National Education Assessment Framework 2019

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Bhutan Council for School Examinations and Assessment

ROYAL GOVERNMENT OF BHUTAN

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FOREWORD

The National Education Assessment Framework offers guidelines to diagnose and monitor the quality of the education system in Bhutan for evidence-based policy recommendations and timely interventions.

This framework has been developed on the basis of the nine student attributes as specified in the Bhutan Education Blueprint 2014-2024, guided by the sound principles and best practices of large-scale assessments. The Framework is aligned with the vision of His Majesty, the Ministry of Education, the Bhutan Council for School Examinations and Assessment, the draft National Education Policy 2018, and other strategic policy documents that express the aspirations of our nation.

It outlines the purpose and the need for a robust assessment framework and other essential aspects of assessment including assessment design, sampling, data analysis, and reporting. Further, it includes discussions on assessment of students with Special Education Needs (SEN).

The framework is the culmination of the extensive collaboration and consultation among stakeholders and meticulous review by the BCSEA Core Team, National Review Team, and ACER, India. I extend my sincere appreciation and gratitude to the technical team, the collaborating agencies, funding and coordinating agencies for the successful development of the NEAF.

This framework will enable BCSEA to implement international best practices in monitoring and assessing the quality, equity and health of the education system.

It would also help MoE to achieve its aspiration in making students realize their potential to become socially useful and economically productive citizens. Further, the framework will guide us in making school education system dynamic and responsive to the changing local, national, and global needs.

Best wishes to BCSEA for a very successful implementation of the NEA.

Tashi Delek

(Jai Bir Rai)
Minister
Ministry of Education

PREFACE

The National Education Assessment Framework (NEAF) is the first of its kind developed by Bhutan Council for School Examinations and Assessment with technical support from Australian Council for Educational Research (India) under the Education Sector Program Implementation Grant funded by the Global Partnership for Education.

It is widely recognised that an assessment frameworks is a key to building stronger and fairer school systems. Great emphasis is being given to the importance of seeing assessment not an end in itself. but as an important tools for achieving improved student learning outcomes.

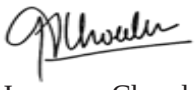
Information regarding the student learning achievement is critical in order to make informed policy decisions in the education system and to provide feedback for the improvement in student learning outcomes.

This document sets out a comprehensive guidelines for the conduct of the National Education Assessment (NEA) at grades III, VI and IX across the four core domains (English Reading and Writing Literacy, Dzongkha Reading and Writing Literacy, Mathematical Literacy, and Scientific Literacy).

With the framework in place and through the capacity building workshops provided for the development of NEAF, it is expected that the quality of assessment instruments, processes and outcomes will be enhanced.

It is our hope that all relevant stakeholders will support us in this endeavour.

Tashi Delek



Jamyang Choeden
Director
Bhutan Council for School Examinations and Assessment

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ABBREVIATIONS AND ACRONYMS

ACER	Australian Council for Educational Research
ASSL	Annual Status of Student Learning
BCSEA	Bhutan Council for School Examinations and Assessment
BBE	Bhutan Board of Examinations
BEP	Bhutan Education Blueprint
CBAT	Competency Based Assessment Test
CRT	Constructed Response Task
CSO	Civil Society Organization
GNH	Gross National Happiness
GNHC	Gross National Happiness Commission
ICT	Information and Communication Technology
IRT	Item Response Theory
ISCED	International Standard Classification of Education
LO	Learning Outcome
MCQ	Multiple Choice Question
MoE	Ministry of Education
MoS	Measure of Size
MTEG	Monitoring Trends in Educational Growth
NEA	National Education Assessment
NEAF	National Education Assessment Framework
NGO	Non-Governmental Organization
OECD	Organisation for Economic Co-operation and Development
PIRLS	Progress in International Reading Literacy Study
PISA	Programme for International Student Assessment
PISA-D	PISA for Development
REC	Royal Education Council
SES	Socio Economic Status
SEN	Special Education Needs
TIMSS	Trends in International Mathematics and Science Study
UNESCO	United Nations Educational Scientific and Cultural Organization
UNICEF	United Nations Intaernational Children's Emergency Fund
UIS	UNESCO Institute for Statistics

EXECUTIVE SUMMARY

The National Education Assesment Framework intends to guide a systemic conduct of National Education Assesment which is a periodical monitoring of the health of the education system. It provides scope for making informed data-driven policy decisions to support and improve the learning outcomes of students.

In the words of our beloved His Majesty, "*the nation's vision can only be fulfilled if the scope of our dreams and aspirations are matched by the reality of our commitment to nurturing our future citizens".*
Further the constitution of the Kingdom of Bhutan states *"education for the purpose of improving knowledge, values and skills of the entire population with education being directed towards the full development of the human personality"*. Thus, the NEAF sets out to fulfil these aspirations through the national education assessment.

With the systemic transition of the system from monastic to modern education, Bhutan has seen a huge advancement in examination and assessment systems. BCSEA was instituted and given a mandate in 2011 to be the watchdog of our education system. Currently, various types of national assessments as well as public examinations are conducted by BCSEA at various key stages of student learning.

Since 2004, the NEA has been conducted several times in Bhutan. The results of NEA, 2013-14 and Programme for International Students Assessment for Development (PISA-D) conducted in 2017 indicated a number of concerns about the quality of education in the country. The need to revamp assessment system is also highlighted in the Bhutan Education Blueprint 2014-24, declaring that the assessment system in Bhutan has enabled Bhutanese students to replicate content knowledge only. Consequent upon the findings, a robust framework has been developed to mitigate the challenges in conducting valid and reliable empirical studies.

This framework not only addresses the issues of the earlier NEA cycles but also presents the underlying theory and the design of the NEA. It provides critical information required by test developers to develop valid and reliable test instruments along with background questionnaires.

Broad objectives of the NEA

- Gather reliable data that can be used to identify trends and growth in the educational achievement over a period of time.
- Monitor the health and quality of school education and provide timely feedback to guide policy development and intervention design.
- Provide independent review of students' achievement in relation to curriculum standards.

Key features of the NEAF

- A clear description of the aims and objectives of the assessment, and a clear definition of each domain.
- Description of the types and proportions of knowledge, skills, values and attitudes as well as learning outcomes.
- Inclusion of 21st century competencies adapted as the Nine Student Attributes, in the context of nine student attributes as stated in the Bhutan Education Blueprint 2014-24.
- Contextual factors that correlate with student achievement.
- Test design, including item format, duration of the test, number of test booklets, number of items in each test booklet, and the number of link items within and across the grades.
- Universal inclusion through appropriate accommodations for children with special education needs.

Assessment design and reporting

Grades III, VI, and IX have been selected as target groups for the NEA, which will be carried out once every three years. As is evident, the gap between the selected grades is three years, which is equal to the gap between subsequent cycles of the NEA. This approach serves two purposes simultaneously – on the one hand, the same cohort of students can be tracked from grade III through grade IX, while on the other, systemic interventions can be implemented and tracked through the years for evaluation purpose. This design component reduces the burden on the system to carry out additional studies for impact assessment.

The NEA is designed to assess student learning outcomes in Reading Literacy, Writing Literacy, Mathematical Literacy and Scientific Literacy. Development of instruments is largely focused on appropriateness, linguistic demand, and mapping to the domain framework as defined in the NEAF. Learning outcomes are then correlated with contextual factors to provide insights into that influence development of capabilities and attitudes related to the cognitive domains as well as the nine student attributes.

The framework provides an overview of the sampling process, which acts as a guide for developing a detailed sampling plan. For the NEA, probability proportional to size (PPS) sampling techniques will be used for selection of schools and simple random sampling will be adopted for selection of students in a school.

Two alternative booklets per domain for each grade will be used in the assessment. Each booklet of the domain is linked horizontally with the alternative booklet of the same grade. The booklets are also linked vertically across grades to enable putting all students on the same scale for reporting. Design choices for booklet design are based upon student testing time, item positioning, linking (horizontal, historical, vertical), item pool, items to be released for public, statistical objectives to be met, and so on. Approximately 65 minutes have been earmarked to test students in one domain, which includes the time for administration and contextual questionnaires as well.

Student performance will be mapped on an empirically developed scale with learning progressions. Meaningful inferences can be drawn from the descriptions given for each achievement level on the scale, and a comparison between the performance of sub-groups of population as well as that of the same cohort across assessment cycles will be reported as per requirement. Each domain will have its own scale and the scale scores are not comparable between domains. Secondary analysis of the data will identify factors that will contribute to student achievement. This will provide useful evidence for developing education policies and interventions.

Contextual questionnaires

The NEAF provides a conceptual framework to develop contextual questionnaires to collect background information pertaining to factors related to student learning outcomes. The model classifies contextual factors as input, process, and outcome factors. In addition, a set of questions also gather data regarding 21st century competencies defined as the nine student attributes in the Bhutan Education Blueprint 2014-24.

To accurately identify and map the relevant context, information will be collected through four questionnaires viz. one each for Student, Teacher, School, and Dzongkhag/Thromde. Through this approach, rich and relevant insights will be provided regarding the factors that affect the competencies and attitudes of students at home and school.

Development process of the NEAF

The NEAF has been developed in collaboration with relevant stakeholders. The framework is guided by the existing set of policy documents, guidelines, strategic documents, and research studies, as well as the national curriculum. The framework is also based upon sound principles and best practices of large-scale assessments conducted by experienced global leaders such as the OECD, World Bank, and the ACER.

The development process entails a thorough review of these policies and strategic documents as well as the curriculum and textbooks from pre-primary to grade XII in the subject areas of English, Dzongkha, Mathematics, and Science. Based on these findings, a wider group of subject experts selected the measurable learning outcomes suitable for the NEA.

The framework was endorsed by the Board of Directors, BCSEA, on 5th June, 2019, after a series of consultative meetings with relevant government agencies, development partners, civil society organizations, non-governmental organizations, educationists, parents and youth representatives.

CHAPTER 1: INTRODUCTION

The National Education Assessment Framework (NEAF) consists of ten chapters. Chapter One provides an overview of the NEA including the objectives and features of a robust NEAF. Chapters Two to Seven describe the specific domains to be assessed, which include English Reading Literacy, English Writing Literacy, Dzongkha Reading Literacy, Dzongkha Writing Literacy, Mathematical Literacy, and Scientific Literacy. Chapter Eight covers the assessment of students with special needs.
Chapter Nine covers the contextual questionnaires which will help in providing further insights into the students' performance in specific domains and to guide educational policy developments and interventions. Chapter Ten highlights the assessment design and cycle of the NEA.

1.1 Overview of the Education System in Bhutan

Bhutan is a unique sovereign nation in the world while other nations use the Gross Domestic Product (GDP) as a key indicator of their nation's progress, Bhutan uses Gross National Happiness (GNH) as the key indicator of national development. This defining approach of the country has undoubtedly influenced the nation's education policies as well.

The Royal Government of Bhutan understands the vital role education plays in the nation-building process and in giving Bhutan its *'distinct identity as a small, peaceful, progressive and happy nation'* (MoE, 2014, p.10).

Since the introduction of modern education in the 1960s, Bhutan has made considerable progress in achieving the objectives of enhancing access to education and ensuring educational quality, equity, and efficiency within the system. The current structure of Bhutanese education system is depicted in figure 1.1 along with its mapping to the International Standard Classification of Education (ISCED) 2011 and Key Stages of school education.

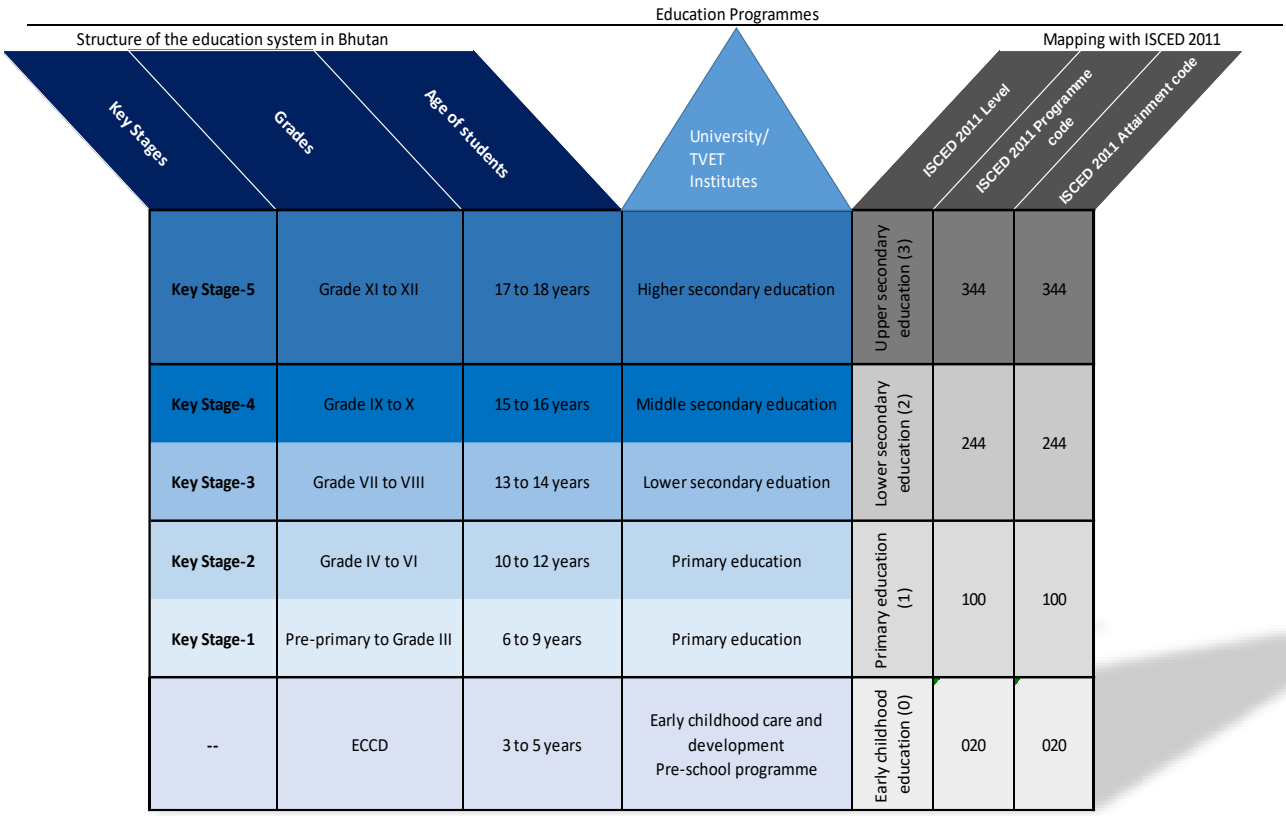


Figure 1.1 Structure of Education System in Bhutan.

Adapted from Bhutan Education Blueprint 2014-24 by MoE, 2014, Thimpu: MoE, p. 31. Copyright 2014 by MoE; International Standard Classification of Education ISCED 2011 by UNESCO Institute for Statistics, 2012, Montreal: UNESCO Institute for Statistics. Copyright 2012 by UNESCO-UIS.

The vision for Bhutan from the perspective of education is to create an educated and enlightened society based on the traditional values of *tha dam-tshig* and *ley gyu-drey* (sublime values of solemn devotion and trust based on interconnectedness, relationship and bonding, and cause and effect). Hence, the outcome expected from the education system is to produce citizens with skills and abilities that are an ideal blend of modern and traditional values reflecting the unique Bhutanese identity.

The system seeks to ensure that future Bhutanese citizens are well-equipped to prosper in the 21st century and beyond by maintaining the Bhutanese identity and valuing its ancient tradition, culture and wisdom. This requires an inclusive and holistic system of education that builds on its competencies embracing new developments in line with this vision. To realise this vision, the Draft National Educational Policy 2018 seeks to create a robust, inclusive, and holistic education system that:

- inculcates the principles and values that underpin the philosophy of Gross National Happiness, and upholds the nation's unique cultural and spiritual heritage and values; and
- prepares citizens to become knowledgeable, skilful, creative, innovative, enterprising, and capable of responding to national needs and emerging global trends.

The Bhutan Education Blueprint 2014-24 also supports the fulfilment of this vision by outlining a strategy on critical areas that respond to the challenges and changing needs of the education system more holistically. It has strategised educational reform in three sequential waves in order to ensure that the complex interventions planned happen systematically and strategically.

The first wave focuses on ensuring that all teachers, schools, and principals achieve a minimum quality standard by up-skilling teachers, empowering principals, and providing other supportive measures. The second wave emphasises change initiatives such as institutional work dynamics and culture. Spillover work from the first wave such as improving student learning outcomes in tune with international benchmarks will also be carried out during this period. The goal of third wave is to create a self-sustaining system that is creative, innovative, and enterprising so that the schools will perform at high levels of effectiveness and efficiency.

The reforms are carried out through eight shifts which are thematically linked to the four important outcomes – access, quality, equity, and efficiency. However, quality is considered the most important aspect and, therefore, it is an underlying theme across all the eight shifts.

1.2 Examination and Assessment Systems in Bhutan

The examination and assessment systems have been an integral part of the education system since the time of the monastic education in Bhutan. This has grown with the development and advancement of the education system in terms of measurement approaches and assessing educational outcomes. The education system in the country is assessed at school level and national level in line with national and international standards. The Bhutan Council for School Examinations and Assessment (BCSEA), was instituted in 2011, with a mandate to be the watchdog of the education system in the country. BCSEA currently carries out various types of national-level examinations and assessments at four key stages of student learning – grades III, VI, X and XII. At the end of grades III and VI, students appear for a year-end Competency Based Assessment Test (CBAT). In this case, the question papers, model answers, and marking schemes are provided by BCSEA, while the administration and evaluation are carried out by the respective schools as per the examination standards set by BCSEA. The consolidated results are sent by the schools to BCSEA for analysis and feedback.

BCSEA also conducts public examinations at the Secondary and Higher Secondary levels. These are considered high- stakes examinations and are administered at the end of grades X and XII.

The NEA is a periodic assessment carried out by BCSEA. The first NEA was conducted in 2004 by the erstwhile BBE (Bhutan Board of Examination) for grade VI students on Literacy (English) and Numeracy (Mathematics). In 2006, grade

VI Dzongkha was assessed, followed by grade X English and Mathematics in 2007. The second round of NEA for grade VI on Literacy and Numeracy was conducted in 2011. Subsequently, grade X students underwent second round of NEA in English and Mathematics in 2013. The test items for the NEA were developed in line with the national and international standards to cover learning standards as well as competencies as per the curriculum.

School-level examinations and assessments across the country are conducted as per the subject curriculum framework developed by the Royal Education Council (REC). Scores of these examinations and assessments are used to determine students' learning achievements, and to provide timely interventions for improvement.

1.3 The Need for National Education Assessment

Although access to education has expanded significantly in recent years, the quality of learning still remains a major challenge. A study on the quality of education carried out by the Royal Education Council (2009)[1] revealed the following findings:

- Student learning outcomes were below the minimum expectations of their grade levels, and they were unable to perform basic Numeracy and Literacy tasks.
- Majority of students were unable to understand core concepts and were also unable to apply knowledge to real-life situation across grades and subjects.
- Students performed better in questions related to recall.
- Gaps existed in procedural learning as students made simple mistakes in questions related to procedural applications.
- Students across grades performed poorly in questions related to visual problems, indicating that students had poor comprehension ability.
- Employers perceived graduates as lacking academic preparation and professional skills to succeed in entry-level jobs.

The results of the NEA 2013-14 and the PISA-D assessment survey conducted in 2017 showed similar concerns about the quality of educational outcomes. The PISA-D findings revealed that the average solution rate in Bhutan for Reading Literacy was 45.3 percent, for Mathematical Literacy was 38.8 percent, while it was 45.1 percent for Scientific Literacy (National Project Centre, 2019). When compared to the other seven participating PISA-D countries, the performance of Bhutan's students was ranked between the two highest-performing PISA-D countries (Ecuador and Paraguay); however, the report further stated that a reliable estimate based on the percent correct scores showed that this performance was significantly below the OECD average. Therefore, it is evident that the education system needs urgent

[1] *Royal Education Council & iDiscoveri Centre for Education and Enterprise, I. (2009). The quality of school education in Bhutan: realities and opportunities. Thimphu: Royal Education Council (cited in MoE 2014).*

intervention to upscale the standard of quality education. One of the immediate measures is to review the current practice of examination and assessment systems to address the gap between the current and expected learning levels of the students. Other interventions such as teaching-learning materials, professional development, and support systems will still remain crucial and require periodical review and appropriate interventions.

International experiences and research indicate that learning assessments are critical tool to promote equity and accountability and to enhance the quality of education systems by providing much-needed information to improve teaching and learning processes at the classroom level (IIEP,UNESCO, 2019). At the system level, good standardised learning assessments can assist in making informed policy decisions, monitoring progress towards system targets, identifying marginalised and disadvantaged groups for targeted interventions, and ensuring appropriate resource allocation.

Standardised assessments for diagnostic purposes are intended to evaluate the system rather than the students, teachers, or schools at an individual level. Hence, they are designed based on these requirements and are different from other assessments such as high-stakes examinations. Standardised assessments identify knowledge, skills, and abilities, as well as values and attitudes that students possess and those they lack to close the information loop by recommending courses of action in order to improve the system. On the other hand, high-stakes examinations are designed to capture individual students' performance and to measure how well students have learnt what they have been taught (ACER,2013). Consequently, reporting of standardised assessments is done at the system level (e.g., at national level) whereas public examinations report a snapshot of performance at the individual students' level.

National assessments are used by countries for informing specific policy and system-level interventions. For example, Vietnam used its national assessments to monitor students' learning progress over time and to evaluate the effectiveness of policy initiatives focused on educational quality to help schools meet new school-based standards (Attfield & Vu, 2013). In Australia, the national assessment was used to target in-service professional development programmes for improving teacher and school quality in identified schools. The programmes provided Literacy and Numeracy coaches to work with identified school staff for the improvement in pedagogy (ACER, 2015).

Realising the gaps in the current education, examination and assessment systems, the Bhutan Education Blueprint 2014-24 highlights the need to revamp these systems to attain desired competencies at various levels. In order to effectively achieve this objective, the government has identified a need for a standardised nationwide low-stakes diagnostic assessment.

BCSEA proposes to conduct empirical studies to provide diagnostic information on examinations and assessments (BCSEA, 2015). However, BCSEA has been facing a number of challenges and issues with the earlier form of NEA. Therefore, this document has been developed not only to address those challenges but also to align education with the vision of education system in Bhutan and the conduct of NEA has been identified as an important tool to achieve this goal.

The following are some of the changes that the NEAF shall address in order to meet the challenges:

- The NEA implementations from 2002 to 2013 did not have the guidance of an assessment framework. As a result of this, test items were based on the text books. This document presents an assessment framework that provides clear guidelines to the test developers and other stakeholders in conducting valid and reliable assessment cycles based on measurable learning outcomes at key stages.
- The technical standards developed alongside the NEAF will assure adherence to international quality standards through the NEA cycles.
- BCSEA's capacity building in the test item design, scientific sampling, data analysis, and reporting will ensure that the NEA follows a robust assessment cycle.
- A sampling plan will be developed to obtain scientifically valid samples for the assessment.
- This NEAF will guide test developers in developing test items in each domain and will also aid in developing valid background questionnaires for students, teachers, schools, and Dzongkhags Education Officers.
- Assessment design has been remodelled in the assessment framework to identify the key stages as well as frequency of testing required in the NEA. Grades III, VI and IX have been identified to be tested every three years in the NEA for several reasons. Firstly, testing grade III at the end of Key Stage 1 and grade VI at the end of Key Stage 2, will give critical information about students' learning development (See Figure 1.1). Secondly, this model will allow tracking the development of the same cohort of students from grade III through grade IX. Thirdly, grade IX has been selected over grade X because the gap between grade VI and X is too large to provide meaningful vertical linking of test items. Further grade X students have board exams at the end of the year, and an additional NEA at that stage would not be suitable.
- This re-design allows for providing comparable analysis of key developmental stages at regular intervals, generating timely and effective policy recommendations for evaluating old programmes, and designing new programmes. Details about this model are provided in Chapter Seven.
- A proficiency scale will be developed for each domain across grades to provide progress and growth analysis.
- The proficiency scale will have proficiency descriptors to facilitate a system-level understanding of students' performance and growth over time in terms of

skills, knowledge, and understanding in each domain. This information can be used at multiple levels for effective policy formulation and curricular reforms.

- An inclusive NEAF is being developed to ascertain that students from all backgrounds are able to participate and benefit from the assessment. The NEA will be made accessible for children with special education needs through proper accommodations and adaptations.
- 21st century competencies are being addressed for the first time in the NEA. However, some background spadework is required before the NEA is able to comprehensively assess and report on 21st century competencies in future cycles. Therefore, the first cycle of NEA will help to report on the state of implementation of 21st century competencies in the education system across Bhutan.

1.4 Objectives of National Education Assessment

The objectives of NEA are to:

- monitor the health and quality of school education by providing timely feedback to its key stakeholders;
- provide information about achievement levels of students at key stages of learning;
- monitor educational standards over time on the following aspects:
  - ✓ students' achievement level across the grades,
  - ✓ growth between grade levels, and
  - ✓ differences between sub-populations.
- monitor learning outcomes over time and how they relate to improvements in educational inputs and initiatives which were implemented;
- guide educational policy developments and interventions to improve learning outcomes and address inequalities in learning outcomes such as those due to differences in socio-economic status;
- make decisions about resource allocations based on the impact of educational inputs on learning outcomes;
- provide an external review of students' achievements in relation to national standards;
- identify areas that need support in terms of curriculum revisions, 21st century teaching and learning strategies, and professional development of teachers; and
- create reliable data that can be used to identify trends in educational achievement and growth over a period of time.

1.5 The Need for a Robust Assessment Framework

An assessment framework is a public document that briefly outlines the assessment programme and explicitly states its characteristics and the principles upon which the assessment is built. The framework serves a number of purposes for individuals and organisations working on a national assessment. It will also inform the public on what an assessment is and how the outcomes are interpreted as stated below:

- ✓ **Consistency** : An assessment framework helps to achieve and maintain uniformity in an assessment.
- ✓ **Quality Assurance :** It guides the test developers in writing test items according to given specifications that help in targeting a test to the appropriate group by covering suitable content areas in the right proportions. It also guides the development of contextual questionnaires by defining the framework and identifying the areas of focus for answering relevant policy questions.
- ✓ **Reliability :** A reliable assessment ensures that repeated or equivalent assessments will produce consistent results. An assessment framework guides the team working on developing assessment tools in constructing reliable test items, test forms, and processes.
- ✓ **Validity:** Validity is one of the most important aspects of assessment to ensure that the assessment measures what it was designed to measure. Hence, an assessment framework helps in removing measurement biases as well as distortions from the assessment.
- ✓ **Transparency:** The details stated in the assessment framework provide a clear picture of the features and purposes of the testing programme to a wide audience.
- ✓ **Comparability:** An assessment framework also documents an assessment plan to ensure consistency from one assessment cycle to the next. As a result, any change in the programme in the future cycles can be compared, recorded, and evaluated.
- ✓ **Acceptability** : An assessment framework also plays a role in ensuring acceptance from a wide range of stakeholders to ensure that any information gathered by the assessment and the recommendations are actually considered.

A robust assessment framework assists in building a valid and reliable test instrument. It also serves as an effective planning tool for monitoring trends in education and comparing the results from different assessment cycles over time to identify areas that need deeper investigation.

The assessment framework is also the document where any changes and deviations from the specified plan are documented along with the reason for the change. The assessment framework thus, tracks any variations, changes, and recommendations

made in a particular testing cycle so that testing is consistent across cycles and students' performance can be tracked over time.

The key features of a national assessment framework include:

- A clear description of the aims and objectives of the assessment.
- A clear definition of what students should achieve at the end of an educational programme, such as, defining reading, writing, listening and speaking literacy, mathematical literacy or scientific literacy.
- A clear definition of the different skills, competencies and essential students attributes.
- The learning outcomes to be assessed.
- The subject domains, sub-domains, and its content proportions to be assessed.
- The types and proportion of skills or competencies to be assessed.
- The target population or grade to be assessed.
- The difficulty level of the items.
- A description of the test design including the item formats, the duration of the test, the number of booklets to be used, the number of items in each test booklet, and the number of link items to be used across grades and within a grade.
- The contextual factors that correlate with student achievement and the aim of the analysis.

1.6 Development Process of National Education Assessment Framework

Considering the need for a standardised NEAF, this document has been developed in consultation with teachers, principals, Dzongkhags and Thromde Education Officers, CSOs, NGOs,UNICEF, Save the Children, GNHC, parents, youth representatives and educational experts from REC, RUB and MoE with technical support from ACER India. The framework is built based on the existing education policies, guidelines, strategic documents, research studies, and curriculum. The NEAF comprehensively incorporates curricular and cross-curricular knowledge, understanding, and competencies that can be used as indicators of students' achievement levels, as formulated within the policy goals.

The development of the NEAF is also based upon the sound principles and best practices of large-scale assessments conducted by experienced global leaders such as the OECD, World Bank, and ACER. The development process began with a thorough review of the documents, curriculum, and textbooks from pre-primary to grade XII in the subject areas of English, Dzongkha, Mathematics, and Science. Findings from these studies were shared with a wider subject expert groups for selecting measurable LOs (learning outcomes). A series of orientation, familiarisation, and consultation workshops were conducted for the development of the NEAF

and technical standards. The initial draft of the NEAF was then shared and consultated with relevant stakeholders. The National Core Review Team and BCSEA Core Technical Team were constituted to review and finalise the NEAF.

The education policies of Bhutan explicitly state the need to prepare students for the 21st century and embrace changes that meet international standards. The aim is to incorporate 21st century competencies such as analysing, creating, evaluating information, critical thinking, problem solving, collaborating, communicating and inherent national values. In addition, the objective is also to prepare students to become nationally rooted and globally competent. These competencies are cross-curricular and beyond the textbooks in testing students' ability to apply knowledge and skills in unfamiliar complex situations. The NEAF explicitly states how the different components of learning outcomes will be comprehensively assessed to identify gaps in educational achievements.

1.7 Reporting and Dissemination of the National Education Assessment

The NEA findings serve a range of stakeholders, hence reporting of the assessment outcomes need to be customised to serve the requirements of diverse audiences. Generally, key stakeholders interested in reporting of the NEA include policymakers, curriculum developers, education officials, and Dzongkhag/Thromde education officers, school leaders, teachers, parents, students, general public, and mass media. Each of these stakeholders wants to see different levels of details, therefore, reporting can also be done at different levels. However, at present, it has been tentatively decided that the NEA will be reported at the national and Dzongkhag/Thromde levels.

All assessment tasks will be mapped to specific learning outcomes and competencies during the item development phase. During the data analysis phase, the tasks will further be arranged along a proficiency scale using Item Response Theory (IRT) indicating their level of difficulty and the level of skill required to answer each item. At the end of the assessment cycle 2020, the results will be reported quantifying the proportion of students at various levels of proficiency along with a description of the skills and knowledge associated with each level. Students' performance and information drawn from contextual questionnaires will be incorporated into reports and disseminated for use by a wide range of stakeholders.

During the implementation of the first cycle in 2020, only grade III students will be assessed, and reports will be generated accordingly. In subsequent cycles, grades VI and IX will also be assessed, thus successive reports will contain comparable information pertaining to performance across the grades participating in an assessment cycle as well as across the assessment cycles. Monitoring of each

cohort participating in assessment cycles across years shall be achieved using a set of techniques such as scale building, horizontal and vertical linking of test forms, etc. For example, the cohort of grade III students assessed in the first cycle will be again assessed when they reach grades VI and IX subsequently in assessment cycles two and three. This tracking of each cohort will enable reporting on the progression of student learning as a result of a new policy or intervention.

1.8 Key Considerations Regarding National Education Assessment Framework and its Reporting

1.8.1 Assessing cognitive skills

In NEA for Grade III, Reading Literacy and Mathematical Literacy shall be assessed. For Grades VI and IX, additional domains such as Writing Literacy and Scientific Literacy shall also be assessed. When necessary arrangements (time, human capacity, and other resources) are in place, Listening and Speaking Literacy, Computation & digital skills, Social Sciences and NEA for grade XII shall be assessed. The grades and cognitive domains to be assessed are given in Table 1.1.

Table 1.1 Grade wise cognitive domains included in the NEAF

Grade	Cognitive domains
III	Reading Literacy, Listening and Speaking Literacy, Mathematical Literacy
VI	Reading Literacy, Writing Literacy, Listening and Speaking Literacy, Mathematical Literacy, Scientific Literacy
IX	Reading Literacy, Writing Literacy, Listening and Speaking Literacy, Mathematical Literacy, Scientific Literacy

It is important to note that grade III has been excluded from the Writing Literacy domain as it was considered more appropriate to assess students at higher levels after they had had adequate time to develop the skills to be assessed in the domain. Further, writing literacy is usually assessed only at the higher grade levels in large-scale assessments. In the context of Bhutan, the educational system is moving towards abolishing examinations up to grade V.

While measurement of one skill cannot stand in for another, they can show a high degree of correlation. For instance, research studies suggest that reading skills and listening skills are highly correlated as are writing and speaking skills (Bozorgian, 2012; Liu & Costanzo, 2013). These two studies also suggest that reading and writing skills correlate with overall language proficiency.

These considerations recommend that the best course of action for an education system is to use large-scale assessments to assess Reading and Writing Literacy and

perhaps, use techniques like classroom assessments for the other skills. This practice is also consistent with global best practices in large-scale assessments. Large scale assessments, whether international (PISA, PIRLS, etc.) or national (MTEG) do not assess the Listening and Speaking domains.

1.8.2 Assessing 21st century competencies

The definition of competency varies slightly in different countries and languages. However, BCSEA defines competency as the essential skills, knowledge, attitudes and behaviours required for effective performance of a real-world task or activity (BCSEA, 2016, p.iv).

In the context of the NEA, it has been decided to include the assessment of 21st century competencies to prepare citizens to cope with the emerging global challenges in their daily lives through the understanding of actual student on learning and planning appropriate policy interventions for teachers, students, administrators, and parents.

The assessment needs to be aligned with specific and clearly defined goals of 21st century competencies that students are expected to meet. However, there is no internationally consensus on the definition of assessing 21st century competencies. Many countries define it as per their own context. Most often, the skills listed under the umbrella of 21st century skills include critical thinking, collaboration, communication, creativity, problem solving, analysis, and global citizenship. Thus, it is essential to assess these skills through tasks requiring students to apply their content knowledge in various situations. The core capability at the heart of 21st century competencies is being able to synthesise and apply content knowledge in new situations and be a life-long learner.

With this background, the Bhutan Education Blueprint 2014-24 elaborates 21st century competencies by anchoring students' aspirations in the four imperatives of learning and achievement, namely knowledge, competencies, values, and attitudes. The Blueprint further describes the nine Student Attributes that indicate the quality of learning in one or more of the imperatives. Hence, one of the objectives of the NEA is to assess 21st century competencies as identified in the nine Student Attributes. These attributes can be assessed through various cognitive and/or contextual instruments in the NEA. The instruments and domains covering each of the nine Student Attributes is given in Table 1.2 below:

Table 1.2 Coverage of the nine Student Attributes in the NEA

Student Attributes	Coverage in the NEA	Assessment domains covering the Student Attributes
Knowledge and understanding	Cognitive instruments	• Reading Literacy • Writing Literacy • Listening and Speaking Literacy • Mathematical Literacy • Scientific Literacy
Intellectual competence	Cognitive instruments	• Reading Literacy • Writing Literacy • Listening and Speaking Literacy • Mathematical Literacy • Scientific Literacy
Communicative competence	Cognitive instruments	• Reading Literacy • Writing Literacy • Listening and Speaking Literacy • Mathematical Literacy • Scientific Literacy
Enduring habits of lifelong learning	Cannot be explicitly covered in NEAF. Will be implicitly reflected in the texts selected for cognitive and contextual instruments	Implicitly covered through texts in • Reading Literacy • Writing Literacy • Listening and Speaking Literacy
Family, community and national values	Cognitive and Contextual instruments	• Scientific Literacy • Contextual questionnaire • Implicitly covered through texts in ✓ Reading Literacy ✓ Writing Literacy ✓ Listening and Speaking Literacy
Spirituality and character	Cannot be explicitly covered in NEAF. Will be implicitly reflected in the texts selected for cognitive and contextual instruments	Implicitly covered through texts in • Reading Literacy • Writing Literacy • Listening and Speaking Literacy
Physical wellbeing	Cannot be explicitly covered in NEAF. Will be implicitly reflected in the texts selected for cognitive and contextual instruments	Implicitly covered through texts in • Reading Literacy • Writing Literacy • Listening and Speaking Literacy • Scientific Literacy

Leadership competence	Will be partially covered in cognitive and contextual instruments	• Reading Literacy • Writing Literacy • Listening and Speaking Literacy • Scientific Literacy • Mathematical Literacy
World readiness	Will be partially covered in cognitive and contextual instruments	• Mathematical Literacy • Scientific Literacy

1.8.3 Children with Special Education Needs (SEN)

Successful inclusion is not only about accepting differences but also about including everyone in the provision of access to quality education. Thus, an inclusive NEA will ensure that children from diverse backgrounds are not only included but are given equitable opportunities to participate in the assessment by providing appropriate support and interventions without any bias built into the tools and processes. To this effect, the NEAF aims not only at the equal opportunity of inclusive of every child, but also ensures that the assessment is fair to everyone. This approach of universal inclusion will be met through various means such as making appropriate accommodations and adaptations in the tools, allocation of extra time, provision of suitable seating, presentation and response format, administration and assessment. In addition, the right sampling technique would provide a valid chance to every child to participate in the assessment. Details of the accomodations and adaptations for children with special needs is mentioned in Chapter 8.

CHAPTER 2: ENGLISH READING LITERACY

2.1 Introduction

This chapter sets the framework for the assessment of Reading Literacy in English for grades III, VI and IX. The importance of Reading Literacy is discussed first, followed by incorporation of 21st century competencies in the Reading Literacy assessment, definition of Reading Literacy, organisation of the domain, and how it will be assessed. The learning outcomes to be assessed for establishing a link to the curriculum are also specified in this chapter.

The fundamental importance of reading to the human condition is clearly stated in the English Curriculum Framework PP-XII, REC (2013, p.1).

Reading is the key to unlocking the vault of the wisdom of the race. To read well is to be in contact with those who have gone before us, who have discovered what it is to be human and the best ways to organise themselves to achieve happiness.

Numerous research studies have emphasised the importance of Reading Literacy as a foundational skill in building fundamental skills of the 21st century. Holloway (1999) suggests that reading skills are essential to the academic achievement of middle and high school students. Further, it is considered an essential skill for successful participation and integration into the society (Cunningham & Stanovich, 1998; Smith et al, 2000).

In the 21st century, the ability to access different sources of information and collate them has become increasingly important (OECD, 2019). The access to information is limited only by the ability – or lack of it – to read, making it a fundamental skill that can significantly impact a student's quality of learning. The ability of individuals to read has an impact not just on the individuals but also on the prosperity of a nation as a whole. Canadian economists have found that the average literacy level of a nation's population is a better predictor of its economic growth than educational achievement over a long period of time (Coulombe et al, 2004).

The Silken Knot, 2002 - Standards for English for Schools in Bhutan and the national curriculum also underscores the importance of reading as a foundational skill in the 21st century. Thus, it is important to undertake an assessment of Reading Literacy to understand the strengths and identify the areas of improvement in the current school system.

2.2 Defining Reading Literacy

One of the objectives of the NEA is to go beyond curriculum and evaluate students' ability to utilise their knowledge and skills to become contributing citizens and to successfully integrate and participate in the society. Therefore, this assessment takes the 'literacy' approach following international best practices in assessments such as the Programme for International Student Assessment (PISA). The 'literacy' concept goes beyond knowledge, understanding, and skills inherent in each learning domain; it encompasses the ability to acquire and apply such knowledge and skills.

The definition of Reading Literacy in the NEA is as follows:

Reading Literacy is the ability of an individual to make meaning from written texts at various levels through an interactive process to fulfil personal and social needs and be a contributing member of the society.

Reading literacy…

The term 'Reading Literacy' is preferred to 'reading' to convey the breadth of coverage. Reading Literacy goes beyond the mere decoding of words. It includes skills such as locating, interpreting, drawing inferences and reflecting on the form and content of various texts. The term is also intended to indicate that reading is done in a context and for a purpose.

…is the ability of an individual to make meaning from written texts…

Reading Literacy is the ability that students demonstrate by deriving meaning from the materials they read. The term 'written text' is included to indicate that spoken texts are excluded. Written texts could be in various formats – handwritten, printed, or digital – and could be continuous or non-continuous.

… at various levels…

Gray (1960) defines reading as having three levels – reading the lines, reading between the lines, and reading beyond the lines. Reading Literacy comprises skills at all these levels. It begins with the ability to decode and goes on to comprehension and the higher levels of cognitive abilities.

… through an interactive process…

This phrase emphasises that reading is not a unidirectional process where a reader directly absorbs the written word. Instead, the reader brings a whole gamut of previously acquired skills and knowledge to the table that influence how texts are interpreted, comprehended, and inferred. These include the reader's prior knowledge, experiences, and beliefs.

…to fulfil personal and social needs…

The manner in which a text is read is often influenced by the context and the purpose. No text is read in isolation. Therefore, to assess Reading Literacy in a realistic manner, texts chosen must depict a rich variety of contexts and purposes to reflect the authenticity of reading in real-life scenarios. '…personal and social needs…' reflects the various needs of a reader and must be understood from an individual's perspective. For instance, personal needs could include reading a story or a poem for pleasure. Social needs could be fulfilled by reading blogs, newspapers, magazines, etc. to be better informed and by reading e-mails, chats, social media posts, etc. to communicate.

…and be a contributing member of the society.

It is important to understand the significance of Reading Literacy not just from the perspective of the individual but also from the perspective of society at large. This phrase is intended to convey that Reading Literacy is essential for a citizen to be able to meaningfully engage with and participate in society and contribute to its progress.

2.3 Organisation of the Domain

The Reading Literacy domain will be described in terms of context, text variables, and item variables. Context refers to the theme or setting of the texts. Text variables refer to parameters such as text type, text format, appropriate length, and complexity. Item variables comprise the cognitive competencies being assessed and item formats used to frame the items. Items presented in the Reading Literacy domain will generally be presented as units that include a reading text and items that assess comprehension of the text.

2.3.1 Contexts

This domain encompasses various purposes and contexts in which reading takes place. Therefore, to ensure a broad coverage of contexts, the texts included in the assessment will be categorised as personal, local, and global. Appropriate representation of each category will be ensured. Definitions of different contexts are provided below.

Personal contexts are those that have individual focus. Reading tasks fitting a personal context include those that are primarily for self-enjoyment or development, such as reading a text for information or pleasure, e.g. reading a story.

Local contexts have an interactive focus requiring engagement with other individuals or with elements of the community, including the nation. This type of context involves day-to-day situations and activities at home, school, local community, and the country where the focus of thought and action lies in connections and interactions with people or objects with which learners are familiar. Reading texts reflecting a local context include a letter from a friend, a school timetable, or a description of one's hometown or the country.

Global contexts have an external focus on broader situations that may affect whole communities or countries or have an even wider global relevance. Texts fitting this context type include those dealing with broad social issues such as public policy, transport systems, and advertisements. Reading texts that reflect a global context include a newspaper report, articles in a magazine, or a historical description. Table 2.1 shows the grade-wise distribution of context.

Table 2.3 Desired distribution of items, by contexts in Reading Literacy assessment

Contexts	Grade III	Grade VI	Grade IX
Personal	50-60%	40-50%	15-25%
Local	30-40%	35-45%	30-40%
Global	5-15%	10-20%	40-50%

The range has been calculated based on the design and context of the English curriculum.

2.3.2 Text variables

Text variables refer to parameters such as text type, text format, appropriate length, and complexity. Whatever the text variable, the following criteria shall be used while selecting the text:

- Appropriate in content and relevant to the students' age at the target grade level.
- Cater to the entire range of student abilities at grades III, VI and IX.
- Self-contained (for example, an extract from a longer magazine article should require no prior knowledge from the reader about the topic or the article).
- Contain materials that students are not likely to have encountered; (The materials it should not come from a textbook or other frequently-used teaching resource).
- Factually accurate.
- Grammatically correct.
- Appropriately illustrated.
- Appropriate in terms of socio-cultural context.
- Gender-sensitive.
- Fair, that is, equally accessible for students from all backgrounds likely to take part in the assessment.
- Inclusive in the usage of texts and graphics to support and extend meaning.

2.3.2.1 Text types

Text type refers to genre and broad purpose of a text. It is important to ensure a wide representation of text types in the assessment as different types of text have different inherent features. It is essential that an assessment of Reading Literacy comprises as wide a range of texts as possible. The types of text to be included in the NEA are described below.

Imaginative texts represent feelings, ideas, and mental pictures using words or visual images. Such texts present and develop characters, events and themes, and deal with questions relating to *when*, or in *what* sequence. The primary goal is to entertain the readers. Examples of imaginative texts are short stories, plays, comic strips, etc.

Descriptive texts present information about people, objects, and abstract concepts or constructs. These kinds of texts address *what* questions and some *how* questions. Description includes forms of writing sometimes referred to as exposition. Examples of descriptive texts include describing a person, place, plant, problem, feeling or a phenomenon, or, at the level of precursor skills, a label for an image.

Persuasive texts deal with opinions and points of view and are used to persuade the reader. They address some of the *which* and *why* questions. Examples of persuasive texts are, a letter to an editor, a book review, an advertisement, a job application, or a discussion of the advantages or disadvantages of a certain public policy.

Instructional texts explain what to do in order to complete a specified task, and thus address some of the *how* and *when* questions. Examples of instructional texts are giving directions for finding a location, listing materials and steps required to make an object, and explaining what to do in an emergency.

Transactional texts aim to achieve a specific purpose involving an exchange of information between two or more parties, such as arranging for something to be done. Transactions are represented by reading tasks such as a message from a friend, or correspondence related to the delivery of goods.

In addition to these text types, the NEA in Bhutan will include items for grade III that involve assessing comprehension of single words, phrases, or sentences. These will be categorised as **Labelling.**

The intended proportion of text types at different grade levels is provided in Table 2.2.

Table 2.4 Deasired distribution of items, by text types in Reading Literacy assessment

Type of texts	Grade III	Grade VI	Grade IX
Imaginative	25-35%	20-30%	10-20%

Descriptive	20-30%	30-40%	20-30%
Persuasive	5-15%	10-20%	25-35%
Instructional	10-20%	10-20%	10-20%
Transactional	5-15%	5-15%	10-20%
Labelling	5-15%	0%	0%

The range has been calculated based on the design and content of the English curriculum.

The proportions reflect the importance of different types of texts at different grade levels, and also the likelihood of encountering or using such texts at different age levels. For instance, as students graduate to higher grades, they are more likely to encounter persuasive texts than other types of texts. Students in grade III, however, are much more likely to encounter stories and other imaginative texts.

2.3.2.2 Text formats and length

Texts can be of different formats – continuous, non-continuous, and mixed. **Continuous texts** contain complete sentences and have a traditional paragraph structure. **Non-continuous texts** contain phrases or incomplete sentences, for instance, in the form of bullet points. Materials in the non-continuous text could be organised in text boxes, graphs, diagrams, or tables. **Mixed texts** contain both continuous and non-continuous formats within a single text. Examples include a page from a newspaper that comprises prose text and graphs, or several texts on a single theme but in one format, such as several opinion pieces by different authors related to a single issue.

It is important to ensure that the range of complexity of texts increases as the grade level increases. Among the various measures of complexity of a text, length is a measure that can be quantified. Therefore, the length of the text used in each grade has been considered as provided in Table 2.3.

Table 2.5 Approximate length of texts in Reading Literacy assessment

Grades	Text Length (all text types)
Grade III	1-100 words
Grade VI	100-250 words
Grade IX	200-350 words

The approximate text length is based on the time, design, and context of the English Curriculum Framework. The age and cognitive development of students have also

been taken into consideration. A further concern is to ensure that the texts are of sufficient length and complexity to allow questions to be asked that assess the full range of reading comprehension sub-skills.

2.3.3 Item variables

Item variables are described in terms of the levels of cognitive processes involved in order to respond to the items.

2.3.3.1 Cognitive processes

The Reading Literacy assessment includes four cognitive processes as defined below.

Codes	Processes	Descriptions
R1	Locate information	Students need to locate and extract a specific piece of information explicitly stated in the text. Sometimes the information to be located is found in a single sentence and sometimes it must be gleaned from several paragraphs. This kind of reading has been called 'reading the lines' (Gray, 1960) because no inference or only minimal inference is required to complete this kind of task.
R2	Grasp ideas and interpret information	Students need to demonstrate that they have understood an idea being conveyed in the text and interpret it correctly. For example, students may need to identify the text's main idea and/or the sequence of events and/or relationships between ideas, events, or characters across the text. In addition, students may need to draw simple conclusions based on their interpretation of the text.
R3	Infer information	Students need to demonstrate an understanding beyond the information and/or ideas stated explicitly in the text, hence, they are asked to read between the lines. For example, students may be asked to identify the text's underlying theme, evaluate its title by examining the text from more than one perspective, and make inferences about the qualities or actions of characters.
R4	Reflect on and evaluate texts	In items testing this process, students are asked to relate and evaluate the information given in the text with what they already know and make judgements. As this skill goes beyond the text itself, it has been called 'reading beyond the lines' (Gray, 1960). The broad range of tasks categorised under this process include focusing on the intended audience of a text or the attitude of the writer, making an evaluation of an argument or a judgement about a character, explaining the effect of a text feature such as its layout, and comparing behaviour of a character in a story with that of acquaintances.

The intended proportion of items for each cognitive process at different grade levels is provided in Table 2.4.

Table 2.6 Desired distribution of items, by cognitive processes in Reading Literacy assessment

Processes	Grade III	Grade VI	Grade IX
Locate information	35-45%	20-30%	10-20%
Grasp and interpret	25-35%	30-40%	20-30%
Infer information	15-25%	20-30%	30-40%
Reflect and evaluate	5-15%	10-20%	20-30%

The range has been calculated based on the design and context of the English curriculum.

The distribution of items of various categories across different grade levels shows an increase in the number of items requiring higher-order cognitive processes as the grade level increases. This reflects the idea that as students begin to read, they spend more time decoding and thus, needs to develop their reading skills more to be able to display higher-order cognitive processes.

2.4 Assessing the domain

Each Multiple Choice Question (MCQ) item will, in general, be considered a score point. The Constructed Response Tasks (CRT) items such as those with partial credit may, however, generate multiple score points. A sufficient number of items will be developed to ensure that a proficiency scale can be generated.

The next section defines item formats, provides details of item difficulty, and specifies the selected learning outcomes.

2.4.1 Item formats

The assessment will include both MCQs and questions requiring short written responses (CRTs). The intended proportion of these will be the same across grade levels, as provided in Table 2.5.

Table 2.7 Desired distribution of item format across all grade levels in Reading Literacy assessment

Item Format	Proportion
MCQ	80-85%
CRT	15-20%

2.4.2 Item difficulty

It is important for an assessment of this nature to include items covering a broad range of difficulty levels to ensure that sufficient information can be gathered about students at all ability levels. Therefore, at the time of item development, the team shall develop items spread across different levels of difficulty. Item review and pilot data will be

used to ensure that a sufficient number of items from an appropriate spread of difficulty levels are included in the assessment.

2.5 Assessing 21st Century Competencies and Values

One of the objectives of NEA in Bhutan is to assess the prevalence of 21st century competencies among Bhutanese students. The nine Student Attributes defined in the Blueprint are used to specify these competencies on the basis of the four learning and achievement imperatives – knowledge, skills, values and attitudes. Typically, assessment instruments dedicated to the cognitive domain are not the best instruments to measure values and attitudes. Therefore, for the Reading Literacy domain, we will focus on measuring knowledge and competencies related to the following three attributes using cognitive instruments:

- Knowledge and understanding
- Intellectual competence
- Communicative competence

Other attributes will be addressed by developing and selecting texts that reflect the values mentioned in the nine Student Attributes.

Table 2.8 Student Attributes to be measured in Reading Literacy assessment

Student Attributes
Knowledge and understanding – The ability to acquire the basic concepts of literacy in order to fulfil students' potential and adapt intelligently to challenges and contribute to society. A literate citizen demonstrates the following knowledge and understanding competencies: • reads with deep understanding of texts in order to gain information about personal, local, and global issues and also to appreciate various literary traditions; • extracts relevant information from texts to draw appropriate conclusions; • interprets and applies information read in texts to solve problems and issues at the personal, local, and global levels; and • makes connections and transfers learning from one situation to another.
Intellectual competence – The ability to apply critical thinking, problem-solving, and innovative skills to generate new possibilities, and to create new ideas or knowledge. A literate citizen demonstrates the following competencies: • uses information read to create new knowledge; • evaluates facts and opinions critically to understand issues; • identifies and analyses information critically, in order to solve real-life and complex problems; • evaluates arguments from various sources critically and draws appropriate conclusions; and • reflects on texts to draw inferences and form appropriate judgements.

Communicative competence – The ability to express opinions and understand complex issues through mastery of English language. A literate citizen demonstrates the following communicative competencies:

- summarises concepts and information read;
- evaluates information and opinions read through appropriate social and cultural lenses;
- correctly applies verbal and written instructions, procedures and other information; and
- analyses, clarifies and interprets complex information and issues effectively.

2.5 Measurable learning outcomes

Due to the requirements of a technically robust large-scale assessment, it is not possible to measure all the learning outcomes defined in the curriculum. Therefore, the learning outcomes have been reviewed and measurable ones have been selected. In order to ensure that the assessment provides an opportunity for all students to demonstrate their ability, appropriate learning outcomes from two grade levels below and two grade levels above each of the identified grades (III, VI and IX) have been reviewed and included, e.g., the learning outcomes for grade VI assessment include learning outcomes from grade IV to VIII. Table 2.7 shows the learning outcomes for Reading Literacy.

Table 2.9 Measurable Learning Outcomes for Reading Literacy assessment

Grade III	
GI R1	Use meaning, structure and visual cues to read new text
GI R2	Expand their bank of known words to read simple texts
GI R3	Recognize new words using meaning, structure and visual cues
GII R4	Identify simple rhyming words, end rhymes and internal rhymes in poetry
GI R5	Read stories, poems, nursery rhymes and songs that introduce students to people, objects and events beyond their immediate environment
GII R6	Locate and report information from the text
GIII R 7	Identify the main idea of a short text
GIV R 8	Read stories and poems about subjects outside their personal experience
GIV R9	Read non-fiction texts descriptions of the natural world and explanations of natural phenomena – for knowledge and information

GV R10	Read fiction and non-fiction texts for explicit and implicit meanings, particularly texts dealing with themes of friendship, cooperation, loyalty, and courage among others
GV R11	Employ textual features such as subtitles, diagrams, charts and graphs to help them make meaning with non-fiction texts
Grade VI	
GIVR1	Read stories and poems about subjects outside their personal experience
GIV R2	Read non-fiction texts – descriptions of the natural world and explanations of natural phenomena – for knowledge and information
GVR3	Read fiction and non-fiction texts for explicit and implicit meanings, particularly texts dealing with themes of friendship, cooperation, loyalty, and courage among others
GV R4	Employ textual features such as subtitles, diagrams, charts and graphs to help them make meaning with non-fiction texts
GVI R5	Read various kinds of formal writing – business letters, applications, and invitations – and know their different purposes
GVI R6	Recognize the difference between fact and opinion in newspapers
GVI R7	Distinguish points of view (first-person narrator, third-person narrator)
GVI R8	Identify figurative language in texts – simile, metaphor, personification and onomatopoeia
GVI R9	Identify the elements of short stories – setting, characters, plot and theme
GVII R10	Recognise denotative and connotative meanings of words in texts
GVII R11	Recognise the music in poetry achieved by rhyme and rhythm, alliteration, and assonance
GVIII R12	Recognize the emotive effect of words in the texts they read
Grade IX	
GVIII R1	Identify the features of a variety of texts and use them to support their reading
GVII R2	Recognize the denotative and connotative effects of words in the texts they read
GVIII R3	Recognize the emotive effect of words in the texts they read
GIX R4	Utilise the features of literary texts to help them understand the ideas they encounter in the texts they are reading
GIX R5	Evaluate the point of view of the writer on issues like right and wrong, justice and injustice, in literature
GXI R6	Analyse how authors achieve their effects using linguistic, structural and presentational devices – points of view, figurative language, flashback, parallel argument, symbols and image patterns - and use this information to help make meaning with the text

CHAPTER 3: ENGLISH WRITING LITERACY

3.1 Introduction

This chapter sets the framework for the assessment of Writing Literacy in English for grades VI and IX. Grade III has been excluded from the Writing Literacy domain. It was deemed more appropriate to assess Writing Literacy of students at higher grades as younger students require more time to develop the skills assessed in this domain. Typically, Writing Literacy is assessed only at higher grades in large scale assessments. In the context of Bhutan, the educational system is moving towards abolishing written exams up to grade V.

Initially, Writing Literacy will be assessed only in grade VI. Depending upon the relevance and reliability of the data gathered, assessment may be extended to grade IX in subsequent cycles. This framework, however, describes the Writing Literacy domain for both grades VI and IX. The Language strand (grammar) will also be assessed in this domain.

This chapter first discusses the importance of Writing Literacy. It then moves on to describe the definition of Writing Literacy, the organisation of the domain, and how it is to be assessed, as well as how 21st century competencies will be assessed in the Writing Literacy assessment. The learning outcomes to be assessed are then specified to establish a link to the curriculum.

The English Curriculum Framework PP-XII, REC (2013, p.10), describes the importance of writing thus:

> **Writing is more than creating a record of discovery and accomplishment. It is also a way of thinking and learning. It is a process with which thoughts are refined and the language in which they are written made more precise. The writing process allows the writers to explore ideas and keep track of the explorations on paper.**

The curriculum framework goes on to describe the various purposes for which writing is used throughout life. Writing can be used for personal purposes such as communicating one's thoughts in a journal, diary, etc. and for transactional purposes such as, conducting business, which entail a more formal kind of writing and finally, writing for creative purposes such as writing poems and stories.

Like reading, writing is also considered a foundational skill in the 21st century as it is considered crucial for future learning and for an individual's full participation in economic, political, and social life as an adult.

3.2 Defining Writing Literacy

The objective of this assessment is to go beyond the curriculum to evaluate students' ability to utilise their knowledge and skills to become contributing citizens and to

successfully integrate and participate in the society. Therefore, this assessment takes the 'literacy' approach following international best practices in assessments such as PISA. The 'literacy' concept goes beyond the knowledge, understandings, and skills inherent in each learning domain. It encompasses the ability to acquire and apply such knowledge and skills.

The definition of Writing Literacy in the NEA is as follows:

> ***Writing Literacy is the ability of an individual to construct meaning by generating texts to fulfil personal and social needs and be a contributing member of the society.***

Writing Literacy…

The term 'Writing Literacy' is preferred to 'Writing' to convey the breadth of coverage. Writing Literacy goes beyond the mere forming of words. While it includes the ability to write words, it also includes skills such as generating and organising ideas, applying vocabulary, using linguistic structures, textual features, etc. The term is also intended to indicate that writing is done in a context and for a purpose.

… is the ability of an individual to construct meaning by generating texts…

Writing Literacy is an ability that students demonstrate by creating and developing meaning through words to convey ideas and information to an intended audience. The words 'construct' and 'generating' are used to emphasise that the ideas come from the writer.

… to fulfil personal and social needs…

Texts are created for specific purposes in particular contexts. No text is written in isolation. Therefore, Writing Literacy must comprise various contexts and purposes to reflect the authenticity of writing in real-life scenarios. This phrase must, however, be read from the perspective of the individual and understood in that context. For instance, writing for personal needs could include writing stories and writing for social needs could include writing editorials, letters, etc.

… be a contributing member of the society.

It is important to understand the significance of Writing Literacy not just from the perspective of the individual but also from the perspective of society at large. This phrase is intended to convey that Writing Literacy is essential for a citizen to be able to meaningfully engage with society and contribute to its progress.

3.3 Organisation of the Writing Literacy Domain

The NEA Writing Literacy domain comprises tasks requiring students to construct their responses. It is described in terms of contexts, text types, and writing sub-skills.

3.3.1 Contexts

Writing Literacy encompasses various purposes and contexts in which writing takes place. As the contexts in which texts are created are likely to be the same as those in which they are read, the same contexts that have been defined for the Reading Literacy domain will be appropriate for this domain. Appropriate representation of each category will be ensured. Descriptions of the different contexts for Writing Literacy domain are provided below.

Personal contexts have an individual focus. The primary audience for such texts is the author himself/herself and include topics such as personal health, personal transport, or travel. Writing tasks fitting a personal context include those that are primarily for personal expression, enjoyment, or reflection, such as writing a story or a diary.

Local contexts have an interactive focus requiring engagement with other individuals or with elements of the community, including the nation. This type of context involves day-to-day situations and activities at home, school, local community, and the country where the focus of thought and action lies in connections and interactions with people or objects with which the learners are familiar. Writing texts reflecting a local context include a letter from a friend, a school timetable, or a description of one's hometown or the country.

Global contexts have an external focus on broader situations that may affect whole communities or countries or have an even wider, global relevance. Tasks fitting this context type include those dealing with broad social issues such as public policy, transport systems, environment, or advertisements. Writing texts that reflect a wider-world context include formal letters or essays on global issues such as the environment.

3.3.2 Text types

In this assessment, students will be asked to respond to a single cluster of tasks. Each cluster will consist of two or three tasks. Each task will, in turn, require students to develop a type of text from the five types listed below, all of which are included in the English curriculum. The number of tasks in a cluster will depend on the time taken for each task and the difficulty level of each task. All the clusters will have a similar level of difficulty and will be alloted the same amount of time. The difficulty level of tasks and the time to be alloted will be decided based upon data from the piloting.

Imaginative texts present and develop characters, events and themes, and deal with questions relating to *when*, or in *what* sequence. Examples of imaginative writing are short stories, plays, comic strips, etc.

Since the ability to write poems requires additional skills, students will not be asked to write poems in this assessment.

Descriptive texts present information about concrete objects like people, places, or items or abstract concepts or constructs these kinds of texts present details on *what* and *how* questions. Description includes forms of writing sometimes referred to as an 'exposition'. Examples of descriptive texts include describing a person, place, plant, problem, feeling, a phenomenon, or a label for an image.

Persuasive texts deal with opinions and points of view and are used to persuade the reader. They address some of the *which* and *why* questions. Examples of persuasive texts are a letter to an editor, a book review, an advertisement, a job application, and a discussion of the benefits or disadvantages of a certain public policy.

Instructional texts explain what to do in order to complete a specified task, and thus address some of the *how* and *when* questions. Examples of instructional texts are giving directions to find a location, listing materials and steps required to make an object, and explaining what to do in an emergency.

Transactional texts aim to achieve a specific purpose involving an exchange of information between two or more parties, such as arranging for something to be done. Transaction is represented by writing tasks such as a message to a friend or correspondence related to the delivery of goods.

3.3.3 Writing sub-skills

The Writing Literacy comprises the sub-skills as defined below which will be used as criteria for assessment.

Codes	Sub-skills	Descriptions
W1	Generate ideas	Writing tasks typically require creation, selection, and crafting of ideas. The quantity and quality of ideas and their appropriateness for the task are constituents of this skill. The nature of ideas will vary from one text type to another. For example, in story writing (narrative), strong characterisation and storyline are important. In persuasive writing, the logic, relevance, and persuasiveness of argument are important, as it is the ability to maintain critical distance. In descriptive writing, completeness of the description, salience of details included, and precision and richness of the picture created for the reader are all important.
W2	Control text structure and organisation	Different text types have different structures. Effective writers have knowledge of the structural features of texts and select a suitable organisational form for the writing task. For example, if writing a recipe, the writer will start with a set of ingredients, and then describe or list a sequence of steps. If writing a narrative, conventionally the writer will start with an orientation, follow this with a complication, and end with a resolution. They will also know what to include in each of these sections. For example, the orientation will introduce main characters and establish the setting.
W3	Manage coherence	Good writers can structure texts in such a way that the links between ideas are clear to the reader. Coherence is achieved through a logical progression of ideas that express meaning consistent with the reader's general world knowledge, as well as through syntactic features such as reference, and lexical features such as discourse markers and connectives. Good writers make use of paragraphing to group ideas around a central topic or use other graphical means such as headings to indicate the relationship between ideas.
W4	Vocabulary and spelling	Writing involves not just knowledge of words but also an understanding of how they can be used in specific contexts. Good writers can draw on a wide range of vocabulary to present ideas precisely and concisely. They choose words that are appropriate for the purpose, audience, and context. A wide range of vocabulary allows writers to present arguments effectively, and to give life to images in descriptive or narrative writing.

W5	Control syntax and grammar	Writers need to understand implicitly how the rules of grammar govern the way words are put together to form phrases, clauses and sentences. Good writers produce grammatically correct meaningful sentences and make use of a range of syntactic structures. They link ideas with a variety of cohesive devices and use sentence structures appropriate to the writing task.
W6	Handwriting	Handwriting has been considered as it contributes to reading fluency and presentation.

Each process will be assessed using various criteria that will depend upon the task and the text type. The criteria will be operationalised using rating scales which may be dichotomous (0, 1) or may have multiple categories. Each category in each criterion is a score point and can be considered an 'item'.

Table 3.1 illustrates the desired proportion of score points belonging to each process across the whole set of tasks. In order to achieve these proportions, every task may not be assessed on all the criteria but only on the most relevant ones.

Table 3.10 Desired distribution of items, by sub-skills in Writing Literacy assessment

Sub-skills	Grade VI	Grade IX
Generating ideas	15-25%	15-25%
Controlling text structure and organisation	10-20%	10-20%
Managing coherence	15-25%	15-25%
Vocabulary and spelling	10-20%	10-20%
Controlling syntax and grammar	25-30%	25-30%
Handwriting	0-5%	0-5%

Controlling syntax and grammar has been given the maximum weighting as the learning outcomes from the Language (grammar) strand will be included under this process. Handwriting has been given the least weighting as students would have developed adequate handwriting skills at these grades.

3.4 Assessing the Domain

3.4.1 Item format

The domain will be assessed through CRTs which will either be open or closed type. Each task will have a rubric attached to it. The rubrics will be used to assess various sub-skills defined above. Every sub-skill may not be assessed in every task as it may not be appropriate to do so.

The sub-skills will be reflected as criteria in the rubric. Under each criterion, various levels or categories are described. These are the score points and will act as the items for the domain. The number of categories in each criterion will vary. Some may

be dichotomous (0 or 1), for instance, handwriting will only be scored as legible or illegible. Other criteria may have up to five or six categories. The number of categories for a criterion depends on the number of defined and distinguishable categories into which student responses can be divided.

Each writing task may not be judged on the same criteria. Various tasks will be judged on several parameters but not necessarily all the criteria. For example, a creative writing task may be judged on the quality of ideas generated, vocabulary used, cohesiveness, and structure. Another descriptive task may include generating ideas, handwriting, spelling, grammar, and cohesiveness as criteria to judge student writing. The specific criteria to be included for a particular writing task will be discussed and decided at the time of item development.

At this stage, all criteria are applicable to both grade levels and, therefore, will act as link items to generate a single proficiency scale for both grades.

3.4.2 Item difficulty

It is important for an assessment of this nature to include a broad range of writing tasks which will give students at various ability levels the opportunity to attempt a task and express themselves. Item review and pilot data will be used to ensure that a sufficient number of items from an appropriate range of difficulty levels are included in the assessment.

3.5 Assessing 21st Century Competencies and Values

One of the objectives of NEA in Bhutan is to assess the prevalence of 21st century competencies among Bhutanese students. The nine Studcent Attributes defined in the Blueprint are used to specify 21st century competencies on the basis of the four learning and achievement imperatives – knowledge, skills, values and attitudes. Typically, assessment instruments focussed on the cognitive domain are not the best instruments to measure values and attitudes (MoE, 2014). Similarly, the limitations of pen and paper tests such as the NEA cannot measure all aspects of values and attitude. Therefore, knowledge and competencies will be assessed as part of the domain. All tasks will reflect the values that are important in the Bhutanese socio-cultural context and the attitudes will be addressed through the contextual questionnaires. Table 3.2 shows the attributes which can be assessed in writing literacy.

Table 3.11 Attributes to be measured in Writing Literacy assessment

Student Attribute
Knowledge and understanding – The ability to acquire the basic concepts of literacy in order to fulfil students' potential and adapt intelligently to challenges and contribute to society. A literate citizen demonstrates the following knowledge and understanding competencies while writing: • a deep understanding of personal, local and global issues; • ability to use different literary forms and techniques appropriately; • conveys ideas in an articulate manner taking into account the audience; and • discusses complex issues with deep understanding at the personal, local, and global levels.
Intellectual competence – The ability to apply critical thinking, problem-solving, and innovative skills to generate new possibilities, and to create new ideas or knowledge. A literate citizen demonstrates the following competencies while writing: • applies prior knowledge and information in an innovative manner to create new knowledge; • uses reasoning skills to provide solutions to complex real-life problems; • links relevant information from various sources in an appropriate manner to create new knowledge and innovative solutions; • develops arguments using relevant information and with deep understanding of the issues; • evaluates ideas critically to draw relevant conclusions; and • generates imaginative texts using various literary techniques and in different literary forms.
Communicative competence – The ability to express opinions and understand complex issues through mastery of English language. A literate citizen demonstrates the following communicative competencies while writing: • reformulates concepts and information in a manner appropriate to the audience; • expresses opinions with appropriate elaboration; • discusses issues and solutions in order to contribute to inter-personal, local, or global discourses; • analyses, clarifies, and interprets complex information and issues effectively and responds appropriately; and • exhibits the skills appropriate influence readers.

3.6 Measurable Learning Outcomes

Realistically, it is not possible to measure all the learning outcomes prescribed in the curriculum in a single assessment. Therefore, these outcomes have been reviewed and only measurable ones have been selected. In order to ensure that the assessment provides an opportunity for all students to demonstrate their ability, appropriate learning outcomes from two grades below and two grades above the targeted grades have been reviewed and included, e.g., learning outcomes for grade VI assessment include learning outcomes from grade IV to VIII. Learning outcomes assessed in NEA are given in Table 3.3.

Table 3.12 Measurable Learning Outcomes for English Writing assessment

Grade VI	
GIV W1	Write detailed compositions based on picture sequences
GV W2	Spell correctly the words they are using
GV W3	Use punctuation – capital letters, full stops, question marks, commas, exclamation marks and quotation marks (inverted commas) correctly
GV W4	Develop ideas more effectively in longer paragraphs in which they use both simple and compound sentences
GV W5	Write using a wider variety of forms encountered in their reading including formal letters, applications, invitations and adventure stories
GVI W6	Use punctuation marks, including the use of the apostrophe for omission (contractions) and possession
GVI W7	Enhance the effectiveness of their writing with the use of figurative language – simile, metaphor, personification and onomatopoeia
GVII W8	Write coherent paragraphs using simple compound-complex sentences
GVII W 9	Take notes to prepare reports and summaries, and complete information transfer
GVII W10	Write for a range of purposes and audiences using a variety of forms encountered in their reading including, explanations, summaries, invitations, realistic fictions, resume, reports, narrative essays and fantasy
GVIII W11	Use punctuation and paragraphing to organise ideas
GVIII W12	Write compositions using a range of sentence structures to achieve different effects
Grade IX	
GVII W1	Spell correctly the words they are using
GVII W2	Write for a range of purposes and audiences using a variety of forms encountered in their reading including explanations, summaries, invitations, realistic fictions, resume, reports, narrative essays and fantasy
GVII W3	Write coherent paragraphs using simple, compound and complex sentences

GVIII W4	Use punctuation and paragraphing to organise ideas
GVIII W5	Write compositions using a range of sentence structures to achieve different effects
GVIII W6	Use figurative language effectively
GIX W7	Write for a variety of purposes and audiences using a wider variety of forms encountered in their reading to include memoir, narrative and descriptive essays
GIX W8	Use rhetorical devices, including irony and antithesis in their writing
GIX W9	Maintain purpose and sense of audience in a piece of writing
GIX W10	Use discourse markers like "however", "therefore", "in so far as" to achieve cohesion in their writing
GIXW11	Select and use diction appropriate to the writing task
GX W12	Write for a variety of purposes and audiences using a wider variety of forms encountered in their reading to include expository essays, letters of application and resumes
GX W13	Write reports on assigned and self-selected topics
GXI W14	Write a short story in which they show control of the elements of the short story form
GXI W15	Write a persuasive essay in which they show understanding and control of the elements of the different essay forms
GXI W16	Demonstrate that they can make fine distinctions in grammar and diction to achieve precision in their writing
GXI W 17	Recognise and apply in their writing, the features of short stories and argumentative essays

Similarly, Table 3.4 shows the list of LOs selected from the Language strand.

Table 3.13 Measurable Learning Outcomes in the Language Strand

Grade VI	
GIV G1	Use direct and indirect speech. Identify some parts of speech (noun, verb, adjective, preposition) and the definite and indefinite article in the texts they are reading and writing
GIVG2	Use simple word order: subject – verb – object in simple sentences
GIVG3	Use subject-verb agreement correctly
GIVG4	Use punctuation marks (full stop, question mark, exclamation mark, comma) in their writing
GIVG5	Use capital letters for the beginning of sentences and for proper nouns
GIVG6	Use subject-verb agreement correctly
GIVG7	Use punctuation marks (full stop, question mark, exclamation mark, comma)
GVG8	Use direct and indirect speech
GVG9	Use word order (article – subject-verb – adjective – object) in longer sentences correctly
GVG10	Use the degrees of comparison (positive, comparative and superlative) of adjectives
GVG11	Use the progressive/continuous forms of tenses (continuous present, continuous past, continuous future)
GVG12	Tell the infinitive, simple past and past participle of regular verbs (play, played, played)
GVIG13	Construct complex sentences, which contain one main (principal) clause with a subordinate clause
GVIG14	Use question tags
GVIG15	Use compound tenses: present perfect and past perfect
GVIG16	Use possessive pronouns
GVIIG17	Use active and passive voice
GVIIG18	Use phrasal verbs correctly
GVIIG19	Use prepositions correctly
GVIIIG20	Use some conjunction coordinators and correlatives (either… or; neither… nor; not only… but also) correctly
GVIIIG21	Use the continuous forms of the compound tenses (present perfect, past perfect and future perfect)
GVIIIG22	Distinguish among the moods – indicative, imperative, interrogative, subjunctive
Grade IX	
GVIIG1	Use possessive pronouns appropriately
GVIIG2	Use question tags correctly
GVIIG3	Tell the parts of commonly used regular and irregular verbs
GVIIG4	Use simple, compound and complex sentences
GVIIG5	Use articles correctly

GVIIG6	Use active and passive voice
GVIIG7	Change from direct to indirect speech and vice-versa correctly
GVIIG8	Show how the meanings of words are changed by adding prefixes and suffixes to root words
GVIIG9	Use phrasal verbs correctly
GVIIG10	Use punctuation marks and question tags appropriately
GVIIG11	Use prepositions correctly
GVIIIG12	Use relative pronouns appropriately
GVIIIG13	Use some conjunction coordinators and correlatives (either… or; neither… nor; not only… but also) correctly
GVIIIG14	Use idiomatic expressions in appropriate contexts
GIXG15	Use modal auxiliaries (can, could, should, must, may and might) to indicate a shift in mood
GIXG16	Use indefinite pronouns appropriately
GIXG17	Use periodic sentences correctly Use a wider range of discourse markers correctly including "however", "in so far as", "therefore", "henceforth"
GIXG18	Use conjunction coordinators and correlatives (hardly… when; scarcely… when; no sooner… than) correctly
GXG19	Use gerunds and participles appropriately
GXG20	Use phrasal verbs appropriately
GXIG21	Know and use transitive and intransitive verbs appropriately
GXIG22	Use literal and figurative language appropriately

CHAPTER 4: MATHEMATICAL LITERACY

4.1 Introduction

Mathematical Literacy has two major components: fluency in mathematical procedures, and the ability to apply mathematical knowledge in solving problems in a variety of contexts. Towards achieving these objectives, learners need to be equipped with competencies comprising logical reasoning, modelling, problem solving, interpreting, communicating the solution in the context of a problem setting to others using symbolic and mathematical representations.

The Blueprint emphasises equipping students with knowledge, skills, values, and attitudes to nurture them to become socio-economically productive citizens who are able to respond and confidently cope with global challenges (MoE, 2014). To realise this aspiration, the goals set for mathematics education in Bhutan are as follows:

- achieve mathematical competence required in a GNH-society that is rich in information and technologically oriented;
- understand various mathematical concepts and procedural skills;
- explore a variety of strategies in problem solving;
- think and reason logically;
- understand the value of mathematics and its usefulness to them;
- nurture confidence in their own mathematical ability;
- encourage a continuing interest in mathematics; the
- build foundation to pursue higher studies in mathematics and foster and development of mathematical talent.

The NEA will measure the attainment of Mathematical Literacy at critical stages of learning to provide reliable and authentic information on the quality of mathematics education. Further, it will help in framing relevant policies for timely interventions aimed at supporting the development of students' Mathematical Literacy.

This chapter lays out a comprehensive framework for the assessment of Mathematical Literacy at grades III, VI, and IX comprising sections: assessing 21st century competencies and values, defining Mathematical Literacy, organisation of the domain, defining mathematical competencies, assessing the domain, and measuring learning outcomes.

4.2 Defining Mathematical Literacy

Mathematics is defined as a logical way of studying numbers, shapes, and spaces with the help of a system of symbols and rules to organise them. Another way to look at it is as the study of structure, order, and relation, which develop gradually from the practices of counting, measuring, and describing objects. These practices provide the requisite mathematical language and tools to investigate and explore the world we live in.

There are two branches of mathematics. The first one is a discipline that can be studied for its intrinsic pleasure, and the other, to explore, understand and communicate with the world around us. However, both are connected by the same mathematical body of knowledge. In this framework, this knowledge is interpreted in terms of Mathematical Literacy.

Mathematical Literacy is defined as an individual's capacity to formulate, apply and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict a solution. It assists individuals to recognise the role mathematics plays in the world and to make well-founded judgments and decisions as constructive, engaged, and reflective citizens.

Mathematical Literacy…

The term Mathematical Literacy is used to emphasise that the focus is on acquiring mathematical knowledge and skills, understanding of mathematical concepts and principles, developing a logical way of thinking, and using mathematical knowledge and skills to solve problems.

… is an individual's capacity to…

In order to solve problems, certain basic competencies are required. These competencies include capacity to utilise mathematical concepts, devise strategies, mathematise, represent, reason and argue, and communicate using mathematical symbols and tools.

… in formulating, applying and interpreting mathematics…

The process of completing a task involves mathematical competencies of formulating, applying and interpreting mathematical concepts, procedures, and skills.

- **Formulate** refers to understanding a given task and converting it into a mathematical structure.
- **Apply** refers to using mathematical competencies to complete the given task.
- **Interpret** refers to skills and procedures in analysing and reflecting upon mathematical facts, solutions, or conclusions, in context of the presented task and determining whether the result(s) or conclusion(s) are reasonable and/or useful.

…in a variety of contexts…

Mathematics can be learnt and applied in a variety of contexts – personal, local, global, and intra-mathematical. These contexts help the student understand, transfer mathematical knowledge, and appreciate the role of mathematics in a broader sense.

…includes reasoning mathematically…

Mathematical reasoning is the critical skill that enables a student to make use of all other mathematical skills. It involves logical and systematic thinking to arrive at solutions to problems set in the four types of contexts stated above, through patterns and structures and being able to justify the solution.

…using mathematical concepts, procedures, facts, and tools...

Problem solving requires using the most appropriate mathematical concepts, procedures, and tools to arrive at solutions to problems set in a variety of contexts.

…to describe, explain, and predict a solution.

The ultimate use of mathematical knowledge and skills is to understand a problem and to either predict or show a solution to problems set in context.

4.3 Organisation of the Domain

The Mathematical Literacy domain will include four aspects:

• Content	Mathematical knowledge and skills
• Context	Situations in which a task can be set
• Cognitive processes	Metacognitive skills required to complete a task
• Mathematical competencies	Fundamental qualities that underpin Mathematical Literacy

4.3.1 Content

This refers to the specific mathematical knowledge and skills required to complete a task. Content areas as provided in the Mathematics Curriculum Framework will form the basis for deciding the content aspect of Mathematical Literacy. Mathematics content is organised in five content strands:

- Number and operations
- Patterns and algebra
- Geometry
- Measurement
- Data management and probability

However, for the NEA, the first two strands are combined to form the 'Numbers and algebra' strand, considering the overlap and interrelation between the content strands that enriches the study of each other. In lower grades, algebra focuses on pre-algebraic concepts which can be combined with number and operations.

Therefore, for the purpose of NEA, the Mathematical Literacy content is divided into four strands:

- Number and algebra
- Geometry
- Measurement
- Data management and probability

Number and algebra: To make sense of the world around us in terms of mathematics, quantification is required. Numbers are fundamental to quantification, and different types of numbers add precision in different ways – whole numbers can serve as counters or estimators, fractions and decimals add to the accuracy of the measurement. Positive and negative numbers act as directional indicators, and per cent and ratio aid comparisons. Additionally, numbers can be used to put things in order and as identifiers (e.g., telephone numbers or zip codes).

Algebra enables a person to recognise, interpret, and create patterns to understand the world better. The pre-algebraic concepts, for example, identifying missing numbers or relationships in simple numeric and geometric patterns, are developed in the primary grades. As students progress from primary grades to higher grades, they build on their understanding of the number system to describe relationships and formulate generalisations. They recognise equivalence and solve equations and inequalities. They apply the concept of numbers and the four fundamental operations (+, –, x, ÷) with an increasing degree of complexity and levels of learning and algebra skills, to conduct investigations, solve problems, and communicate their reasoning.
The Numbers and algebra strand can be further divided into subsections – whole numbers, fractions and decimals, integers, rational numbers, and patterns and algebra. The proportional coverage of numbers and algebra is higher in grades III and VI.

Based on the curriculum coverage of numbers and algebra at the end of different grade levels, the approximate proportion is given in Table 4.1.

Table 4.14 Desired distribution of items, by Number and algebra in Mathematical Literacy assessment

Grades	Approximate percentage
Grade III	55-65%
Grade VI	45-55%
Grade IX	35-45%

Geometry: The study of shapes, spaces, and spatial relationships is an important and essential branch of mathematics. Shape is a category describing real images and entities that can be visualised in both two and three dimensions, e.g., man-made things like buildings, vehicles, art and craft, or natural things like snowflakes, shadows, and plants. Direction and location are fundamental qualities which are called upon when reading, interpreting, or sketching maps and

diagrams. Geometry is a formal study of shapes and their characteristics and relationships. Through the course of the study, students develop an increasingly sophisticated understanding of size, shape, position, and movement in two and three dimensions. Understanding of basic geometrical concepts deepens with the analytical study of parallelism, perpendicularity, and angle relationships. As learners progress, they start applying their knowledge and understanding to establish relationships between various attributes in shapes and apply them in systematically solving problems. The curriculum coverage of geometry content in primary grades is less in comparison to the secondary grades. Taking this into account, the coverage of geometry in NEA aligns with the Mathematics curriculum as given in Table 4.2.

Table 4.15 Desired distribution of items, by Geometry in Mathematical Literacy assessment

Grades	Approximate percentage
Grade III	10-20%
Grade VI	15-25%
Grade IX	15-25%

Measurement: It is a tool to quantify things around us. This content area requires an understanding of the units of measures and the systems of measurement, both non-formal and formal, such as the metric and the imperial systems. A basic task in this fundamental aspect could be measuring a given quantity, whereas a complex task might involve describing change in the capacity of an object when one dimension is changed.

In the mathematics curriculum, students begin by learning about measurable attributes of objects and proceed from the non-standard to standard units of measurement. Gradually, the concepts of length, mass, temperature, time, area, and volume are learned. Students also build an understanding of connections between the different units of measures and calculate derived measures such as area, speed, and density.

Table 4.3 gives the approximate proportion of test items in measurement, aligned with the curriculum coverage of measurement at the end of different grade levels.

Table 4.16 Desired distribution of items, by Measurement in Mathematical Literacy assessment

Grades	Approximate percentage
Grade III	10-20%
Grade VI	10-20%
Grade IX	15-25%

Data management and probability: In data management statistics, students collect, recognise, organise, and then draw inferences from the data. They learn to represent, summarise, and interpret data and undertake purposeful investigations involving the collection and interpretation of data. In probability, they assess likelihood and assign probabilities using experimental and theoretical approaches. Gradually, students develop increasingly sophisticated abilities to critically evaluate data and probability concepts and make reasoned judgements and decisions. Since the two components – data management and probability – are developed in parallel, they are combined under a single strand of Data management and probability.
Coverage of Data management and probability in primary grades is less than the secondary grades.

The approximate proportion of test items in Data management and probability is given in Table 4.4. This is based on the curriculum coverage of measurement at the end of different grade levels.

Table 4.17 Desired distribution of items, by Data management and probability in Mathematical Literacy assessment

Grades	Approximate percentage
Grade III	5-15%
Grade VI	10-20%
Grade IX	15-25%

Detailed categorisation ensures adequate coverage of mathematical learning outcomes as specified in the Mathematics Curriculum Framework. It is also designed to include tasks of different complexities for students across a wide range of proficiency levels.

The distribution of the assessment tasks of different content areas is proportional to the content distribution in the curriculum. However, in real life, it has to be understood that problems do not necessarily fall neatly into one content category. How a student as a problem solver, chooses knowledge, skills, and procedures appropriate to the problem that combines aspects of different content areas would reflect the general Mathematical Literacy of the student.

4.3.2 Context

Contexts in mathematics are the situations in which a problem to be solved has arisen (MTEG, 2016). It stimulates the task in which mathematical thinking can be assessed. The purpose of defining the contexts is to ensure that the NEA contains a variety of stimulus materials to assess Mathematical Literacy. It is assessed through four contexts – personal, local, global, and intra-mathematical. In real life, these contexts are not totally isolated and are usually found to overlap.

Personal context have an inward focus, i.e., context is set around individual experiences , and all interactions that affect the individual, such as, money transactions in buying and selling of commodities by an individual, personal travel, etc.

Local context pertains to tasks that require engagement with other individuals or with elements of the surrounding environment. It can be a setting at home or in the school, community, or the nation at large.

Global context requires students to go beyond their actual experiences and understand effects on larger communities or communities as a whole. Such context requires students to go beyond the physical world and develop a degree of abstractness to respond to the tasks. For example the height or structure of famous buildings, population, national, or regional economic problems, etc.

Intra-mathematical context does not have any specific context and is set in the mathematical domain only. As procedural fluency is considered one of the important skills in school mathematics, some contexts in NEA will be purely mathematical.

4.3.3 Cognitive Processes

The definition of Mathematical Literacy refers to an individual's capacity to formulate situations mathematically, apply mathematical concepts, facts, procedures, and skills, and interpret, reason and evaluate mathematical outcomes or results. For the purpose of the NEA, items will be set with a focus on any of the three mathematical processes below:

- **Formulating** refers to the process of providing a mathematical structure to a real-life problem. It indicates ability to recognise and identify opportunities to use mathematics in a given situation and then provide the necessary mathematical structure needed to translate the given task into the mathematical world.
- **Applying** refers to the process of using mathematical concepts, facts, and procedures to perform computations/manipulations and to arrive at a mathematical solution for a given task.
- **Interpreting** refers to the process of reasoning and reflecting upon mathematical solutions or conclusions, understanding them in the context of a problem, and determining whether the result(s) or conclusion(s) are reasonable and/or useful.

A student's capacity to apply mathematics to problems set in various contexts is dependent on competency inherent in all three of the above processes.

Formulating situations mathematically

To succeed in mathematics, a number of cognitive processes need to work together. Basic among them are the student's ability to recall rules and formulae and recognise patterns, use language to understand vocabulary, instructions, and explain their thinking, and use sequential ordering to solve multi-step problems and use procedures. Other than this, students need to learn to use spatial ordering to recognise symbols and deal with geometric forms.

In Mathematical Literacy, formulate refers to the process of converting a given task into mathematical language. The task is transferred from a real-world setting to the domain of mathematics and converted into mathematical structures, representations and specificity, bearing in mind the considerations and assumptions given in the task.

The tasks that falls under **formulating situations mathematically** can be:

- recognising and recalling definitions, number properties, units of measurement, geometric properties, and notations in a given task;

- selecting an appropriate model from a list;
- classifying and ordering numbers, expressions, quantities, and shapes by common properties;
- identifying the mathematical aspects of a problem situated in a real-world context and identifying the significant variables;
- representing a situation mathematically, using appropriate variables, symbols, diagrams, and standard models;
- retrieving information from graphs, tables, texts, or other sources;
- representing a problem in different ways by organising it in accordance to mathematical concepts;
- recognising aspects of a problem that correspond to known problems or mathematical concepts, facts, or procedures;
- choosing among an array of the most effective computing tools to potray a mathematical relationship inherent in a contextualised problem; and
- creating an ordered series (step-by-step) of instructions for solving problem.

Applying mathematical concepts, facts, and procedures

Applying refers to a student's ability to use knowledge and conceptual understanding to solve a problem. Successful problem solving involves the process of coordinating previous experiences, knowledge, and intuition in an effort to determine an outcome of a situation for which a procedure for determining the outcome is not known (Lester, 1987). This skill focusses on students' ability to use mathematics as a tool in familiar situations and routine problems.

In the Mathematical Literacy definition, 'apply' refers to the competency of using mathematical concepts, facts, procedures, and reasoning to solve mathematically-formulated problems in order to obtain mathematical conclusions. In the process of applying mathematical concepts, facts, procedures, and reasoning to solve problems, individuals perform the mathematical procedures required for finding a mathematical solution (e.g. performing arithmetic computations, solving equations, performing symbolic manipulations, extracting mathematical information from tables and graphs, representing and manipulating shapes in space, and simple analysis of data).

The tasks which involve this process of applying can be:

- performing a simple calculation;
- drawing a simple conclusion;
- selecting an appropriate strategy from a list;
- devising and implementing strategies for finding mathematical solutions
- using mathematical tools, including technology, to help find exact or approximate solutions;

- applying mathematical facts, rules, algorithms, and structures when finding solutions;
- manipulating numbers, graphical, and statistical data and information;
- applying algebraic expressions and equations, and geometric representations;
- developing mathematical diagrams, graphs, simulations, and constructions, and extracting mathematical information from them; and
- using and switching between different representations in the process of finding solutions.

Interpreting, reasoning, and evaluating mathematical outcomes

Reasoning is a logically rooted thought process that explores and links problem elements to make inferences from them, checks a given justification, or provides a justification (Turner, 2010). Reasoning mathematically involves logical and systematic thinking. It includes intuitive and inductive reasoning based on patterns and regularities that can be used to arrive at solutions to problems set in a novel or unfamiliar situations. Such problems may be purely mathematical or may have real-life settings.

The word 'interpreting' used in the Mathematical Literacy definition focuses on the ability of individuals to reflect upon mathematical solutions, results, or conclusions and interpret them in the context of the real-life problem that initiated the process. 'Interpret' in Mathematical Literacy involves reasoning with the mathematical solution in the context of the problem and also evaluating the reasonableness of the solution or processes in the context of the problem. Interpreting, reasoning, and evaluating mathematical outcomes encompass both the 'reasoning' and 'evaluating' elements of the mathematical modelling cycle. Individuals engaged in this process may be called upon to construct and communicate explanations and arguments in the context of the problem, reflecting on both the modelling process and its results. This process includes activities such as:

- determining, describing, or using relationships among numbers, expressions, quantities, and shapes;
- evaluating a mathematical outcome in terms of the context;
- interpreting a mathematical result back into the real-world context;
- evaluating the reasonableness of a mathematical solution in the context of a given task;
- understanding how the real-world impacts the outcomes and calculations of a mathematical procedure or model in order to make contextual judgments about how the results should be adjusted or applied;
- explaining why a mathematical result or conclusion does, or does not, make sense given the context of a problem;

- understanding the extent and limits of mathematical concepts and solutions;
- critiquing and identifying the limits of the model used to solve a problem;
- using mathematical thinking and computational thinking to make predictions, provide evidence for arguments and, test and compare proposed solutions;
- reflecting on mathematical arguments and, explaining and justifying mathematical results; and
- creating new ideas.

Table 4.5 shows the desired proportion of mathematical processes in the assessment.

Table 4.18 Desired distribution of items, by Proportion of mathematical processes in Mathematical Literacy assessment

Competencies	Approximate percentage
Formulating	25 - 30%
Applying	45 - 50%
Interpreting	25 - 30%

4.3.4 Mathematical Competencies

Mathematical competencies are a set of characteristics or qualities that underpin each of the three processes of Mathematical Literacy in practice, possessed to a greater or lesser extent by a student. Development of Mathematical Literacy will help students handle real-world challenges by making productive use of their mathematical knowledge in practical situations.

School mathematics education identifies communication, mathematising, representation, reasoning, devising strategies, and using symbolic, formal, and technical language and operations, and mathematical tools as the required mathematical competencies.

Communication comprises of two aspects: incoming communication and outgoing communication. Incoming communication refers to reading, decoding, interpreting statements, and mathematical information while outgoing communication refers to explaining, presenting, and arguing mathematical results.

Mathematising refers to transforming a real-world problem into a mathematical problem, i.e., interpreting mathematical objects or information in relation to the situation represented.

Representation is devising or using depictions of mathematical objects or relationships, equations, formulae, graphs, tables, diagrams, and textual descriptions.

Reasoning and argument entails developing logically rooted thought processes that explores and links problem elements to make inferences from them, or to check a given justification or provide a justification.

Strategic competence refers to selecting or devising and implementing, an appropriate mathematical strategy to solve problems arising from a task or context.

Using symbolic, formal, and technical language and operations, and mathematical tools refers to understanding, manipulating, and making use of symbolic expressions,

using constructs based on definitions, rules and conventions, formal systems, and relevant mathematical tools including software.

4.4 Assessing the Domain

The Mathematical Literacy domain is comprised of content, context and cognitive processes underpinned by mathematical competencies. The achievement of Mathematical Literacy will be measured through the analysis of the three processes of formulating, applying and interpreting and related mathematical competencies.
Table 4.6 below shows the relationship between mathematical processes and the competencies that underpin these processes.

Table 4.19 Relating competencies to processes

Competencies /processes	Formulating situations mathematically	Applying mathematical concepts, facts, procedures and	Interpreting, evaluating and reasoning mathematical
Communicating (reading, decoding, interpreting statements and mathematical information, explaining, presenting, and arguing.)	Read, decode, and make sense of statements, questions, tasks, objects or images, in order to form a mental model of the situation.	Explain a solution, show the work involved in reaching a solution, and/ or summarise and present intermediate mathematical results.	Construct and communicate explanations and arguments in the context of the problem.
Mathematising (Transform a real-world problem into a mathematical problem. Interpret mathematical objects or information in relation to the situation represented.)	Identify the under-lying mathematical variables and structures in the real-world problem.	Use an understanding of the context to guide or expedite the mathematical solving process, e.g., working to a con-text-appropriate level of accuracy.	Understand the extent and limits of a mathematical solution that are a consequence of the mathematical model employed
Representation (Devising or using depictions of mathematical objects or relation-ships: equations, formulae, graphs, tables, diagrams, and textual descriptions.)	Create a mathematical representation of real-world information.	Make sense of, relate, and use a variety of representations when interacting with a problem.	Interpret mathematical outcomes in a variety of formats in relation to a situation or use; compare or evaluate two or more representations in relation to a situation.

Reasoning and argument (Logically rooted thought process-es that explore and link problem elements to make inferences from them, or check a given justification, or provide a justification.)	Explain, defend or provide a justification for the identified or devised representation of a real-world situation.	Explain, defend, or provide a justification for the processes and procedures used to determine a mathematical result or solution. Connect pieces of information to arrive at a mathematical-cal solution, make generalisations or create a multi-step	Reflect on mathematical solutions and create explanations and arguments that support, refute, or qualify a mathematical solution to a contextualised problem.
Devising strategies for solving problems (Selecting or devising, and implementing, a mathematical strategy to solve problems arising from the task or context.)	Select or devise a plan or strategy to mathematically reframe contextualised problems.	Activate effective and sustained control mechanisms across a multi-step procedure leading to a mathematical solution, conclusion, or generalisation.	Devise and imple-ment a strategy in order to inter-pret, evaluate, and validate a mathe-matical solution to a contextualised problem.
Using symbolic, formal, and technical language and operations, and mathematical tools (Understanding, manipulating, and making use of symbolic expressions, using constructs based on definitions, rules and conventions, formal systems, and using mathematical tools.)	Use appropriate variables, symbols, diagrams, and standard models in order to represent a real-world problem. Use mathematical tools in order to recognise mathematical structures or to portray mathematical relation-ships in symbolic/ formal language,	Understand and utilise formal con-structs based on definitions, rules, and formal systems, as well as employing algorithms. Know about and be able to make appropriate use of various tools that may assist in implementing processes and procedures for determining mathematical solutions.	Understand the relationship between the context of the problem and representation of the mathematical solution. Use this understanding to help interpret the solution in context, and gauge the feasibility and possible limitations of the solution. Use mathematical tools to ascertain the reasonableness of a mathematical solution and any limits and constraints on that solution, given the context of the problem.

4.4.1 Item formats

An assessment instrument for Mathematical Literacy constitutes an effective stimuli set in a relevant context that demands various levels of cognitive rigour and competencies. It may be either in Multiple Choice Question (MCQ) or Constructed Response Test (CRT) format. For its ease of administration and objective grading,

multiple-choice testing is the prevalent form of assessment in science and humanities education (Ali, Carr, & Ruit, 2016). Considering the best international practices, it is proposed that a majority of questions in the test be MCQs.The intended proportion for different grade levels are as provided below.

Table 4.20. Desired distribution of item format in Mathematical Literacy assessment

Item Format	Grade III	Grade VI	Grade IX
MCQ	80% – 85%	75% – 85%	65% – 75%
CRT	15% – 20%	15% – 25%	25% – 35%

4.4.2 Item difficulty

Research shows that learning is most likely to happen when students are given challenging tasks just beyond their comfort zone. At any given point during their learning, every student is capable of further progress if they can be engaged, motivated, and provided with relevant learning opportunities (Masters, 2013). In a particular grade level, all students will not be at the same level of learning. They will be in a range of levels, with the possibility of bright students being several years ahead of the low performing students.

Therefore, to assess the students at all levels of learning, the NEA will include items across a difficulty range. The proportion of these levels of difficulty – easy, medium, and difficult – is flexible in the first cycle, and will be subsequently fixed during future cycles. For the first cycle, approximately 20-25 per cent of test items will be easy, 50-60 per cent of items will be at medium level, and the remaining 20-25 per cent will be difficult.

4.5 Assessing 21st Century Competencies

In this framework, the 21st century competencies defined by international agencies such as UNESCO, OECD, and the Partnership for 21st Century Skills have been interpreted in the context of the nine Student Attributes in accordance with the Blueprint. It is further noted that not all these attributes can be assessed by a pen-and-paper test. However, Mathematical Literacy will assess these attributes through tasks that enable students to exhibit a particular attribute or even multiple attributes.

Table 4.8 shows how various attributes can be measured in Mathematical Literacy.

Table 4.21 Student Attributes to be measured in Mathematical Literacy assessment

Student Attributes
Knowledge and understanding – This attribute can be assessed in terms of mathematical knowledge and understanding. The instrument to assess Mathematical Literacy will include items focused on mathematical knowledge and understanding. This attribute will be measured through the following indicators: • recalling of information such as fact, definition, term, or a simple procedure, rules and formulae, and recognition of patterns; • formulating one-step, well-defined, and straight and simple algorithmic procedural items; • performing a well-known algorithm following a set of procedures (performing a clearly defined series of steps); • representing mathematical situations in different ways and knowing how different representations connect with each other, how they are similar, and how they are different; • retrieving information from graphs, tables, texts, or other sources; and • applying mathematical facts, rules, algorithms, and structures when finding solutions.
Intellectual competence – This attribute can be assessed in terms of mathematical competencies like formulating, applying, and interpreting between the real-world and the maths world. The instrument to assess mathematical literacy will include items focused on these processes, which will measure it through the following indicators: • creating a sequential order of instructions to solve multi-step problems and use procedures; • identifying the mathematical aspects of a problem situated in a real-world context and identifying the significant variables; • representing a situation mathematically, using appropriate variables, symbols, diagrams, and standard models; • recognising aspects of a problem that correspond with known problems or mathematical concepts, facts, or procedures; • choosing among an array for the most effective computing tools to portray a mathematical relationship inherent in a contextualised problem; • devising and implementing strategies for finding mathematical solutions; • using mathematical tools, including technology, to help find exact or approximate solutions; • manipulating numbers, graphical, and statistical data and information; • making mathematical diagrams, graphs, simulations, and constructions, and extracting mathematical information from them; • using and switching between different representations in the process of finding solutions; and • using relationships among numbers and different units of measurement, expressions, • quantities, and shapes to mathematise problems and work out solutions

Communicative competence –This attribute can be assessed through items that require students to demonstrate mathematical communication. The aspects of communication include students' understanding and interpreting the information given in the task, and communicating the solution to others using symbolic and mathematical representations. The instrument to assess Mathematical Literacy will include items assessing mathematical language.

This attribute will be measured through the following indicators:

- understanding and interpreting information;
- explaining their interpretations of the mathematical solution in a problem context;
- explaining why a mathematical result or conclusion does, or does not, make sense given the context of a problem;
- using sequential ordering to solve multi-step problems and use procedures;
- presenting and extracting information through mathematical diagrams, graphs, simulations, constructions, etc.;
- using algebraic expressions and equations, and geometric representations; and
- using mathematical language to express mathematical ideas.

Leadership Competence – In the Bhutanese context, leadership attributes include knowledge, i.e., understanding of the discipline and of the real world and the ability to generate creative solutions. These attributes will be addressed in the Mathematical Literacy instrument by including items assessing the understanding of mathematical concepts and creativity in a variety of contexts.

This attribute will be measured through the following indicators:

- applying mathematical knowledge and understanding to solve problems in practical situations; and
- identifying the problem, exploring options for solutions, and reaching and generalizing results for a wider context.

World-readiness – This attribute can be assessed through items based on analytical, reasoning, critical thinking, creativity, and problem-solving skills. Instruments demanding broad mathematical knowledge, skills, and cognitive demand appropriate to the stage of development will be used to infer information about this attribute.

This attribute will be measured through the following indicators:

- transfering mathematical knowledge to problems set in a context; and
- successfully sieving through problems and solution options using broad mathematical knowledge and skills.

4.6 Measurable Learning Outcomes

In a practical situation, it is not possible to measure all the learning outcomes prescribed in the mathematics curriculum in a single assessment. Learning outcomes were reviewed and those that were measurable were identified for the assessment of Mathematical Literacy. In order to ensure that the assessment provides an opportunity to students at different grade levels of learning to demonstrate their ability, appropriate learning outcomes from two grades below and two grades above the targeted grade have been reviewed and included, e.g., learning outcomes for grade VI assessment include outcomes from grades IV to VIII.

Table 4.9 shows the list of learning outcomes selected from the Mathematics Curriculum Framework for the Mathematical Literacy.

Table 4.22 Measurable Learning Outcomes for Mathematical Literacy assessment

Grade III	
Number and Algebra	
Whole Numbers	
C3N-1	Represent whole numbers with manipulatives, in pictorial forms, words, diagrams, number lines or symbols from 100 to 1,000,000
C3N-2	Demonstrate knowledge of place value of 2-digit to 6-digit numbers
C3N-3	Order and compare numbers using symbols 100 to 1,000,000
C3N-4	Add up to 5-digit numbers with and without regrouping, including computation in simple contextual problems
C3N-5	Subtract up to 5-digit numbers with and without regrouping, including computation in simple contextual problems
C3N-6	Demonstrate knowledge of different addition strategies for 1 to 5 digit numbers: double, half, make ten, front-end, (adding a number from left to right) counting on, subtract 10 and compensate, balancing, using the nearest multiple of ten then compensating, partner number in simple addition subtraction problems
C3N-8	Demonstrate the understanding of multiplication as equal grouping and repeated addition, skip counting, double facts, multiplication as array
C3N-9	Multiply up to 4-digit by 1-digit, including computation in simple contextual problems
C3N-10	Demonstrate knowledge of division as equal sharing and repeated subtraction and understanding of relation between multiplication and division facts
C3N-11	Demonstrate knowledge of properties of numbers (odd or even) or operations (commutative and associative) to solve problems in simple context
Fractions and Decimals	
C3N-12	Identify fractions as parts of a whole or part of a set; represent fractions using words, numbers, or models, including those set in problem situations (Fractions may have denominators of 2, 3, 4, 5, 6, 8, or 10)
C3N-13	Demonstrate knowledge of decimal place value (up to tenth) including representing decimals using words, numbers, or models; compare, order, and round decimals
Patterns and Algebra	
C3N-14	Demonstrate knowledge of different types of patterns (repeating, growing) based on size, shape, colour, attributes etc
C3N-15	Use understanding of patterns in context (missing number or operation in a number sentence, etc.)
C3N-16	Identify and use relationships in a well-defined numerical and geometrical pattern
Measurement	

C3M-01	Demonstrate the understanding of length, capacity, mass in standard and non-standard units and time using analogue clock (up to 5 minutes) and digital clock
C3M-02	Solve problems involving length (millimetres, centimetres, meters, and kilometres), mass (gram and kilogram), volume (millilitre, litre) and calendar (days, week, month and seasons): identify appropriate types and sizes of units and read scales
C3M-03	Demonstrate the understanding of relationships among different units of time such as minutes, hours, days, weeks, months, seasons and years
C3M-04	Identify and compare angles based on right angle
Geometry	
C3G-01	Identify quarter, half and full turns
C3G-02	Identify different types of lines (parallel lines, perpendicular lines, etc.), reflection, symmetry and congruence in real world
C3G-03	Identify common 2-D (triangles and quadrilaterals) and 3-D shapes (cube, cuboid, cylinder, cone and sphere) and their attributes
C3G-05	Classify 2-D and 3-D shapes by their attributes
C3G-06	Identify nets of prisms and pyramids (up to hexagon)
Data Management and Probability	
Reading, Interpreting and Representing Data	
C3D-01	Read, represent and interpret data from tally charts, tables, pictographs, and bar graphs
C3D-02	Organize and represent data in tables, pictographs, and bar graphs to help answer questions (simple scales can be included)
C3D-03	Identify and describe probability in terms of impossible, unlikely, equally likely, likely and certain and by using fractions
Grade VI	
Number and Algebra	
Whole Numbers and Integers	
C6N-01	Represent whole numbers with manipulatives, in pictorial form, words, diagrams, number lines or symbols up to 9 places
C6N-02	Demonstrate knowledge of place value of whole numbers up to 9 places
C6N-03	Order and compare whole numbers up to 9 places
C6N-04	Solve problems using addition, subtraction, multiplication and division of whole numbers
C6N-05	Find and use common factors of whole number up to 2-digit
C6N-06	Demonstrate the knowledge of positive and negative integers including on the number line and models
Data Management and Probability	
C6N-07	Demonstrate knowledge of fraction and mixed numbers using diagrams, number lines and models (grid and rectangular)

C6N-08	Order and compare fractions using different strategies (number line, reference number, etc.)
C6N-09	Add and subtract simple fractions (like and unlike fractions, proper and mixed fractions) using different strategies
C6N-10	Demonstrate knowledge of decimals using diagrams, number line, models; order and compare decimal numbers
C6N-11	Add, subtract, multiply and divide decimals with whole numbers using different strategies
C6N-12	Compute with decimals including those set in problem situations
C6N-13	Estimate the product and quotient of decimal multiplication and division
Ratio and Percentage	
C6N-14	Demonstrate knowledge of ratio as part to part and part to whole
C6N-15	Use the concept of equivalent ratios and apply it to solve problems using models and symbols
C6N-16	Demonstrate knowledge of percentage as a way to benchmark and estimation for familiar fractions
C6N-17	Demonstrate the understanding of rate by relating them to ratio
Patterns and Algebra	
C6N-18	Demonstrate the understanding of function as input/output values
C6N19	Identify and generate patterns with whole numbers (including square and triangular numbers) and decimals
C6N-20	Demonstrate understanding of multiplication and division computation patterns and multiplicative relationship between equivalent fractions
C6N-21	Demonstrate understanding of relation between dimensions and area/ perimeter/volume
C6N-23	Write expressions and equations to represent problem situations
Measurement	
C6M-01	Measure and estimate length in SI units (mm, cm, m and km), mass in SI unit (g, kg, tonne)
C6N-02	Demonstrate understanding of relation between different SI units
C6M-03	Demonstrate understanding of angle as measure of turn; identify and draw types of angles, and triangles based on angles
C6M-04	Solve problems involving time including time intervals and elapsed time
C6M-05	Solve problems involving area and perimeter of polygons including triangles, squares, rectangles and parallelograms, use area unit as square centimetre
C6M-06	Estimate and find the volume of prisms
Geometry	
C6G-01	Solve problems using angle bisectors, parallel and perpendicular lines
C6G-02	Solve problems using geometric properties of triangles

C6G-03	Recognize and draw images of geometric transformations (flips, translations, reflections, rotations and tessellations) in the plane
C6G-04	Identify rotational symmetry and use its properties in simple geometric shapes
C6G-05	Identify and draw isometric and orthographic images of geometric shapes
C6G-06	Relate 3-D shapes (prisms and pyramids) with their 2-D representations
C6G-07	Identify planes of symmetry in 3-D shapes
Data Management and Probability	
Reading, Interpreting and Representing Data	
C6D-01	Read, interpret, and represent real-world data using single and double bar graphs, line graphs, and stem and leaf plots
C6D-02	Calculate and use mean, median and mode of given data
C6D-03	Construct and interpret coordinate graphs
Probability	
C6D-04	Identify outcomes as more/less likely
C6D-05	Determine theoretical and experimental probability of simple events
Grade IX	
Real Numbers	
C9N-01	Demonstrate knowledge of divisibility rules, LCM, and GCF
C9N-02	Solve problems involving ratios, rates, proportion, and percentages including real-world problems
C9N-03	Demonstrate knowledge of integer, rational, and irrational numbers in including representation, comparing and ordering them
C9N-04	Demonstrate knowledge of exponents including negative exponents and scientific notation
C9N-05	Solve problems involving roots including square roots estimation
C9N-06	Write expressions, equations, or inequalities to represent problem situations and solutions
C9N-07	Represent and solve problems using matrices including networking problems
C9N-08	Demonstrate knowledge of order of operations involving rational numbers
C9N-09	Compute and solve problems with integers, fractions, and decimals (including rational numbers and decimals)
C9N-10	Demonstrate understanding of properties of operations (commutative, associative, and distributive)
C9N-11	Compute with irrational numbers
C9N-12	Solve problems involving simple interest, compound interest, and taxes
C9N-13	Solve problems, analyse situations and make decision involving financing
C9N-14	Identify like and unlike terms

C9N-15	Simplify algebraic expressions including use of commutative, associative and distributive properties
C9N-16	Evaluate polynomial expressions for given values of the variables
9N-17	Add, subtract, multiply, and divide polynomials
C9N-18	Solve linear and simple radical, exponential, and absolute value equations, linear inequalities, and simultaneous linear equations in two variables, including those that model real-life situations, using a number of strategies including graphically
C9N-19	Interpret, relate and generate representations of linear and non-linear functions in tables, graphs, or words; identify properties of linear functions including slope and intercepts
C9N-20	Solve two linear equations graphically
C9N-21	Solve quadratic equations using factors and graphically
C9N-22	Analyse and describe transformations and apply them to absolute value functions including linear and quadratic functions
C9N-23	Demonstrate understanding of independent and dependent variables, and domain and range
C9N-24	Apply and predict patterns including scatter plots in real-world relationships
Measurement	
C9M-01	Solve measurement problems involving unit conversion using proportion
C9M-02	Solve problems with diameter, radii, circumference and area of circle
C9M-03	Find area of composite shapes
C9M-04	Demonstrate knowledge of Pythagorean relationship and use it to solve problems
C9M-05	Solve problems involving area and perimeter of quadrilaterals
C9M-06	Calculate volume and surface area of right prism, cylinders, pyramids, cones, spheres and composite 3-D shapes
C9M-07	Demonstrate knowledge of properties of similar triangles and use the knowledge to solve problems
C9M-08	Demonstrate understanding of trigonometric ratios and identities and use the understanding to solve problems
C9M-09	Solve bearing and vector problems using the Pythagorean theorem and/or trigonometric ratios
C9M-10	Recognize that a network with more than two odd vertices is not traversable
Geometry	
C9G-01	Use the relationships between angles on lines and in geometric figures to solve problems
C9G-02	Demonstrate the knowledge of altitudes, medians, angle bisectors and perpendicular bisectors

C9G-03	Interpret and analyse properties of geometric transformations (translations, reflections, and rotations) in the plane; identify congruent and similarity criteria in triangles and solve related problems
C9G-04	Represent, analyse and apply concept of dilatations on geometric figures
C9G-05	Use orthographic mat, and isometric drawings to represent more than one 3-D shape
C9G-06	Demonstrate knowledge of minimum sufficient conditions for a unique triangle
C9G-07	Demonstrate understanding of inductive and deductive reasoning
C9G-08	Analyse the relation between number of lines symmetry and rotation to sides of regular polygon
C9G-09	Identify algebraic equation related to transformation and use them to draw graphs
Data Management and Probability	
Reading, Interpreting and Representing Data	
C9D-01	Identify appropriate procedures for collecting data, examine biases in data; organize and represent data including circle graphs, histograms, box and whisker plots, scatter plots to help answer questions and analyse results
C9D-02	Demonstrate an understanding of the properties of the normal distribution (e.g., the mean, median, and mode are equal; the curve (and data) is symmetric about the mean)
C9D-03	Analyse and interpret the impact of alterations to data sets in each of mean, median and mode
C9D-04	Demonstrate the basic understanding of simple random sample
C9D-05	Use range, outliers, gaps, clusters to make inferences and predictions to solve problems
Probability	
C9D-06	Demonstrate the knowledge of dependent and independent events, theoretical and experimental probability
C9D-07	Determine theoretical probability or experimental probability for simple and compound events
C9D-08	Differentiate between independent and dependent events
C9D-09	Determine conditional probability

CHAPTER 5: SCIENCE

5.1 Introduction

In the era of science and technology, scientific evidence has become the basis of policy decisions that have huge impacts on the lives of people. Therefore, making Bhutanese citizens scientifically literate is a priority for the education system. The Bhutan Education Blueprint 2014-2024 emphasises the need to equip Bhutanese students with the knowledge, skills, and values and attitudes that nurture them into socio-economically productive citizens who can respond and confidently cope with the emerging global challenges in their daily lives. Thus also resonates with the goals and principles of Science Curriculum Framework.

The findings of the Annual Status of Student Learning (ASSL) 2011 by REC raises concerns about the performance of Bhutanese students in science. Specifically, the performance of both grades VI and VIII students in science was lower than international standards. Grade VI science performance declined significantly in 2011 compared to performance in 2008. It also highlighted the difficulties faced by students in understanding core concepts, procedural learning, and applying knowledge to real-life situations. Similarly, findings from PISA-D 2017 showed that the performance of Bhutanese students in science was significantly below the OECD average achievement scores, which further confirmed the findings of ASSL. However, the PISA-D findings showed that Bhutanese students performed better in tasks requiring lower cognitive skills than those requiring higher cognitive skills.

The functional and fundamental scientific competencies as identified globally are incorporated and assessed to some extent in the school-based standardised examination conducted by BCSEA. Over the years, numerous cycles of NEA have been conducted on Reading and Numeracy by BCSEA, but Scientific Literacy was never included in any of these cycles.

Given the emphasis accorded by the Blueprint to scientific education in preparing citizens to cope with the complexities of 21st century challenges, there is an urgent need to include assessment of literacy in science in the NEA. Scientific Literacy, therefore, intends to assess the fundamental scientific competencies of the students. In doing so, reliable and authentic information can be obtained on the health of science education in Bhutan at critical stages of learning for making relevant policy decisions and timely interventions.

5.2 Defining Scientific Literacy

In a world that is increasingly affected by science and technology, students of the 21st century are required to realise the importance of developing an inquiring attitude towards all forms of scientific information. This ability will enable them to become scientifically literate citizens who can make informed decisions, supported by

evidence or justifications that can be communicated to the wider society. Therefore, it is essential to develop competencies in the students to help them analyse any situation through the use of scientific knowledge and appropriate technology.

Scientific Literacy refers to knowledge and understanding of science that makes an individual capable of solving issues that affect the wellbeing of society.

A scientifically literate person has the following abilities:

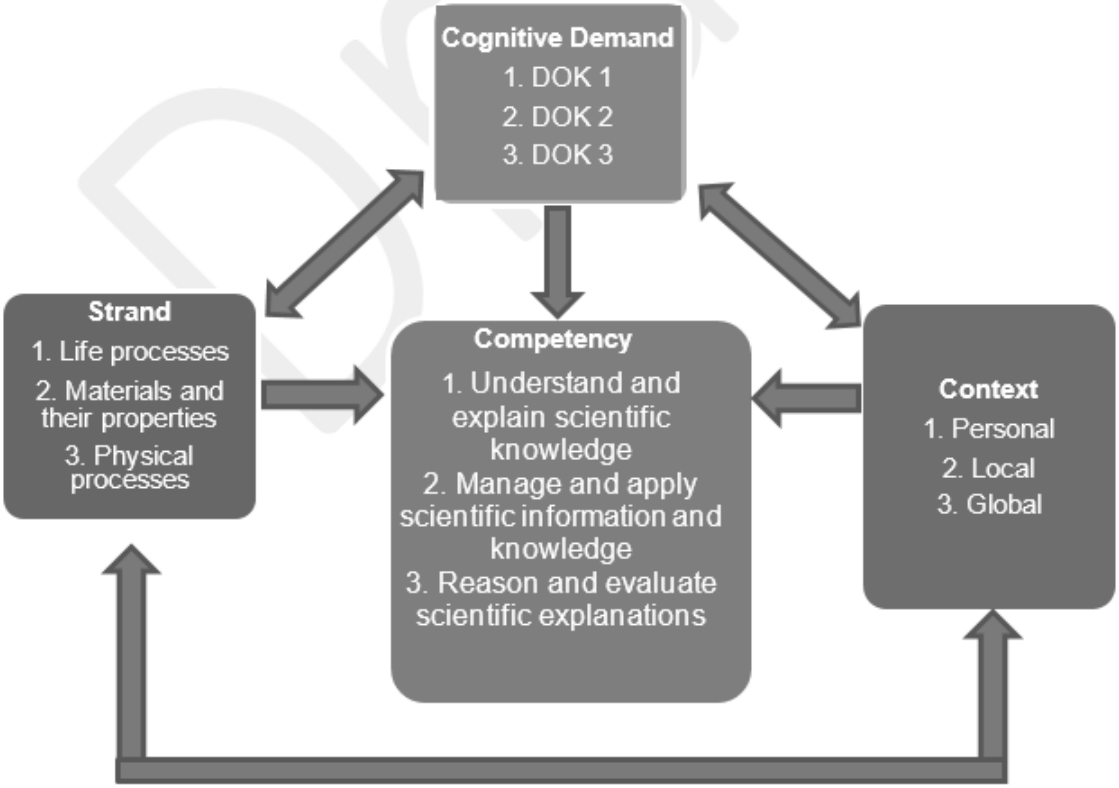
- Possesses skills to acquire knowledge and understanding of science and uses tools to succeed and function effectively in a changing world.
- Collaborates and communicates effectively by clearly expressing opinions and intentions based on scientific reasoning in various forms.
- Has a sense of care, kindness, compassion, love, gratitude, and respect for the natural environment.
- Transfers learning experiences critically and creatively to real-world situations by connecting knowledge from all curricula.

5.3 Organisation of the Domain

Scientific domain is organised in terms of content that prescribes the scientific knowledge of students, context that describes situations which are relevant to their interests and lives, competencies that describe their abilities, and cognitive demand that measures the complexity and depth of knowledge acquired.

One of the goals of NEA is to create cognitive instruments targeting to assess 21st century competencies. A cognitive instrument constitutes an effective stimuli set in a relevant context, and a task or a problem that demands various levels of cognitive rigour and competencies. An instrument is characterised by the competencies at its core with the other elements (strands, cognitive demands, and contexts) linked to it. Figure 5.1 shows a schematic representation of the characteristics of a cognitive instrument.

Figure 5.1. Characteristics of cognitive instrument



5.3.1 Content

The Science Curriculum Framework categorises the science learning experiences into four strands as follows:

Working scientifically explores the nature of science and investigates the natural and technological world through experimentation, reflection and analysis, and effective communication.

Life processes deal with the biology of living things and their interactions with the surroundings, maintaining good health and hygiene, and how human behaviours affect the environment.

Material and their properties deal with the study of materials in terms of their structure, form, chemical properties, uses, and the impact of some materials on the environment.

Physical processes deal with the study of matter, energy and the interaction between them in terms of force, motion, light and sound, and electricity and magnetism.

The strand 'Working scientifically' can be embedded in each of the other three strands: Life processes, Material and their properties, and Physical processes.

The Science Curriculum Framework prescribes a greater proportion of weighting to the conceptual strands: Physical processes and Life processes than the Material and their properties in grade VI and equivalent weighting for all three conceptual strands in grade IX. However, the Physical processes also include Space Sciences. Table 5.1

shows the weighting for each strand in Scientific Literacy based on the Science Curriculum.

Table 5.23 Desired distributaion of items, by strand in Scientific Literacy assessment

Strands	Grade VI	Grade IX
Life processes	30% - 40%	25% - 35%
Material and their properties	25% - 35%	25% - 35%
Physical processes	30% - 40%	35% - 45%

5.3.2 Contexts

The NEA focuses not only on the assessment of students' content knowledge in science but also on their ability to apply the knowledge to a personal, local and global contexts. The contexts are generally set in the areas of concerns, such as health and disease, natural resources, environmental quality, hazards, and the frontiers of science and technology.

- **Personal context** includes situations and tasks that arise in students', their peers' and families' daily lives, such as safety while handling everyday chemical products and hygiene.
- **Local context** comprises issues related to community and the nation where people live, such as contamination of water sources and human-wildlife conflict.
- **Global context** encompasses all the problems and tasks relating to global issues, such as carbon emission and ozone layer depletion.

5.3.3 Competencies

Students who have an in-depth understanding of social and environmental issues, engage in critical discussions, communicate effectively, and collaborate to solve problems for sustainable living, become scientifically literate.

The indicators of the level of Scientific Literacy under respective competencies are given in Table 5.2.

Table 5.24 Competencies in Scientific Literacy

Competencies

SC1. Understand and explain scientific knowledge

- Remember and recall scientific knowledge.
- Provide clear, concise, and accurate scientific information and ideas.
- Describe phenomena scientifically, identify patterns, and predict changes.
- Explain the potential implications of scientific knowledge and technological developments on society.
- Recognise the key features of a scientific investigation.

SC2. Manage and apply scientific information and knowledge

- Integrate and apply concepts and information obtained from various sources.
- Interpret and analyse data and evidence to draw valid conclusions and respond appropriately using various media.
- Engage in an inquiry process to solve real-life problems.
- Apply analytical and problem-solving skills to create new knowledge and seek innovative solutions to complex problems.
- Make connections and transfer learning from one context to another.

SC3. Reason and evaluate scientific explanations

- Recognise issues that can be investigated scientifically.
- Identify the assumptions, evidence, and reasons behind conclusions.
- Identify and analyse a situation critically, and reflect upon the implications of decisions made.
- Evaluate scientific arguments from various sources through critical thinking and reasoning skills.

Table 5.3 shows the weightage assigned to competencies for grades VI and IX. Greater weightage has been given to Understand and explain scientific knowledge for grade VI in accordance to their cognitive development. However, for grade IX, the weightage for the competencies, manage and apply scientific information and knowledge, and Reason and evaluate scientific explanations, are slightly higher compared to grade VI.

Table 5.25 Desired distribution of items, by competencies in Scientific Literacy assessment

Competencies	Grade VI	Grade IX
Understand and explain scientific knowledge	40% - 50%	30% - 40%
Manage and apply scientific information and knowledge	30% - 40%	35% - 45%
Reason and evaluate scientific explanations	15% - 25%	20% - 30%

5.4.4 Cognitive Demand

Cognitive demand refers to the type of mental processes required to solve a question or a problem. Low-level cognitive demands generally include memorisation tasks or procedures that do not make connections to understanding, meaning, or concepts. On

the other hand, tasks with high-level cognitive demands engage students in more abstract reasoning, analysis, and creative thought, and require them to verify, justify, and apply correct procedures in multiple ways.

In science, knowledge refers to both content knowledge and knowledge of science processes. The assessment of Scientific Literacy is based on the Webb's Depth of Knowledge (DOK) of learning. DOK reflects the complexity of cognitive processes demanded by the tasks rather than its difficulty. It is based upon the cognitive demands required to produce an acceptable response to a specific context. The complexity of items under each strand are aligned to the competencies and contexts so that students can express the depth and the extent of learning. The DOK levels are categorised as follows.

DOK 1: Students are required to recall facts, terms, properties, or a simple one-step procedure. They should demonstrate rote response, use a well-known formula, follow or perform a clearly defined series of steps, or solve simple word problems using a formula. Students' response at this level demonstrates whether they know the answer.

DOK 2: Students are required to explain scientific concepts and establish relationships among facts, properties, and variables. They select and apply appropriate procedures involving two or more steps and arrange, represent, interpret, and display simple data in the form of tables, charts, graphs etc., and apply information to a new context.

DOK 3: Students are required to design investigations and models, analyse complex information or data, evaluate evidence, justify, and sequence an approach to solve a scientific problem. They solve non-routine real-world problems that are complex and abstract, demanding more reasoning and multiple steps.

The highest DOK level (Extended Thinking) is rare or absent in most standardised assessments due to its very high cognitive demand, openness and complexity. Therefore, Scientific Literacy focuses only on the assessment and analysis of the three DOK levels.

Table 5.4 shows the percentage of items to be developed under each strand according to the DOK levels to suit the degree of cognitive development of grades VI and IX students. As in global practices, higher weighting has been given to DOK 1 for grade VI while higher weighting is assigned to DOK 3 for grade IX.

Table 5.26 Desired distribution of items, by DOK in Scientific Literacy assessment

Strands	Grade VI			Grade IX		
	DOK 1	DOK 2	DOK 3	DOK 1	DOK 2	DOK 3
Life processes	45%-55%	35%-45%	5%-15%	30%-40%	35%-45%	15%-25%

Material and their properties	35%-45%	35%-45%	15%-25%	25%-35%	35%-45%	25%-35%
Physical processes	25%-35%	35%-45%	25%-35%	20%-30%	35%-45%	35%-45%

5.4 Assessing the Domain

5.4.1 Item Formats

The following item formats are considered in assessing the Scientific Literacy:

Multiple Choice Questions (MCQ) are items that require the selection of a single response from a set of multiple options. Each item, in general, is considered a score point.

Constructed Response Tasks (CRT) are items that require responses either through writing or drawing. The length of the written response may vary from a phrase to a short paragraph (two or three sentences). Each item generates a score point or multiple score points.

Table 5.5 shows the intended weighting of the item formats.

Table 5.27 Desired distribution of items, by format

Item format	Grade VI	Grade IX
MCQ	75% - 85%	65% - 75%
CRT	15% - 25%	25% - 35%

5.4.2 Item Difficulty

It is important for an assessment of this nature to include items with a range of difficulty levels to ensure that sufficient information can be gathered about students of different ability levels. Therefore, a required number of items with a range of appropriate levels of difficulty must be considered for the assessment.

5.5 Assessing 21st Century Competencies

As much as students need to learn scientific content, they also need to know how to continue learning and make effective and innovative use of knowledge throughout their lives. This is essential for the increasingly complex life and work environments in today's world (Partnership for 21st Century Skills, 2009). Hence, the Bhutanese education system has identified nine Student Attributes to equip students with 21st century competencies and enable them to be a part of an educated and enlightened society focussed on maximising Gross National Happiness (GNH). These competencies prepare them to thrive in a competitive and harmonised world (MoE, 2014).

Among the nine Student Attributes, six can be assessed using pencil and paper-based assessments. Therefore, the mainstay of the framework is to assess 21st century competencies and learning outcomes in alignment with the six Student Attributes provided in the table below.

Table 5.28 Desired distribution of items, by Student Attribute in Scientific Literacy assessment

Student Attributes
Knowledge and understanding – Students are able to acquire deeper knowledge and understanding of science and use tools to succeed and function effectively in a changing world. This attribute is measured by the following indicators: • remember and recall scientific knowledge; • identify and understand the positive and harmful effects of scientific knowledge on both environment and human life; • apply scientific knowledge and understanding to solve local and global problems; and • adapt intelligently to the real-life challenges using the understanding of scientific concepts and theories.
Intellectual competence – Students are able to analyse, synthesise, evaluate, and judge complex situations through critical reasoning. They anticipate and seek creative solutions to problems by generating innovative ideas and exploring possibilities. This attribute is measured by the following indicators: • identify and analyse a situation critically, and reflect upon the implications of decisions made based on personal and collective considerations in solving real-life and complex problems; • anticipate and seek innovative solutions to complex problems; • use acquired knowledge to create new knowledge; • interpret and analyse data and evidence to draw valid conclusions; • evaluate scientific arguments from various sources through critical thinking and reasoning skills; • engage in an inquiry process to solve problems; and • make connections and transfer learning from one context to another.
Communicative competence – Students are able to communicate effectively with a clear expression of opinions and intentions in various forms. In particular, they are able to express contexts and problems and use various media to present scientific ideas and concepts. This attribute is measured by the following indicators: • provide clear, concise, and accurate information and ideas; • provide relevant knowledge, context, and implications, rather than just facts and data; • understand and correctly apply verbal and written instructions, procedures, and technical information; • analyse, clarify, and interpret complex scientific information and issues effectively, and respond appropriately; and • communicate effectively in different contexts through various media.

Family, community and national values – Students are able to recognise and appreciate their roles in conserving the environment and maintaining natural harmony. Students generate a sense of care, kindness, compassion, love, gratitude, and respect for the natural environment. This attribute is measured by the following indicators:

- develop ethics and responsibilities to apply knowledge of science for positive impact and conservation of environment;
- recognise the importance of scientific contributions of an individual for harmony in the community and country;
- identify environmental issues and generate ideas that show concern to mitigate those issues;
- observe and describe patterns in natural and human-designed phenomena and use those patterns to support claims about the observed or predicted relationships among phenomena for a stable community and environment; and
- draw inferences from events based on observations and forecast a future event.

World-readiness – Students are able to transfer their learning experiences to real-world situations by acquiring and connecting knowledge from all curricular areas in order to have a better understanding of the world. They have enhanced ability to apply ideas and skills to solve issues that confront all nations. This attribute is measured by the following indicators:

- apply analytical and problem solving skills to overcome world issues based on scientific reasoning;
- integrate concepts and information obtained from various sources to develop holistic understanding of science; and
- identify scientific and technological issues and design models to address them.

Physical wellbeing – Students are able to understand the importance of physical fitness, healthy eating, and living a healthy life to become self-responsible person. This attribute is measured by the following indicators:

- acquire knowledge on healthy habits and way of living;
- make informed decisions on the consumption of food and health care based on scientific knowledge;
- identify the benefits of hygiene and cleanliness; and
- recognise the importance of a healthy lifestyle.

5.6 Measurable Learning Outcomes

By the end of grade VI, the students discover a wide range of living things, materials, and phenomena, though still predominantly focused on their immediate environment and everyday experiences. Students begin to make links between ideas and explain simple abstract and natural phenomena using simple models and theories. They apply their knowledge and understanding of scientific ideas to familiar everyday occurrences, things around, common materials and their personal health. They carry out more systematic investigations while working on their own and with others. Students communicate ideas using a wider range of scientific language, simple diagrams and drawings, and charts and graphs.

Due to the requirements of a technically robust large-scale assessment, it is not possible to measure all the learning outcomes defined in the curriculum. Therefore, the learning outcomes have been reviewed and only objectively measurable ones are selected. In order to ensure that the assessment provides an opportunity for all students to demonstrate their ability, appropriate learning outcomes from two grade levels below and two grade levels above each of the identified grades (grade VI and IX) are reviewed and included, e.g., the learning outcomes for grade VI assessment include learning outcomes from grade IV to VIII.

Table 5.29 Measurable Learning Outcomes for Scientific Literacy (Grade VI)

Strand A: Working scientifically Grade IV - VI	
GVIA1	Explain how living and non- living things work, and establish cause and effect
GVIA2	Verify ideas using given observations from experiments
GVIA3	Make predictions, pose simple questions, and plan activities and investigations using fair test
GVIA4	Identify appropriate equipment, explain different techniques and resources for conducting investigations
GVIA5	Identify appropriate tools and express measurements in standard metric system units
GVIA6	Communicate data in an appropriate and systematic way using a wide range of methods, including diagrams, drawings, tables, bar charts, line graphs
GVIA7	Identify simple patterns or associations in the measurements and observations, and draw conclusions using simple scientific vocabulary
Grade VII and VIII	
GVIIIA1	Describe diverse ways scientists work, including the role of experimentation, evidence, and creative thought in the development of scientific ideas and theories

GVIIIA2	Apply scientific knowledge and understanding to identify and develop questions that can be investigated
GVIIIA3	Explain the importance of considering the validity and reliability of the sources to investigate question(s)
GVIIIA4	Explain ways to reduce errors and obtain reliable evidence
GVIIIA5	Use diagrams, tables, charts and graphs, identify patterns and relationships, draw conclusions, and communicate the data accurately
GVIIIA6	Consider anomalies in observations or measurements and try to explain them
GVIIIA7	Critique experimental procedures and suggest ways to improve the investigation and method
Strand B: Life processes Grade IV to VI	
GIVB1	Classify objects in our surroundings into natural and human-made, and degradable and non-degradable
GIVB2	Describe that organisms need adequate food, light, air, water, and temperature for activities and growth
GIVB3	Draw and label the parts of a flower
GIVB4	Explain the adaption of animals and plants to their environment
GIVB5	Describe feeding habits of animals and construct some simple food chains
GVB1	Differentiate between plants and animals based on their characteristics and explain variation among individuals of one kind within a population
GVB2	Identify different food groups, e.g. carbohydrate, fat, protein, fibre, and describe their functions in maintaining good health
GVB3	State the negative impacts of junk food on health
GVB4	Identify different parts of the circulatory system and explain their functions (blood, heart and blood vessels)
GVB5	Describe the life cycle of common animals
GVB6	Describe the functions of the root in the transportation of water and minerals via the stem to the leaves
GVB7	Describe the parts of a flower and their functions
GVB8	Construct a food web
GVIB1	Classify animals into five classes and describe their characteristics
GVIB2	Explain the importance of varied diet for good health
GVIB3	State the functions of teeth and describe ways to care for them
GVIB4	Describe the process by which the heart pumps blood around the body through the blood vessels, including the blood vessels of lungs
GVIB5	Describe that the skeleton and muscles provide support and protection, and help in the movement
GVIB6	Describe the main stages of growth in humans
GVIB7	Explain the role of a leaf in producing glucose for growth
GVIB8	List the nutrients that plants need for healthy growth

GVIB9	Explain pollination, seed formation (fertilization), seed dispersal, and germination
GVIB10	Describe useful and harmful changes brought about by humans and animals to habitat
GVIB11	State ways by which humans and animals can protect their local environment
GVIB12	Identify the characteristics of living things that enable them to live in different habitats
GVIB13	Represent food chains using pyramids of numbers
GVIB14	Identify beneficial or harmful micro-organisms
GVIIB1	Explain that humans need a balanced diet in order to be healthy
GVIIB2	Explain that plants need carbon dioxide, water and light for photosynthesis and to produce food and oxygen
GVIIB3	Explain germination and the types of germination
GVIIB4	Explain that different habitats support diversity of plants and animals
GVIIB5	Explain variation within a species caused by environmental factors
GVIIB6	Identify food chains in a food web and represent those using pyramids of numbers
GVIIIB1	Identify factors in our environment and lifestyles that influence our health and suggest ways to improve lifestyle and environment
GVIIIB2	Describe that the function of root hairs is to absorb water and minerals from the soil
GVIIIB3	Compare the effect of inorganic farming and organic farming on soil health
GVIIIB4	Explain that some organisms adapt to changes in their environment for their survival
GVIIIB5	Suggest ways to protect the local environment
Strand C: Material and their properties Grade IV to VI	
GIVC1	Explain the differences between a pure substance and a mixture
GIVC2	Identify solids that dissolve in water
GIVC3	Describe filtration and give examples of filtration existing in the local environment
GVC1	Explain that substances are made of elements
GVC2	Explain physical changes in materials, e.g. dissolving, melting, boiling, condensing, freezing, and evaporating
GVC3	Describe separation of solids of different sizes of particles and materials
GVIC1	State the names and symbols for some common elements e.g. carbon, hydrogen, oxygen, nitrogen, iron, gold, silver, copper, magnesium, lead, and aluminium
GVIC2	Classify substances as acids or alkalis
GVIC3	Explain chemical changes in materials e.g., formation of concrete, and baking a cake
GVIC4	Describe the formation of hard water

GVIC5	Identify different ways in which materials are separated
GVIIC1	Explain that the elements are made of atoms
GVIIC2	Associate names and symbols of the elements of atomic number ranging from 1 to 30
GVIIC3	List the names of common acids found in fruits and other food items e.g., citric acid in oranges
GVIIC4	Describe the properties of acids and bases
GVIIC5	Classify solutions as acids and bases and their level of acidity or basicity in terms of their reaction to indicators
GVIIIC1	Explain that mixtures are composed of materials that are not chemically combined and can be separated by techniques such as filtration and distillation
GVIIIC2	State examples of local and industrial applications of filtration and distillation
Strand D: Physical processes **Grade IV to VI**	
GIVD1	Identify contact and non-contact forces
GIVD2	Predict whether a body sinks or floats in water
GIVD3	Describe the sources of electricity
GIVD4	Identify a complete circuit
GIVD5	Differentiate between magnetic and non-magnetic materials
GIVD6	Describe the properties of light e.g. light travels in straight lines and casts shadows
GIVD7	Explain that vibrations cause sounds
GIVD8	Explain rotation and revolution of the Earth and their effects on the formation of days, nights, years, and seasons
GVD1	Describe frictional force with examples and suggest ways of increasing and decreasing frictional force in terms of its advantages and disadvantages
GVD2	Define energy and give examples of where energy is stored e.g., in food, and in a battery
GVD3	State that energy cannot be created or destroyed (Law of Conservation of Energy)
GVD4	Describe different types of energy e.g. light, sound, heat, etc
GVD5	Give some examples of transformation of energy from one type to another
GVD6	Identify conductors and insulators
GVD7	Identify magnetic poles of a magnet and explain that opposite poles of magnets attract and like poles repel
GVD8	Describe that light is composed of seven colours
GVD9	Describe reflection of light from some surfaces e.g. shiny metal and mirrored glass
GVD10	Identify the characteristics of sounds of musical instruments (drums and stringed instruments)

GVID1	Relate gravitational force to the mass of the object
GVID2	Explain the relationship between gravitational force and altitude
GVID3	Determine the density of different regular solids in different liquids
GVID4	Explain potential energy and kinetic energy of a body
GVID5	State advantages and disadvantages of fossil fuels and nuclear energy
GVID6	Identify and draw simple parallel circuits and differentiate them from series circuits (in terms of brightness of bulbs in circuits)
GVID7	Identify the types of circuits at home
GVID8	Draw diagrams to represent magnetic lines of force and explain the power of attraction of a magnet
GVID9	Describe transparent, translucent, and opaque objects based on the transmission of light through different media (refraction)
GVID10	Explain the working of Newton's disc
GVID11	Describe pitch and volume of sounds produced by vibrating objects
GVID12	Describe polar day, polar night, solar eclipse, and lunar eclipse
GVIID1	Identify a variety of energy sources including oil, gas, coal, biomass, food, wind, water, waves, and batteries, and classify energy sources as renewable or non-renewable sources
GVIID2	Describe the formation of fossil fuels
GVIID3	Explain the types of electrical circuits at home
GVIID4	Draw the parts of the basic electrical circuits using symbols of battery, bulb and switch
GVIID5	Read current and voltage in series and parallel circuits, and explain the distribution of voltage and current in parallel circuits
GVIID6	Track the energy transformation in electrical appliances
GVIID7	Explain magnetic effect and magnetic field
GVIID8	Describe the ways of increasing the power of a temporary magnet
GVIID9	State that light travels in straight lines with a finite speed in a uniform medium
GVIID10	Explain laws of reflection of light
GVIID11	Explain that loud sounds and noise pollution can cause damage to the ear and identify ways to reduce sound pollution
GVIID12	Describe the solar system
GVIID13	Explain the causes of solar eclipse and lunar eclipse
GVIIID1	Explain the difference between the weight of an object on Earth and mass of the object
GVIIID2	Describe the variation and effect of gravity due to change in places and altitudes
GVIIID3	Explain differences in temperature in terms of transfer of heat energy
GVIIID4	Define energy and its units of measurement
GVIIID5	Calculate kinetic energy and potential energy
GVIIID6	Describe the transfer of energy in a battery and its exhaustion
GVIIID7	Illustrate a variety of ways in which electrical heating is used at home
GVIIID8	List the uses of electromagnets

GVIIID9	Explain the dispersion of white light to give a range of colours
GVIIID10	Explain that sound travels at different speeds in different media

By the end of grade IX, students would develop basic knowledge and understanding of the concepts of Chemistry, Biology, and Physics, and the fundamental skills needed to explore and discover a wider range of scientific ideas at greater depth, laying the foundations for further study and application of these ideas in new contexts to solve problems. Students should be able to critically evaluate all the relevant evidence to draw conclusions by comparing, synthesising, questioning, and critiquing different sources of information, and communicate their ideas clearly and precisely in a variety of ways.

Table 5.30 Measurable Learning Outcomes for Scientific Literacy (Grade IX)

Strand A: Working scientifically	
Grade VII and VIII	
GVIIIA1	Apply scientific knowledge and understanding to identify and develop questions that can be investigated
GVIIIA2	Explain the importance of considering the validity and reliability of sources to investigate question(s)
GVIIIA3	Explain ways to reduce errors and obtain reliable evidence
GVIIIA4	Use diagrams, tables, charts, and graphs to identify patterns and relationships, draw conclusions, and communicate data accurately
GVIIIA5	Consider anomalies in observations or measurements and try to explain them
GVIIIA6	Critique experimental procedures and suggest ways to improve the investigation and method
Grade IX and X	
GXA1	Use scientific knowledge and understanding to devise questions or ideas that can be investigated
GXA2	Identify an appropriate method and write the procedures to investigate questions or ideas devised
GXA3	Describe key factors that need to be taken into account when collecting evidence
GXA4	Describe the safe use of a wide range of apparatus and chemicals appropriately
GXA5	Assess the level of uncertainty in observations and measurements
GXA6	Communicate qualitative and quantitative data using diagrams, tables, charts, and graphs
GXA7	Obtain the results of calculations to an appropriate degree of accuracy
GXA8	Use observations, scientific knowledge, and understanding to draw conclusions

GXA9	Identify anomalous data giving reasons for rejecting or accepting them using scientific understanding
GXA10	Suggest improvements to the methods used and propose further investigations that could be carried out
GXIA1	Explain theories and models that explain ideas in science and also their limitations
GXIA2	State some benefits and risks of the applications of science, and evaluate the implications of these benefits and risks to the society
GXIA3	Describe the ways in which science informs decision making at the national level and across the world
GXIA4	Identify an appropriate question for investigation using the knowledge acquired from daily life experiences
GXIA5	Describe the purpose and the use of experiments
GXIA6	Distinguish between accuracy and reliability
GXIA7	Identify safety measures, environmental issues, and ethical considerations in an investigation or experiment
GXIA8	Describe methods to safely use apparatus and chemicals
GXIA9	Interpret key trends and patterns in data collected and communicate these in an appropriate form
GXIA10	Assess the reliability and precision of experimental data and draw valid conclusions using scientific knowledge
GXIA11	Apply simple statistical tests and, where appropriate, assign confidence limits to experimental results
GXIA12	Evaluate the techniques used in the experimental activity by recognising their limitations
GXIA13	Suggest improvements and adjustments to the given investigation and methods
Strand B: Life processes	
GVIIB1	Describe that all living organisms are made up of cells and explain differences in the basic structures of an animal cell and a plant cell by labelling their parts
GVIIB2	Label the key structures of respiratory system e.g. lungs, trachea, bronchi, and alveoli
GVIIB3	Describe that aerobic respiration involves chemical reaction in every cell of the human body
GVIIB4	Describe male and female reproductive systems in humans using diagrams
GVIIB5	Describe the basic stages of the menstrual cycle
GVIIB6	Draw a labelled diagram of a neuron and label the key structures of the nervous system and explain their functions
GVIIB7	Explain the importance of personal hygiene and list some common diseases, their effects, and their prevention
GVIIB8	Explain using word equation that plants need carbon dioxide, water, and light for photosynthesis and to produce food and oxygen

GVIIB9	Explain the importance of nitrogen and phosphorus for growth of plants
GVIIB10	Explain that different habitats support diversity of plants and animals
GVIIB11	Explain variation within a species caused by environmental factors
GVIIB12	Define the term ecosystem and identify a few local ecosystems
GVIIIB1	Describe the functions of different parts of animal cell and plant cell (e.g. chloroplast and cell wall, cytoplasm, and the nucleus in both animal cell and plant cell)
GVIIIB2	Explain that cells can form tissues, and tissues can form organs, and organs form organ systems, and different organ systems make an organism
GVIIIB3	Label the key structures of the digestive system and state their functions
GVIIIB4	Explain the principle of digestion and describe absorption of digested soluble products into the bloodstream
GVIIIB5	Explain the role of the lungs in gaseous exchange
GVIIIB6	Explain the transportation of reactants and the products of respiration to and from the cells of the human body
GVIIIB7	Identify factors in our environment and their lifestyles that are detrimental to our health and suggest ways to improve lifestyle and environment
GVIIIB8	Describe the function of root hairs
GVIIIB9	Explain asexual reproduction and sexual reproduction and propagation in plants
GVIIIB10	Describe that some organisms are adapted to changes in their environment for their survival
GVIIIB11	Explain the effect of predation and competition for resources on the size of different populations in a habitat
GVIIIB12	Explain biodiversity and its importance
GVIIIB13	Give examples of ways to protect the local environment
GIXB1	Describe the basic structure of an animal cell and plant cell and state their functions
GIXB2	Explain the need for staining
GIXB3	Explain how different cells (e.g. root hair cells, sperm cells) are adapted to their functions and relate cells and cell function to life processes in a variety of organisms
GIXB4	Explain that the nucleus contains chromosomes that carry genes
GIXB5	Explain the processes of digestion, including the adaptations of digestive organs to their functions
GIXB6	Describe the basic structure of the heart, veins, arteries, and capillaries
GIXB7	Describe the basic structure of the breathing system (lungs, diaphragm, bronchi, and alveoli) and its role in providing cells with oxygen for respiration and explain that respiration
GIXB8	Describe the types, structure, and functions of the nervous system

GIXB9	Justify the presences of myelin sheath in some neurons and explain the role of neurones in transmitting electrochemical impulses
GIXB10	Name glands and the hormones they secrete
GIXB11	Describe how humans maintain a constant body temperature
GIXB12	Describe the stages of menstrual cycle and the control of menstrual cycle by the hormones FSH, LH, oestrogen, and progesterone
GIXB13	Describe the defence mechanisms of our body, including the role of the skin, blood, and mucous membranes of the respiratory tract
GIXB14	Explain the effect of solvents, alcohol, tobacco, and other drugs on our body functions
GIXB15	Explain the importance of healthy plant growth by the uptake and utilisation of mineral salts
GIXB16	Name the basic plant hormones and describe their roles in the growth and development of plants
GIXB17	Explain transpiration in plants and the transportation of substances within plants that are required for growth and reproduction
GIXB18	Describe that variation arises from genetic causes, environmental causes, and/or a combination of both
GIXB19	Explain the basic principles of cloning, selective breeding, and genetic engineering, and their implications
GIXB20	Evaluate the implications of reduced variation within a population
GIXB21	Define a gene as a section of DNA and describe its relationship with chromosomes
GIXB22	State the theories of evolution and the evidence for them
GIXB23	Explain, using ideas of interdependence, adaptation, competition, and predation, and about the distribution and relative abundance of organisms in a habitat
GIXB24	Explain the impact of humans on the environment
GIXB25	Explain the roles of microbes and other organisms in the decomposition of organic materials and the carbon and nitrogen cycles
GXB1	Explain how substances enter and leave cells through the cell membrane by diffusion, osmosis, and active transport, and the exchange of substances between capillaries and tissue
GXB2	Explain the role of enzymes, stomach acid, and bile in the process of digestion
GXB3	Categorise respiration as aerobic respiration or anaerobic respiration based on the availability of oxygen
GXB4	Describe the pathway taken by nervous impulses in response to a variety of stimuli, including the roles of receptors, sensory neurons, and motor neurons
GXB5	Explain the rapid responses to dangerous stimuli by the reflex arc and the relay neuron
GXB6	Describe removal of waste products of body functions by the lungs and the kidneys

GXB7	Explain the uses of hormones in controlling fertility (oral contraceptives inhibiting FSH production, and giving FSH as a fertility drug)
GXB8	Explain the utilisation of the products of photosynthesis by plants
GXB9	Explain that plant hormones are used to control plant growth and development, including the plant hormones used commercially (rooting and grafting)
GXB10	Explain how minerals and food synthesised in the leaves are transported to other parts of the plants
GXB11	Explain that sexual reproduction is a source of genetic variation, while asexual reproduction produces clones
GXB12	Explain that mutation is a source of genetic variation and has a number of causes
	Describe the structure of DNA and its functions
GXB14	Describe the mechanism of monohybrid inheritance, where there are dominant and recessive alleles
GXB15	Explain that variation and selection may lead to evolution or to extinction
GXIB1	Describe the structure of the mammalian gas exchange system and the essential features and roles of the alveoli
GXIB2	Describe the structure of the mammalian heart, including the atria and ventricles, atrioventricular, and semilunar valves
GXIB3	Describe the structure and roles of arteries, veins, and capillaries
GXIB4	Explain the principles of homeostasis in terms of receptors, effectors, and negative feedback
GXIB5	Determine the physiological and behavioural responses that maintain a constant core body temperature in ectotherms and endotherms, with reference to peripheral temperature receptors, the hypothalamus, and effectors in skin and muscles
GXIB6	Explain mammalian hormones and describe the roles of FSH, LH, oestrogen, and progesterone in controlling the human menstrual cycle
GXIB7	Explain the movement of water between plant cells and their environment in terms of water potential
GXIB8	Evaluate the ethical, moral, and social issues associated with genetic engineering
GXIB9	Distinguish the types of variation
GXIB10	Define the terms habitat, population, and ecosystem
GXIB11	Describe the stages in the carbon and nitrogen cycle and explain the role of microorganisms in the cycle
Strand C: Material and their properties	
GVIIC1	Identify naturally occurring elements that make up the materials
GVIIC2	Justify that the elements are organised in the Periodic Table in vertical groups that have similar properties

GVIIC3	Explain that elements are organised in horizontal rows in the Periodic Table called periods
GVIIIC1	Describe the different particles in the atom (proton, electron, and neutron) including their charges and relative masses
GVIIIC2	Describe the simple model of the atom, and define mass number and atomic number
GVIIIC3	Explain electronic configuration and valency with examples
GVIIIC4	Write word equation and chemical equation for the reactions of elements to form compounds
GVIIIC5	Explain that mass is conserved when chemical reactions take place because of the presence of the same atoms in the reactants and the products
GVIIIC6	State examples of local and industrial applications of filtration, distillation, and chromatography
GVIIIC7	State the reactions in the form of word equation and chemical equation of metals and bases (including metal carbonates) with common acids
GIXC1	Describe the structure and bonding in metal elements and explain duplet and octet rules
GIXC2	Explain the formation of ions and giant ionic lattices, and the formation of covalent
GIXC3	Describe that elements (e.g. H_2, O_2, N_2, C) or compounds (e.g. CH_4, CO_2, SiO_2) can form covalent bonds that may have simple molecular structures or giant structures
GIXC4	Differentiate physical properties of substances with giant structures (metallic, ionic, or covalent) from those with simple molecular structures
GIXC5	Explain that alkanes are saturated hydrocarbons, while alkenes and alkynes are unsaturated hydrocarbons
GIXC6	Apply the general formula and IUPAC rules to the nomenclature for alkanes (C_nH_{2n+2}), alkenes (C_nH_{2n}), and alkynes (C_nH_{2n-2})
GIXC7	Draw and name structural isomers for simple alkanes, alkenes, and alkynes, e.g., hexane
GIXC8	State the products of burning hydrocarbons and write balanced chemical equations for these reactions
GIXC9	Describe the process of fractional distillation of crude oil and the uses of the different fractions of crude oil and addition polymers
GIXC10	Explain cracking to obtain more useful alkanes and alkenes
GIXC11	Describe reactions of common metals with acids, oxygen, and water using balanced chemical equations, and construct a reactivity series to predict the reactions of other metal
GIXC12	Describe the different parts of the nitrogen cycle
GIXC13	Explain the manufacture of nitrogenous fertilisers and the importance of converting nitrogen to ammonia for agriculture
GIXC14	Explain the environmental consequences of the over-use of chemical fertilizers

GIXC15	Describe the role of carbon cycle and explain that the burning of fossil fuels can upset the balance of the carbon cycle resulting in global climate change
GIXC16	State the environmental hazards caused by waste polymers and measures to prevent them
GIXC17	Identify that each element has a specific number of protons in the nucleus
GIXC18	Explain the connection between the arrangement of outer electrons and the position of an element in the Periodic Table, and predict the group of the given elements
GIXC19	Explain that elements in the same group of the Periodic Table have similar properties and justify with reasons
GIXC20	Explain periodic properties and their variations across the period and down the group
GIXC21	State the physical properties e.g. m.p.s and b.p.s of the Noble Gases and the alkali metals, and describe the changes in these properties as the order in group descends
GIXC22	Describe the trends of the reactions of the alkali metals, Li, Na, and K with water, oxygen, and chlorine and write balanced chemical equations for each reaction, and also predict the reactions of Cs and Fr with water, oxygen, and chlorine
GIXC23	State uses of the Noble Gases based on their properties
GIXC24	Justify that mass is conserved in all chemical reactions and there is a great variation in the rates at which these reactions take place and that these rates can be varied by altering temperature and pressure, by changing the surface area of a solid reactant, or by adding a catalyst
GIXC25	Classify reactions as exothermic or endothermic reactions depending on the temperature change that takes place during the course of the reaction
GXC1	Describe the general properties of alcohols and name the first three alcohols
GXC2	Describe the process of industrial manufacture of ethanol and the principles of manufacture of alcohol in the distilleries
GXC3	Compare the economic and environmental advantages and disadvantages of the production of alcohol, and state the uses of ethanol and the social and health issues of drinking alcohol
GXC4	Explain the effects of the reactivity of a metal in determining the extraction process from its naturally occurring ores
GXC5	Explain that the rate of many reactions depend on the frequency and energy of collisions between particles, temperature, and concentration
GXC6	Classify reactions as exothermic or endothermic reactions, and describe the energy transfer involved in making and breaking of chemical bonds in chemical reactions
GXIC1	Explain ionic bond and the nature of the covalent bond
GXIC2	Define the term electronegativity and describe the structure of metals in terms of the attraction of positive metal ions

GXIC3	Apply the IUPAC rules to the nomenclature of simple alkanes, alkynes, and alkenes
GXIC4	Write the general formula for alkanes, alkynes, and alkenes and write correct formulae for an alkyne
GXIC5	Explain that alkenes and alkynes are unsaturated hydrocarbons and state the uses of polymers
GXIC6	Compare the reactions of alkanes, alkenes, and alkynes
GXIC7	Explain the effects of global warming and climate change, and explain actions that can mitigate them
Strand D: Physical processes	
GVIID1	Calculate the average speed of an object
GVIID2	Describe the effects of unbalanced and balanced forces to predict the direction of movement of objects
GVIID3	Define density and relative density
GVIID4	State that light travels in straight lines with a finite speed in a uniform medium
GVIID5	Describe the solar system
GVIIID1	Differentiate speed and velocity
GVIIID2	Calculate pressure using formula P=F/A
GVIIID3	Differentiate between temperature and heat and explain that differences in temperature can lead to the transfer of heat energy by conduction, convection, and radiation
GVIIID4	Define resistance, voltage, and current with symbols, and describe the relationship between current and voltage and the calculation of resistance and voltage using Ohm's Law
GVIIID5	Describe the difference between direct current (d.c.) and alternating current (a.c.) in terms of source of electricity
GVIIID6	Describe refraction of light at the boundary between two different materials and explain the dispersion of white light to give a range of colours
GVIIID7	Formulate the relationship between the loudness of the sound and the amplitude of the vibration, and the pitch of the sound and the frequency of the vibration causing it
GIXD1	Compare speed and velocity and determine distance, time, and speed graphically
GIXD2	Explain that balanced forces do not alter the velocity of a moving object and apply equations of motions to simple numerical problems
GIXD3	State that acceleration is change in velocity per unit time and explain momentum and its effect on stopping distances
GIXD4	Explain Newton's law of motions and define one newton
GIXD5	Derive equation of Newton's second law of motion as F=ma, where mass is constant, considering that force and acceleration are always in the same direction
GIXD6	Explain pressure and laws of liquid pressure

GIXD7	Derive the expression, p= hdg to show pressure in a liquid increases with depth
GIXD8	Describe upthrust and factors affecting upthrust, explain Archimedes' principle and buoyancy and the equilibrium of floating bodies
GIXD9	State the principles of floatation and its application in everyday life
GIXD10	Determine density of irregular solids and liquid using Archimedes' principle
GIXD11	Convert temperatures from degree Celsius to Kelvin and Fahrenheit
GIXD12	Explain the transfer of thermal energy, thermal equilibrium, and use of insulation
GIXD13	Define specific heat capacity and apply equation, $Q = mc\Delta T$ and Principle of Calorimetry ($Q = V \times I \times t$) in numerical problems
GIXD14	Explain latent heat of fusion, latent heat of vaporisation, and thermal expansion of matter
GIXD15	Explain the terms a.c. and d.c., Lorentz force, and Fleming's Left Hand Rule
GIXD16	Describe the working of simple d.c. motor and explain electromagnetic induction (Faraday's laws, Lenz's law, and Fleming's Right-Hand Rule)
GIXD17	Explain charging of an insulating material by friction
GIXD18	Describe the forces of attraction between unlike charges (positive and negative charges) and forces of repulsion between like charges
GIXD19	Explain electric current, and calculate steady current using the formula, I = dq /dq
GIXD20	Describe refraction through glass slab, lateral displacement, and the refractive index
GIXD21	Explain the principle of reversibility and the relationship among refractive index, real depth, and apparent depth
GIXD22	Explain dispersion and refractive index of different coloured light through a prism
GIXD23	Describe the properties of light waves (reflection and refraction) total internal reflection, and its occurrence and applications
GIXD24	Describe properties of sound waves (reflection and refraction), define time period, frequency, wavelength and amplitude of a wave, and calculate speed, frequency, and wavelength of a wave using the equation $v = f \lambda$
GIXD25	Explain transfer of energy by waves, uses of ultrasound, and radio waves
GIXD26	Describe asteroids, comets, meteors and meteoroids, black holes and wormholes
GIXD27	Compare the relative sizes and positions of heavenly bodies in the universe (parallax method and Kepler's law)
GIXD28	Describe the development of telescopes and satellites that has helped our knowledge and understanding of the Solar System and the universe
GXD1	Explain stability of bodies in reference to stable equilibrium, unstable equilibrium, neutral equilibrium, and system in equilibrium
GXD2	Explain pressure and the factors affecting the magnitude of pressure

GXD3	State Archimedes' principle and describe liquid pressure
GXD4	Apply equation for pressure, P = F /A and equation for density, p= m/V
GXID1	Define displacement, speed, velocity, and acceleration and represent distance travelled, displacement, speed, velocity, and acceleration using graphical methods
GXID2	Interpret displacement-time graph and speed-time graph for uniform accelerations, and find the distance travelled by a body calculating the area under a speed-time graph and acceleration using the slope of a velocity-time graph
GXID3	Derive and apply equations of motion, from the definitions of velocity, acceleration, and kinematic equations which represent uniformly accelerated motion in a straight line
GXID4	Define potential difference and the volt in terms of work done per unit charge, resistance, and the ohm
GXID5	Calculate the total resistance of resistors in series and the total conductance
GXID6	State the laws of refraction of light
GXID7	Define refractive index, explain critical angle and total internal reflection, and relate refractive index to the critical angle
GXID8	Describe the application of total internal reflection in the transmission of light along an optical fibre
GXID9	Define displacement, amplitude, frequency, period, speed, and wavelength and deduce equation, $v = f\lambda$
GXID10	Describe the practical uses and dangers of electromagnetic waves
GXID11	Describe orbital motions, conic sections, and gravitational orbits using Kepler's Laws and Newtonian gravitation

CHAPTER 6: CONTEXTUAL QUESTIONNAIRES

6.1 Introduction

Large-scale assessments often incorporate contextual components by asking students, principals and teachers about their background, experiences, and values regarding education. The NEA will include a set of questions to gather information on the nine student attributes identified in the Bhutan Education Blueprint 2014-24. These findings will inform national policy and decision making processes aligned to the 21st century competencies.

This chapter will also discuss the importance of contextual questionnaires with a special emphasis on the content, components, and conceptual framework. To accurately identify and map the relevant context, information will be collected through four questionnaires viz. Student, Teacher, School, and Dzongkhag/Thromde Questionnaires.

6.2 The Importance of Contextual Questionnaires

Contextual questionnaire enables teachers, educators and policymakers to understand the variables that could influence the learning outcomes of students. One of the objectives of the NEA is to guide educational policy developments and interventions. This can be achieved by collecting a comparable data set on contextual information and learning outcomes of students. While the cognitive instruments measure students' learning outcomes, the contextual questionnaires collect data about variables that might be associated with, or help explain, differences in the levels of student performance (Anderson & Morgan, 2008, p. xi).

Data collected from the contextual questionnaires will help understand the practical context in which student learning occurs. For example, information on parental qualification level would indicate the type of academic support provided at home which has impact on the learning outcomes.

6.3 Categorising Contextual Factors

The NEA takes into account contextual factors which will be observed at various levels such as country, community, school, classroom, teacher, home, and the individual student. These contextual factors will be categorised as inputs, processes, and outcomes (ACER-GEM, 2016). The categorised contextual factors are described below:

Input

Inputs are a range of factors that affect how student learning takes place. Inputs are not easily influenced by other contextual factors and include demographics, structural, resources, and information (Keeves, 1972).

These factors can be measured at different levels. At the student level, the inputs will include demographic information such as gender, age, language spoken at home, and structural information such as socio-economic index. At the school level, inputs may include resources such as student-teacher ratio, number of classrooms, and access to additional learning resources.

Process

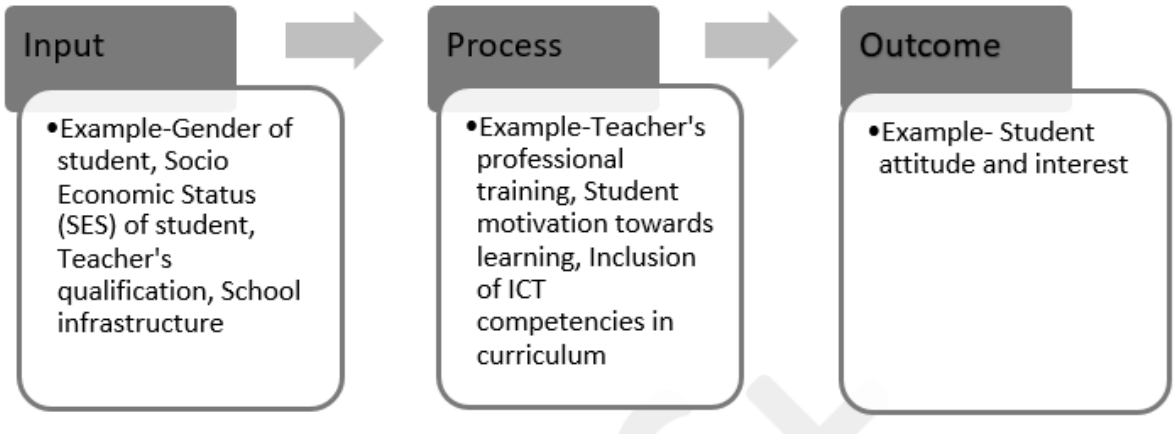
Processes are factors related to student learning and are constrained by the inputs. Processes include values, practices, and behaviours (Keeves, 1972).
Practices and behaviours refer to activities undertaken by various participants in an education system, namely students, teachers, school leaders, education ministry and funding agencies.

At the student level, practices and behaviours include reading habits, interaction in the classroom, and time spent on studies. Teacher-level processes refer to factors such as training programmes, resources evaluation methods, and the frequency of checking homework. Practices and behaviours at the school level include decision-making processes such as the inclusion of 21st century skills in the curriculum, and teacher training and development.

Outcome

Outcome factors are related to attitudes, values, and interests at the student level. These outcomes are continuously developed over time within individuals after experiencing various factors in the input and process. They are frequently measured in terms of students' attitude towards school and learning, as well as their interests in various subjects. Input and process factors at different levels can contribute to determine the non-cognitive outcomes of students.

The linear model can be depicted as



6.4 Conceptual Framework for the Contextual Questionnaires

A conceptual framework specifies the areas of focus on which the questionnaires are developed according to the categorisation of the contextual factors. Table 6.1 illustrates the conceptual framework for the questionnaires with the example variables which may affect student learning at school.

Table 6.31 The conceptual framework of contextual questionnaires

Dimensions					
Level	**Input**		**Process**		**Outcome**
	Structure/ demographic	**Resource**	**Value**	**Practice/ behaviour**	
Country	Different regions	Education budget	Nine student attributes	21st century competencies in the curriculum and teaching processes	Indicators related to student attitudes and values, educational outcomes
Community	Rural/Urban	Inclusive education	Equity	Creating an enabling condition (SEN programmes)	
School	Class size	Infrastructure	Academic success	Monitoring and support	
Classroom/ teacher	Qualification of teacher	Teaching material	Expectation of the student performance	Teacher training and practices	
Home	Language spoken at home	Resources available at home	Value of education	Parental involvement	
Student	Gender	Study materials	Motivation towards learning	Reading habits	

(Framework adapted from Lietz, 1996)

The first column shows different levels to which the collected information correspond, while different dimensions of each level are specified across the cells according to the input, process and outcome. The cells allow categorisation of any variable depending on the level and the dimension with which they are associated. For example, the education budget is a country level variable that is associated with the resource dimension, while teacher training is a process variable at the classroom/teacher level.

In general, factors in the vertical cells are frequently interdependent. For example, students' motivation towards learning and how their families value education may be

linked to their academic success. Similar is the case with the factors in the horizontal cells.

The outcomes in the framework are considered at the individual student level. However, if such measures are aggregated correctly they can be used as outcome measures at higher levels. For example, the variables related to students' attitude and interest can be aggregated to compare their attitude and interest at the classroom, school, or country level.

A similar conceptual framework will be followed for the development of Student, Teacher, School and Dzongkhag/Thromde Questionnaires.

6.5 Content of Contextual Questionnaires

The content of the contextual questionnaires will be based on the conceptual framework. Questionnaires for students, teachers, schools and Dzongkhags/Thromdes will incorporate the prioritised specificities in the areas of input, process and outcome. Research based on global trends, such as Hattie's list of factors influencing students' achievement, PISA, TIMSS and PIRLS are considered where relevant.

6.5.1 Student questionnaire

The student questionnaire contains questions pertaining to the students' background such as gender, age, language used at home and social group. It also contains questions pertaining to the socio-economic status, alternative help in studies, activities outside school, attitude towards learning, classroom and school environment, pedagogical practices and nine student attributes.

6.5.2 Teacher questionnaire

The teacher questionnaire contains questions pertaining to the teachers' background such as gender, social group, highest academic and professional qualification. It also contains questions pertaining to the teaching and assessment practices, professional enhancement, classroom and school environment, attitude towards teaching environment and nine student attributes.

6.5.3 Principal questionnaire

The principal questionnaire contains questions pertaining to the principal's background such as gender, social group, highest academic, professional qualification and leadership experience. It also contains questions pertaining to school background, principal's attitude towards profession, student and teacher characteristics, teacher efficacy, school environment, monitoring and support and nine student attributes.

6.5.4 Dzongkhag / Thromde questionnaire

The Dzongkhag/Thromde questionnaire contains questions pertaining to the CDEOs/CTEOs such as gender, social group, highest academic, professional qualification and leadership experience. It also contains questions pertaining to the Dzongkhag/Thromde background, CDEOs/CTEOs attitude towards profession, principals' characteristics, teacher efficacy, school environment, professional support and development, planning and implementation, management and administration of resources, school autonomy and responsibility, and nine student attributes.

Annexures 1, 2, 3 and 4 are the blueprints for contextual questionnaires that highlight the factors, variables, variable types and the expected outcomes.

6.6 Inclusion of Nine Student Attributes in the Questionnaires

The Nine Student Attributes defined in the Bhutan Education Blueprint 2014-24 encompasses the 21st century competencies. While some of the attributes can be explicitly measured through cognitive questionnaires, others such as enduring habits of lifelong learning, spirituality and character, and Bhutan-specific competencies based on '*tha-dam-tshig*' and '*ley-ju-drey*' require contextual questionnaires.

To obtain information on the student attributes, set of questions will be incorporated as a part of the student, teacher, school and Dzongkhag/Thromde questionnaires designed for the NEA. Questions will be developed to collect information on the following areas:

- nine student attributes included in the current policy guidelines and curriculum;
- nine student attributes currently being taught to students;
- whether these attributes are being assessed; and
- the extent to which students embody the attributes to represent their holistic development.

CHAPTER 7: ASSESSMENT DESIGN

7.1 Introduction

The NEA is designed to provide information about students' achievement in Reading Literacy, Writing Literacy, Listening and Speaking Literacy, Mathematical Literacy, and Scientific Literacy, which can be used for evidence-based decision making by policymakers and education leaders to improve students' achievement levels and practices as set out in the national goals.

The key aspect of the NEA is to monitor trends in performance between grades and track changes in students' performance from one assessment cycle to the next. This will assist in tracking the students' performance over the years, enabling the government to intervene and support to improve the student learning outcomes. The NEA is intended to collect information about student performance in different domains at a regular interval of three years along with the contextual information that would have an impact on their learning.

7.2 Instrument Design

Key considerations at the time of designing the instruments include the kind of data to be collected, the manner in which it will be analysed and reported, and how the findings of the assessment might be used in policymaking and improving the education system.

Two different types of instruments will be developed for NEA, viz., cognitive instruments and contextual questionnaires. Different instruments will be developed for each grade level.

Cognitive instruments will cover domain-specific assessment materials. The topics covered and the assessment tasks developed will be appropriately mapped to the assessment framework. Two types of items that shall be used to assess the cognitive domains are MCQ and CRT. Considering the nature of large-scale assessments, the majority of the items will be MCQs. Item difficulty and complexity shall also be considered.

Contextual questionnaires will collect information about variables affecting the learning environment of the student. The usefulness of each variable will be

described within the analysis plan, including how to analyse the variables. Variables that are able to produce reliable data and are critical to inform education policy development will be selected for the contextual instruments.

Multiple Choice and Free-Response questions shall be used to collect data from the contextual questionnaires. Respondents will have the opportunity to select one or more options in multiple-choice responses and be able to provide a response of their choice without any restrictions in the case of free-response questions. Given the nature of large-scale assessment, the majority of items here too will be multiple choice. Linguistic difficulty and complexity shall also be considered when developing the contextual questionnaires.

The instruments across all domains will be designed in English language except for Dzongkha. It will be ensured that respondents are able to understand and respond appropriately. The instruments will contain clear instructions on how the questions should be answered.

Annexure 5 provides an example of the steps involved in the development of contextual questionnaires, and the person(s) who should be responsible for completing the task.

7.3 Finalisation of the Instruments

The instruments will be reviewed and revised by a panel of experts and will undergo a field trial to establish the suitability of questions, and appropriateness and clarity of the language used. After the field trial, the data will be analysed and instruments modified, if necessary.

Cognitive instrument layout –While designing the cognitive instruments for NEA, the following points will be considered:

- Appropriateness of items for the grade level.
- Providing items with a range of cognitive demand to get to the correct answer.
- Mapping of items to criteria laid down in the assessment framework for the subject-specific domain.

Questionnaire layout – While designing the questionnaire layout for NEA, the following points will be taken into account:

- Questionnaires that are easy to use for the respondent must have
    - a simple, consistent way of answering items;
    - an uncluttered presentation;
    - response categories that are clearly associated with each question; and

  - explanations for codes used if any.
- Layout of questionnaires must be easy to use for data processing after administration.

7.4 Data Analysis Plan

Item response theory will be the preferred approach for the data analysis of cognitive instruments. The analysis plan will involve using the one-parameter model (Rasch Model) in psychometric analysis, item calibration, linking tests, mapping student performance through the development of learning progressions, drawing population inferences through applying weights, and replication methods using advanced approaches.
An outline of the proposed contextual data analysis will be ready before the finalisation of the key variables included in each instrument. The data analysis plan will specify the following:

- The kind of information that will be provided by each question in an instrument.
- The manner in which this information will be used in the analysis.
- The method by which the variables included in the instruments will be meaningfully analysed while ensuring that there is no redundancy in the analysis.

In some cases, it may be difficult to fully capture a construct by asking a single question in an instrument. For example, a composite index of socio-economic variables will be constructed by combining various background factors of parents of the sample students such as their economic background, their education and occupation, etc. in a weighted manner. Similarly, a composite index of nine student attributes will be constructed by using cognitive instrument data and contextual questionnaires. The data analysis plan will describe how these variables will be aggregated to produce the composite index (if required) and how the composite index will be used.

The information captured by the instruments will be analysed with various statistical techniques such as descriptive statistics, graphical analysis, comparing means of two variables, correlation, and regression analysis. The choice of data analysis methodology will be dependent on the types of variables, research model, and their hypotheses.

7.5 Assessment Cycle

The NEA for grades III, VI, and IX will be conducted in a three-year cycle model. This will ensure that the gap between the grades will be the same as the number of years between each cycle. This model will serve two fundamental purposes, viz., tracking the same cohort across the school years, and identifying the impact of long-term interventions in school education system in Bhutan.

This model will allow policy changes to be introduced at grade III (entry-level grade) and then to monitor the effect of these changes in phases. It reduces the load of introducing changes to cohorts accustomed to one model of education. The diagram below shows the design in which different cohorts can be tracked and their progress monitored over a period of time. The complete cycle for cohort 1 to cohort 3 is visible and the same can be replicated in the model.

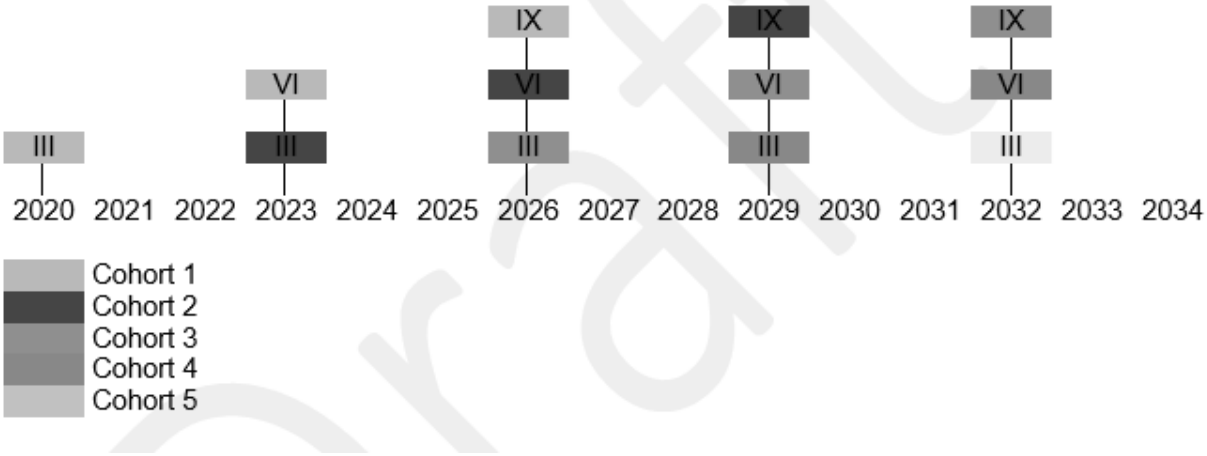


Figure 7.2: Tracking student performance in the NEA

In 2020, Grade III will be assessed in Reading Literacy and Mathematical Literacy domains. After three years, along with grade III, grade VI will be assessed in Reading Literacy, Writing Literacy, Mathematical Literacy and Scientific Literacy. In 2026, along with grades III and VI, grade IX will be assessed in Reading Literacy, Writing Literacy, Mathematical Literacy and Scientific Literacy.

7.6 Sampling

The NEA is a sample-based assessment for students in grades III, VI, and IX across Bhutan *and students studying at these grades are defined as the target population*. In order to achieve the level of precision and accuracy in the result, it is recommended that systematic sampling is used to identify a representative sample and report on subgroups of interest.

The NEA will follow a systematic multi-level sampling similar to renowned large-scale learning assessments, such as PISA and TIMSS. The sampling will have two levels − school level and student level. Schools will be sampled at the first level by the method called Probability Proportional to Size, and students will be sampled at the second level by Simple Random Sampling. For consistency, the NEA shall a single data source across all sampling units when constructing the sample frame.

7.6.1 Level 1 - School sampling within each sampling unit

The sampling frame for each grade would list all schools where the target population is studying. A separate sampling frame for each grade will be developed.

The details of the sampling requirement will be decided during the sample planning based on the suggestions provided by experts. The details will include a measure of size (MOS), stratification variables, use of replacement schools, and method for identification and non-response adjustments at the school and student levels.

7.6.2 Level 2 - Student sampling within each sample school

Within school, sampling procedures involve the selection of students prior to testing. When deciding which within-school sampling approach to use, it is important to consider how best to balance technical and logistical demands, and to ensure that every student has an equal chance of being selected in the sample. Stratification or clustering at this level will decrease the efficiency of the sample in order to achieve the same level of precision, more students would be required than under a simple random sampling scenario.

7.7 Reporting Student Achievement

The data collected on students' response data collected will be used to develop a scale for mapping student performance, comparing performance between sub-groups of the population, and also for comparisons over time. Development of the scale will be followed by describing the achievements at various levels on the scale to meaningfully draw a composite picture of student performance in the respective domains. These descriptions will form learning progression or metrics. It must be pointed out that different domains will have different scales and the scales and scores are not comparable between domains. This implies that a scale score of 250 in the mathematics domain does not have the same substantive meaning as a scale score of 250 in the science domain.

In 2020, a learning progression will be developed for grade III. In the subsequent cycles, when other grades are included in the assessment, this learning progression will be further enriched to have a learning progression from grade III to the highest grades being assessed under the NEA for each cognitive domain. This learning progression will cover domain-specific competencies and content to present a composite picture of achievement on a scale. Bhutan will then be able to compare students' performance of various subgroups on this learning progression with the help of the scale score, and will also be able to describe the achievements using the learning progression.

The scale will have a midpoint of 250 for grade III, and 50 scale score points will be equivalent to one standard deviation for the entire student distribution in NEA 2020. Other grades, when included, will use the same scale and map the progression accordingly on the same scale. Some items from the cycle will be used in the next cycle to link the assessment results from the two cycles and report the performance of both assessments on the same scale. This will enable comparisons between cycles and monitoring of performance over time and between grades.

Development of a learning progression to describe performance of students or groups requires collecting data on a large number of items. There are limitations on the number of items a student can attempt before fatigue sets in, and also on the time for which a student can sit for a test before they start losing interest. Both of these limiting factors have an influence on gathering reliable information about student performance. The next section describes a model in which a large number of items can be assessed and also addresses the issues of students fatigue and interest.

In addition to student performance in each domain, the NEA will also collect contextual information about the students and other factors that influence student learning, as described in the previous chapter. Analysis of contextual variables and their association with students' performance will provide meaningful insights into understanding students' learning processes and ultimately developing education policies, interventions, and reforms.

7.8 Assessment Booklet Design

To correctly measure a learning progression, the number of items required to be tested in the NEA will usually be more than the items that can be possibly answered by one student within the available testing time. To mitigate this problem, the NEA will use multiple booklets which involve assigning all assessment items to at least one assessment booklet for each domain. There will be some items which would be common between booklets to enable linking of student responses from different booklets. Each student will be required to complete only one booklet in a domain. Selection of link items will be undertaken using the two basic criteria:

- link items have a range of difficulties; and
- link items cover all strands in the domain.

This implies that the link items will behave somewhat like a mini test. However, the exact number of link items will depend on the number of strands and also the range of difficulties covered. Usually, 10-15 items that are statistically sound and meet the above-mentioned criteria are used as link items between two booklets.

For vertical linking between two grades, appropriate items must be chosen for both grades and that all students of any particular grade do not either get a zero or full

credit in those items. For example, if item **A** is a link item between grades III and VI, it should not have a situation where all students of grade III or VI get a zero or full credit in the item.

Considering the complexity of measuring students' learning, the NEA shall develop a booklet design that enables the collection of sufficient and reliable information through **two** sets of booklets per domain. Some considerations while designing booklets are:

- statistical objectives to be met;
- reporting student performance;
- test administration format (for example, single domain, multiple domains, all domains administered to one student);
- student testing time;
- item positioning effect;
- item linking (horizontal, vertical, and historical);
- number of items in the pool ; and
- number of items to be released to the public.

There are multiple approaches to booklet design, like rotated design, matrix design, and separate booklet design. The NEA will use a simpler version of *separate booklets* in which all of the items in a pool can be grouped into clusters. The clusters are then assigned to different booklets. However, there would be a cluster or a number of clusters which would be assigned to multiple booklets for the purpose of linking. The items in the pool will be grouped into clusters, the size of which would depend on one of two factors, viz., the number of items in each cluster, or time required to answer the questions in each cluster. When the number of items in each cluster is used as the deciding factor of cluster size, test developers need to be careful to develop clusters that require approximately the same time to answer them. When the duration of time required to answer questions in a given cluster is kept the same, then test developers have flexibility to vary the number of items in each cluster. However, given that the number of items in each cluster will be less than the ideal number required, it may not be possible to cover all content areas. Therefore, item developer must be careful in maintaining equivalent difficulty levels for all clusters. The difficulty level of each cluster will be decided based on the trial data available for the NEA. For the purpose of the NEA, the clusters will have an equal number of items and each student will be assessed on an equal number of items.

Table 7.1 below shows a sample booklet design for a domain. In the design, all test items have been assigned to one of the seven clusters. Among the seven clusters, cluster 2 is assigned to all sets. This cluster 2 is the link cluster and the remaining six clusters are assigned to the two booklets.

Table 7.32 An example of two booklet design for a domain

Booklet A	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Booklet B	Cluster 5	Cluster 2	Cluster 6	Cluster 7

The same model can be used for assessment design for all grades being assessed, and there could be link clusters between grades to enable comparisons between them. It should be noted that all clusters will have the same number of items in a grade. However, the number of items will increase in a cluster as grade level increases.

7.9 Student Testing Time

The testing time allocated for the administration of the items has an impact on the booklet design. It determines the number of items that can be administered to each student. For example, if testing time allocated for the cognitive instrument is 40 minutes, it will allow only a certain number of items in the domain to be administered to each student. Generally, each item will require a different span of time to answer and therefore, a number of items are grouped into clusters that have similar difficulty and similar testing time. These clusters can then be assigned to different booklets that can be administered to students.

In the NEA, time will be allocated for administration (instructions, etc.) for responding to the cognitive instrument as well as for responding to the questionnaire, as shown in the table below. The instructional time shown in the table is for both the cognitive and contextual instrument.

Table 7.33 Assessment time for one domain

	Instructional time	Questionnaire time	Domain time	Total
Grade III	10 min	15 min	40 min	65 min
Grade VI	10 min	15 min	60 min	85 min
Grade IX	10 min	15 min	60 min	85 min

According to the table above, each student of grade III will need a total of 65 minutes for the assessment where as students of grades VI and IX will need 85 minutes each to assess one domain. For assessing each student in two domains, testing time would increase by 50 minutes in grade III and 70 minutes in grades VI and IX. In this case, a 15-minute break should be provided to students between the first and the second domain. Total testing time in such a case will be as given in Table 7.3.

Table 7.34 Assessment time when a student takes two domains

	Instructional time	Questionnaire time	Domain 1 time	Break	Instructional time	Domain 2 time	Total
Grade III	15 min	10 min	40 min	15 min	10 min	40 min	30 min
Grade VI	15 min	10 min	60 min	15 min	10 min	60 min	170 min
Grade IX	15 min	10 min	60 min	15 min	10 min	60 min	170 min

ANNEXURE 1

Blueprint for student questionnaire

Factors	Variables	Variable Types	Expected Outcomes
A. Students' background	Gender (Q1)	Categorical	It is expected that the students' background will impact their learning outcomes.
	Social group (Q2), (Q3), (Q4), (Q5i, ii & iii) & (Q6)	Categorical	
	Grade repetition (Q7)	Dichotomous (Yes/No)	
	The number of years studied in the present school (Q8)	Categorical	
B. Socio-Economic Status (SES)	Parental background (Q9) & (Q10)	Categorical	It is expected that socio-economic status of parents have an impact on the learning of students.
	Resources at home (Q11), (Q12), (Q13), (Q14), (Q15) & (Q16)	Categorical	
C. Classroom environment	Physical environment (Q17)	Categorical	It is expected that the classroom environment influences the performance of students.
	Social environment (Q18)	Categorical	
	Emotional environment (Q19)	Categorical	
D. School environment	Physical environment (Q20)	Categorical	It is expected that the school environment influences the performance of students.
	Social environment (Q21)	Categorical	
	Emotional environment (Q22)	Categorical	
E. Students' attitude towards learning	Motivation to learn (Q23)	Likert Scale	It is expected that students' attitude towards learning significantly impacts their learning outcome.
	Attitude towards the subject (Q24) & (Q25)	Likert Scale	
F. Pedagogical practices	Teaching, learning and assessment (Q26)	Categorical	It is expected that the pedagogical practices influence students' performance.
G. Additional help in studies	Family support (Q27) & (Q28)	Categorical	It is expected that students who get additional help in studies learn better.
	School support (Q29) & (Q30)	Categorical	
H. Students' activities outside the school	Study activities (Q31) & (Q32)	Categorical	It is expected that students' learning depend on not only what they learn from the school but also from the activities they do outside the school.
	Leisure activities (Q33) & (Q34)	Categorical	
	Family activities (Q35) & (Q36)	Categorical	
I. Student's health	Health condition (Q37)	Categorical	It is expected that the students' health influence their performance.

Factors	Variables	Variable Types	Expected Outcomes
J. Nine student attributes	Enduring habits of lifelong learning (k) & (l)	Rating Scale	It is expected that the students exhibit certain attributes at each key stage of learning.
	Family, community and national values (b) & (c)	Rating Scale	
	Spirituality and character (d) & (e) & (f)	Rating Scale	
	Physical wellbeing (j)	Rating Scale	
	Leadership competence (a), (g), & (i)	Rating Scale	
	World readiness (h)	Rating Scale	

ANNEXURE 2

Blueprint for teacher questionnaire

Factors	Variables	Variable Types	Expected Outcomes
A. Teachers' background	Gender (Q1)	Categorical	It is expected that the teachers' background will influence students' learning outcomes.
	Social group (Q2) (Q3i & ii) (Q4)	Categorical	
	Highest academic qualifications (Q5)	Categorical	
	Highest professional qualification (Q6)	Categorical	
	Teaching experience (Q7)	Categorical	
	Subject and grade level taught in the school (English, Dzongkha, Mathematics and Science) (Q8a & b)	Categorical	
	Instructional hours (Q9)	Categorical	
B. Teaching practices	Emphasising learning intentions (Q10ia-ie)	Categorical	It is expected that the teaching practices will impact students' learning outcomes and have policy implication.
	Learner-centered strategies (Q10iia-iig)	Categorical	
	Reflective practices (Q10iiia-iiif)	Categorical	
	Integration of ICT in the teaching and learning process (Q10iva)	Categorical	
	Resources used (Q10va-vd)	Categorical	
C. Assessment practices	Understanding the importance of assessment (Q11ia)	Likert Scale	It is expected that the assessment practices will impact students' learning outcomes and have policy implication.
	Continuous formative assessment (Q11iia, b, c, d, e, f, g, h, i, j, k)	Likert Scale	
	Summative assessment	Likert Scale	
D. Classroom environment	Physical environment (Q12)	Categorical	It is expected that the classroom environment will impact students' learning outcomes and have policy implication.
	Social environment (Q13)	Categorical	
	Emotional environment (Q14)	Categorical	
E. School environment	Physical environment (Q15)	Categorical	It is expected that the school environment will have implications on students' learning outcomes and policy.
	Social environment (Q16)	Categorical	
	Emotional environment (Q17)	Categorical	
F. Professional enhancement	Content knowledge (Q18i.a) & (Q18ii.a)	Categorical/Rating scale	It is expected that the professional enhancement will impact students'
	Teaching methods (Q18i b & g) & (Q18iib & g)	Categorical/Rating scale	

Factors	Variables	Variable Types	Expected Outcomes
	Assessment strategies (Q18i.c) & (Q18ii.c)	Categorical/Rating scale	learning outcomes and have policy implication.
	Research (Q18i.d) & (Q18ii.d)	Categorical/Rating scale	
	Student behaviour management (Q18i.e & h) & (Q18ii.e & h)	Categorical/Rating scale	
	Use of Information and Communication Technology (ICT) (Q18i.f) & (Q18ii.f)	Categorical	
G. Motivation to teach	Students' interest (Q19i. a, b & c)	Likert Scale	It is expected that the teachers' motivation will influence students' learning outcomes.
	Management support (Q19 ii. a, b, c d, e, f & g)	Likert Scale	
	Peer support (Q19 iii. a)	Likert Scale	
	Stakeholders' support (Q19 iv. a, b & c)	Likert Scale	
	Remuneration (Q19 v. a, b & c)	Likert Scale	
H. Support from education officials	Monitoring and support (Q20 a, b, c, d, e, f, & h)	Categorical	It is expected that the support from education officials will influence students' learning outcomes.
I. Nine student attributes taught in schools	Nine student attributes taught in schools (Q21)	Likert Scale	It is expected that the nine student attributes are incorporated in the school practices for the holistic development of a child.

ANNEXURE 3

Blueprint for principal questionnaire

Factors	Variables	Variable Types	Expected Outcomes
A. Principal's background	Gender (Q1)	Categorical	It is expected that the principal's background will influence students' learning outcomes.
	Social group (Q2) & (Q3i &ii)	Categorical	
	Highest academic qualification (Q4)	Categorical	
	Highest professional qualification (Q5) & (Q6i & ii)	Categorical	
	Leadership experience (Q7)	Categorical	
B. School background	School strength (Q8) & (Q9)	Categorical	It is expected that the school background will influence students' learning outcomes.
	School management board (Q10) & (Q11)	Categorical	
	Community support (Q12)	Categorical	
	Instructional hours (Q13) & (Q14)	Categorical	
	School culture (Q15) & (Q16)	Categorical	
C. Principal's attitude towards profession	Students' interest (Q17i.a)	Likert scale	It is expected that the principal's attitude will influence students' learning outcomes.
	Management efficacy (Q17ii.a, b, c, d & e)		
	Stakeholders' support (Q17iii.a, b, c & d)	Likert scale	
	Remuneration (Q17iv. a, b & c)	Likert scale	
D. Students' characteristics	Socio-economic status (Q18a, b & c)	Categorical	It is expected that the student's characteristics will influence their learning outcomes.
	SEN students (Q18 d & e)	Categorical	
	Students' disciplinary issues (Q18f)	Categorical	
E. Teachers' efficacy	Pedagogical practices (Q19i.a) (Q19ii.a, b, c, d, e, f, g, h & i) & (Q19iii. a, b, c, d, e, f, g, h & i)	Rating scale	It is expected that the teachers' efficacy will influence students' learning outcomes.
	Motivation of teacher (Q19i.b, c, d, e, f, g, h, i, j & k)	Rating scale	
	Resources (Q19i.l)	Rating scale	
	Information Communications and Technology (ICT) (Q19i.m), (Q20) & (Q21)	Rating scale	
F. School environment	Physical environment (Q20 a – y), (Q21), (Q22), (Q23) & (Q24 a - i)	Categorical	It is expected that the school environment will influence students' learning outcomes.
	Social environment (Q25i. a – i), (25ii. a –d) & (25iii. a – d)	Categorical	
	Emotional environment (Q26i. a – h), (Q26ii. a – e), (Q26iii. a – e) & (Q26iv)	Categorical	

Factors	Variables	Variable Types	Expected Outcomes
G. Monitoring and support	Dzongkhag/Thromde (Q27 a & b)	Likert scale	It is expected that the support from stakeholders will influence students' learning outcomes.
	Royal Education Council (Q27 c & d)	Likert scale	
	Bhutan Council for School Examinations and Assessment (Q27 e & f)	Likert scale	
	Ministry of Education (Q27 g & h)	Likert scale	
H. Nine student attributes	Nine student attributes taught in school	Likert scale	It is expected that the nine student attributes are incorporated in the school practices for the holistic development of a child.

ANNEXURE 4

List of variables for DEO/TEO questionnaire.

Factors	Input Variables	Variable Types	Expected Outcomes
Background	Gender	Dichotomous	
	Qualification (educational / academic)	Categorical	
	Experience	Categorical	
Professional and academic development	Professional supervision	Likert scale	
	Professional development support	Likert scale	
	Periodical monitoring	Likert scale	
Policy and planning	Educational plan	Likert scale	
	Guidelines for principals and teachers	Likert scale	
	Advocacy on educational policies	Likert scale	
Management and administration	Planning and deployment of teachers	Likert scale	
	Equitable distribution of educational facilities	Likert scale	
	Teacher/student placement	Likert scale	
	Coordination of intra Dzongkhags and Thromde educational programs	Likert scale	
Financial management	Annual budget (education programs in the Dzongkhags and Thromdes)	Likert scale	

ANNEXURE 5

Contextual Questionnaire Development Process

Steps	Descriptions	Person(s) responsibilities
Defining the purpose	Clarify the purpose and potential use of the questionnaire data	Policy-makers, key stakeholders and test development managers
Development of questionnaire blueprint	Design questionnaire blueprint to specify respondents, focus areas, item types, coding, and administration protocol	Test development managers, subject experts, data analyst, item writers, experienced teachers, policy-makers, and key stakeholders
Development of questionnaires	Write questionnaire	Test development managers and item writers
	Refine for clarity and usefulness in questionnaire panels	Test development managers and item writers
	Review questionnaires	Test development managers, policy-makers, and key stakeholders
Planning for data analysis	Specify the plan for processing information, for creating measurement variables and indicators, and for types of analysis	Data analyst and test development managers
Piloting of the questionnaires	Design, produce and proofread the questionnaires for pre-testing	Test development managers, item writers, design and layout professionals, and proof-readers
	Write administration instruction for pre-testing of the questionnaires and train administrators	Test development managers and item writers
	Pre-test the questionnaires at the same time when cognitive tests are being pre-tested	Test development managers, logistic manager, and test administrators
Data analysis of pilot data	Reliability and validity of the items	Test development managers and data analyst
Finalization of questionnaires	Analyse the pre-test questionnaire data	Test development managers and data analyst
	Refine the questionnaires and administration instructions on the basis of the pre-test data and feedback from the pre-test administrator.	Test development managers, item writers, and data analyst
	Produce the final form of questionnaires	Test development managers, item writers, design and layout professionals, and proof-readers

Adapted from Anderson, P. and Morgan, G. (2008)

ANNEXURE 6

1. BCSEA Core Team

Sl. No.	Name	Designation	Agency
1.	Arjun Kumar Gurung	Principal Education Monitoring Officer (Project Manager)	AMD, BCSEA
2.	Kinley Dema	Education Monitoring Officer (Domain Expert-English)	AMD, BCSEA
3.	Sonam Lhamo	Education Monitoring Officer (Domain Expert-Science)	AMD, BCSEA
4.	Mani Dorji	Education Monitoring Officer (Domain Expert-Dzongkha)	AMD, BCSEA
5.	Dorji Wangchuk	Education Monitoring Officer (Domain Expert-Social Science)	AMD, BCSEA
6.	Karma Jigme Lepcha	IT Subject Coordinator (Data Manager)	SED, BCSEA
7.	Sangay Tenzin	Chief Programme Officer (Overall Administration and Management)	AMD, BCSEA
8	Kezang Dema	Admin Assistant (Project Assistance)	AMD, BCSEA
8	Bhim Kumar Gurung	Account Officer (Project Finance)	BCSEA
9.	Kezang Deki Tshering	Controller of Examnations (Project Advisor)	BCSEA
10	Tshering Tenzing	Executive Specialist (Project Advisor)	BCSEA
11	Jamyang Choeden	Director, BCSEA (Project Director)	BCSEA

2. National Review Team

Sl. No.	Name	Designation	Agency
A	**Reading and Writing Literacy (English)**		
1.	Kinley Dema	Education Monitoring Officer	AMD, BCSEA
2.	Sharda Rai	Subject Coordinator	SED, BCSEA
3.	Amber Rai	Curriculum Developer	REC
4.	Phub Dorji	Training Developer	REC
B	**Mathematical Literacy**		
1.	Arjun Kumar Gurung	Principal Education Monitoring Officer	AMD, BCSEA
2.	Geewanath Sharma	Curriculum Developer	REC
C	**Scientific Literacy**		
1.	Sonam Lhamo	Education Monitoring Officer	AMD, BCSEA
2.	Surjay Lepcha	National Consultant	Freelance
3.	Kesang Deki Tshering	Controller of Examinations	SED, AMD
4.	Bhoj Raj Rai	Curriculum Specialist	REC
D	**Reading and Writing Literacy (Dzongkha)**		
1.	Mani Dorji	Education Monitoring Officer	AMD, BCSEA
2.	Loden Chozin	Subject Coordinator	SED, BCSEA
3.	Pema Wangdi	Subject Coordinator	SED, BCSEA
4.	Tenzin Dorji	Curriculum Specialist	REC
5.	Dorji	Curriculum Developer	REC
6.	Wangda Dorji	Curriculum Specialist	REC
E	**General Content**		
1.	Dorji Wangchuk	Education Monitoring Officer	AMD, BCSEA
2.	Karma Jigme Lepcha	Subject Coordinator	SED, BCSEA
3.	Pedup Dukpa	Senior Research Officer	REC
4.	Tshering	Lecturer	SCE, RUB
5.	Dochu	Chief Planning Officer	PPD, MoE
6.	Sangay Tenzin	Chief Programme Officer	AMD, BCSEA

3. The following individuals were consulted during the development of NEAF

Sl. No.	Name	Designation	Agency
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2.	Karma Tshering	Director General	DSE, MoE
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4.	Jamyang Choeden	Director	BCSEA
5.	Tenzin Dakpa	Director	REC
6.	Man Bahadur Ghalley	Director	Save the Children
7.	Natalia Mufel	Education Specialist	UNICEF
8.	Frank Van Cappelle	Education Specialist	UNICEF
9.	Mr M.C. Sharma	Secretary General	CoBSE, India
10.	Tshering Tenzing	Executive Specialist	BCSEA
11.	Bishnu Bhakta Mishra	Education Officer	UNICEF
12.	Sonam Pelden	Project Coordinator	Save the Children
13.	Karma Dyenka	Education Manager	Save the Children
14.	Tashi Lhamo	Chief Programme Officer	TPSD, MoE
15.	Phuntsho Lhamo	Chief Education Monitoring Officer	AMD, MoE
16.	Ngawang Dorji	Chief Dzongkhag Education Officer	Paro
17.	Tshering Penjor	Dy. Chief Programme Officer	SPCD, MoE
18.	Binod Sunwar	Programme Officer	PPD, MoE
19.	Karma Norbu	Programme Officer	SEND, DSE, MoE
20.	Chencho Wangdi	Programme Focal Person	ECCD & SEND, DSE, MoE
21.	Karma Gayleg	Dy. Chief Programme Officer	ECCD & SEND, DSE, MoE
22.	Karma Choden	Dy. Chief Programme Officer	ECCD & SEND, DSE, MoE
23.	Lekema Dorji,	Sr. Planning Officer	GNHC
24.	Gangaram Sharma	Finance Manager	Save the Children
25.	Nar Chhetri	Monitoring Evaluation Accountability and Learning (MEAL) Coordinator	Save the Children
26.	Sherab Phuntshok	Chief Programme Officer	ECCD & SEND, DSE, MoE
27.	Madam Dechen Dolkar	Principal	Nima HSS
28.	Tashi Dendup	Curriculum Developer	REC
29.	Mr Lhendup Dukpa	Unit Head	TPD, REC
30.	Phub Wangdi	Vice Principal	Daga CS
31.	Dawa Chencho	Teacher	Shari HSS
32.	Sonam Tashi	Education Monitoring Officer	EMD, MoE
33.	Rinchen Dorji	Dy. Chief Programme Officer	TPSD, MoE
34.	Amit Kaushik	CEO	ACER, India
35.	Anit Cherian	English Language Expert	ACER, India
36.	Dr Abha Bhagat	Scientific Literacy Expert	ACER, India
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38.	Urmila Sarka	Education Adviser	ROSA, UNICEF
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40.	Kinley Dorji	Subject Coordinator	SED, BCSEA
41.	Sriman Gurung	Subject Coordinator	SED, AMD
42.	Sonam Gyeltshen	ICTO	BCSEA
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44.	Dumcho Wangdi	Teacher	Bajothang HSS
45.	Sumitra Subba	Teacher	Shari HSS
46.	Yeshey Lhamo	Vice Principal	Lamgong MSS
47.	Pema Dorji	Teacher	Khasadrapchu MSS
48.	Phub Dorji	Teacher	Khasadrapchu MSS

49.	Karma Tshering	Principal	Drukgyel CS
50.	Chencho Tshering	Principal	Yoezerling HSS
51.	Kharka Bahadur Monger	Sr. Teacher	Wangsel Institute
52.	Suk Kumari Monger	Teacher	Wangsel Institute
53.	Anita Chhetri	Teacher	Changzamtog MSS
54.	Ugyen Pelmo	Teacher	Changangkha MSS
55.	Sonam Choden	Vice Principal	Tshaphel LSS
56.	Tshedup Dema	Vice Principal	Gaupel LSS
57.	Thinley Wangchuk	Principal	Taju PS
58.	Gyeltshen Dukpa	Principal	Doteng LSS
59.	Sonam Wangdi	Teacher	Doteng LSS
60.	Ugyen Tshering	Teacher	Gaupel LSS
61.	Tshering Wangmo	Teacher	Taju PS
62.	Khandu Gyem	Teacher	Shaba PS
63.	Kezang Tshering	Vice Principal	Khangkhu MSS
64.	Tashi Phuntsho	Teacher	Khangkhu MSS
65.	Tek Nath Kafley	Teacher	Shari HSS
66.	Bakbir Rai	Principal	Shari HSS
67.	Lhabu	Principal	Shaba PS
68.	Sonam Wangmo	Vice Principal	Doteng LSS
69.	Kezang Dema	Administrative Assistant	AMD, BCSEA
70.	Bhim Kumar Pradhan	Accounts Officer	BCSEA

The following individuals were consulted during Consultatve Meeting of Thimphu Dzongkhag and Thromdee on 14th December 2019 at Hotel Ariya , Thimphu			
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2	H.J Subba	Offg. Principal	Sisina PS
3	Tenzin Wangmo	Vice principal	Khasadrapchu MSS
4	Kencho	Vice principal	Kuzhugchen MSS
5	D.B Tamang	Principal	Chang Rigphel PS
6	Syel Denmo	Vice principal	Dr. Toggyel School
7	Cheku Wangchuk	Vice principal	Jigme Namgyel LSS
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9	Karma Tshewang	Principal	Kuensel Phodrang PS
10	Lhagyal Tshering	Principal	Lungtenphu MSS
11	Baynu Gurung	Youth	Lungtenphu MSS
12	Jambay Dorji	Parent	Lungtenphu MSS
13	Mani Gyeltshen	Parent	Lungtenphu MSS
14	Yangchen T Gyeltshen	Student	Yangchenphu HSS
15	Tshering	Parent	Lungtenzampa MSS
16	Karma Tashi Dendup	Student	Lungtenzampa MSS
17	Sherab Jamtsho	Teacher	Yangchen Gatshel MSS
18	Ugyen Dorji	Teacher	Tsheluna PS
19	Rudra Chhetri	Principal	Pelkhil School
20	Pem Dechen	Vice principal	Yangchenphug HSS
21	Tshering Zangmo T	Vice principal	Motithang HSS
22	Jigme Dorji	Vice principal	Thimphu PS
23	Sonam Tshering	Vice principal	Zilukha MSS
24	Sonam Pem	Teacher	Phuensum PS
25	Tshewang Choden Wangdi	Principal	Druk School
26	Dorji Wangchuk	Teacher	Bjemina PS

27	Ngawang Tshering	Teacher	Y.T.Z.C.S
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29	Tashi Dekar	Registration	BCSEA
30	Kamal Hingmag	Vice principal	DHSS
31	Sujana Pradhan	Teacher	Jigme Losel PS
32	Sherab Dema	Principal	Taba LSS
33	Tashi C Namgyel	Principal	Little Dragon PS
34	Mohan Rai	Offg. Principal	Kelki HSS
35	Tshering Dorji	Principal	Babesa PS
36	Sangay Duba	Principal	Sunshine PS
37	Pem Thinley	Vice principal	Loselling MSS
38	Tshering Pema Sherpa	Teacher	Etho Metho PS
39	Dorjee Wangchuk	EMO	BCSEA
40	Ten Gyelmo	Vice principal	Changangkha MSS
41	Yeshey Tshogyal Loday	Student	Zilnon Namgyelling LSS
42	M.B.Rai	Parent	Zilnon Namgyelling LSS
43	Tshering	Principal	Lingzhi PS
44	Tshering Gyalmo	Parent	Changangkha MSS
45	Tshering Euden	Student	Changangkha MSS
46	Sonam Phuntsho	Principal	Zilnon Namgyelling LSS
47	Sangay Dorji	Principal	Jungzhina PS
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54	Thinley Dendup	Student	Babesa MSS
55	Kuvam Gurung	Student	Changzamtog MSS

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6	Leki Phuntsho	Dy.CHRO	TPSD
7	Yonten Jamtsho	Asst. Program	DPAB
8	Prakash Pradhan	Principal Counselor	RENEW
9	Ugyen Thinley	EMO	EMD
10	Kinley Dema	EMO	BCSEA
11	Dorji Wangchuk	EMO	BCSEA
12	Sonam Peldon	Program Cordinator	Save the Children
13	Natalia Mufel	Education Specialist.	UNICEF
14	Lekimo Dorji	Senior Program Officer	GNHCS
15	Baburam Sherpa	CPO	SSSD,DAHE
16	Kezang Choden	Country Manager	READ Bhutan
17	Rinchen Choden	Field Officer	READ Bhutan
18	Jigme Wangchuk	Editor	Kuensel
19	Dochu	Chief	PPD
20	Tashi Deki	Program Officer	YDF

The following individuals were consulted during Consultatve Meeting of Tsirang Dzongkhag on 25th November, Royal Audit Professional Developement Centre , Tsirang			
Sl. No.	Name	Designation	School/Agency/Gewog
1	Tshering	Deputy CDEO	Tsirang Dzongkhag
2	Bhuwan Ghalley	Principal	Damphu CS
3	Chotey Wangchuk	Principal	Mendrelgang CS
4	Chuzang Norbu	Principal	Damphu LSS
5	Tshiltrim	Principal	Pemathang PS
6	Passang dukpa	Principal	Beteni PS
7	Tashi Wangchen	Principal	Barshong PS
8	Nidup Wangdi	Principal	Phuentenchu PS
9	Cheten Wangchuk	Principal	Shemjong PS
10	Dawa Penjor	Principal	Dunglagang PS
11	Cheku	Principal	Rangthangling PS
12	Sonam Tenzin	Principal	Tsholingkhar PS
13	Tek Bdr. Kharka	Principal	Salami PS
14	Sha Bdr. Subba	Principal	Sergithang PS
15	Yeshi	Principal	Tsirangtoe CS
16	Tshering Tobgyal	Offtg. Principal	Gosaling PS
17	Madhu Lal Biswa	Vice Principal	Damphu LSS
18	Namgay Lham	Vice Principal	Damphu LSS
19	CB Tamang	Vice Principal	Damphu LSS
20	Dorji Phuntsho	Teacher-Incharge	Nimazor ECR
21	Bal Bdr. Ghalay	Cluster Lead Teacher	Teacher Resource Centre, Mendrelgang CS
22	Prem Kumar Ghalley	Teacher	Damphu LSS
23	Karma Wangmo	Teacher	Damphu LSS
24	PP Timsina	Teacher	Damphu LSS
25	Chone Dolma	Teacher	Damphu LSS
26	Santosh Kumar Biswa	Teacher	Damphu CS
27	Tashi Yangzom	Teacher	Damphu CS
28	Bal Krishna Pokhrel	Teacher	Damphu LSS

29	Karma Tenzin	Teacher	Damphu LSS
30	Bhim Kumar Sharma	Teacher	Damphu CS
31	Bal Bdr. Tamang	Gup	Ranthangling Gewog
32	Ram Bdr. Kharki	Gup	Gosarling Gewog
33	Beda Moni Chamalagai	Gup	Kilkorthang Gewog
34	Nado Gyeltshen	Business representative	Damphu Throm
35	Gopal Giri	Business representative	Damphu Throm
36	Dil Kumar Rasaily	BPC, officails	Damphu Throm
37	Tendi Dorji	Parent representative	Damphu Throm

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