil composition can change, which can support, or hinder, plant growth. (C)	**01**			compositi on and characteristics of different soils. (P)				comprehe nd how astronauts explore space, how do astronauts survive and research in space. (M)		**02** **02** **01**

geologists. (C)												**01**
Know that a satellite is an object in space that orbits a larger object and a moon is a natural satellite that orbits a planet. (C)	**01**											
Describe the natural satellites of the planets of the Solar System. (C)	**01**											**01**
Define artificial satellites and explain their importance in exploring the Earth and Space. (C)	**01**											**01**
Recognize the role of NASA (National Aeronautics	**01**											**01**

and Space Administration); explore the contribution of SUPARCO in space exploration. (C)												**01**
Identify using secondary sources the key milestones in space technology in the past 10 years. (C)	**01**											**01**
Identify professions related to the Earth Science i.e., Astronauts, Physicists, Space Scientists, etc. (C)	**01**											
Total Frequency	**10**		**03**				**01**				**01**	**15**
Overall Total	**27**		**12**		**07**		**09**				**06**	**61**

PHYCHOMOTOR DOMAIN

From Low Order Taxonomies to High Order Taxonomies													
Perception	**No**	**Set**	**No**	**Guided Response**	**No**	**Mechanism**	**No**	**Complex Overt Response**	**No**	**Adaptation**	**No**	**Origination**	**No**
Domain B: Physical Sciences													
		Draw circuit diagram with symbols. (P)	**01**	Design a model of a footbridge using the given specifications (e.g can sustain a given weight). Design a model of a bookshelf using the given specifications (e.g can sustain a given weight, space, materials). Prepare LED light strings working with 2 volt battery. Construct a magnetic compass. (STEM/STEAM) (P)	**01** **01** **01** **01**								
Total Frequency			**01**		**04**								**5**
Technology in everyday life													

						Practice safety measures for earthquake and fire drill.	**01**						
Total Frequency							**01**						**1** **6**