Handbook of Assessment and Evaluation

Best Practices in Item Design and Test Development

Central Board of Secondary Education

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Best Practices in Item Design and Test Development

Central Board of Secondary Education

In collaboration with

Azim Premji University, Bengaluru

and

Central Square Foundation, New Delhi

CENTRAL BOARD OF SECONDARY EDUCATION

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भारत का संविधान

उद्देशिका

हम, भारत के लोग, भारत को एक सम्पूर्ण [1]प्रभुत्व-संपन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य बनाने के लिए, तथा उसके समस्त नागरिकों को:

सामाजिक, आर्थिक और राजनैतिक न्याय,

विचार, अभिव्यक्ति, विश्वास, धर्म

और उपासना की स्वतंत्रता,

प्रतिष्ठा और अवसर की समता

प्राप्त कराने के लिए

तथा उन सब में व्यक्ति की गरिमा

[2]और राष्ट्र की एकता और अखंडता

सुनिश्चित करने वाली बंधुता बढ़ाने के लिए

दृढ़संकल्प होकर अपने इस संविधान में आज तारीख 26 नवम्बर, 1949 ई॰ को एतद्द्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।

1. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 को धारा 2 द्वारा (3.1.1977) से "प्रभुत्व-संपन्न लोकतंत्रातक गणराज्य" के स्थान पर प्रतिस्थापित।
2. संविधान (बयालीसवां संशोधन) अधिनियम, 1976 को धारा 2 द्वारा (3.1.1977) से "राष्ट्र की एकता" के स्थान पर प्रतिस्थापित।

भाग 4 क

मूल कर्त्तव्य

51 क. मूल कर्त्तव्य–भारत के प्रत्येक नागरिक का यह कर्त्तव्य होगा कि वह–

(क) संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्र ध्वज और राष्ट्रगान का आदर करें;

(ख) स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाला उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे:

(ग) भारत की प्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण रखे;

(घ) देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;

(ङ) भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभाव से परे हों, ऐसी प्रथाओं का त्याग करे जो स्त्रियों के सम्मान के विरुद्ध हैं;

(च) हमारी सामाजिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका परिक्षण करे;

(छ) प्राकृतिक पर्यावरण की जिसके अंतर्गत वन, झील, नदी, और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणी मात्र के प्रति दयाभाव रखे;

(ज) वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;

(झ) सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;

(ञ) व्यक्तिगत और सामूहिक गतिविधियों से सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत प्रयास करे जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई उंचाईयों को छू ले;

[1](ट) यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य के लिए शिक्षा के अवसर प्रदान करे।

1. संविधान (छयासीवां संशोधन) अधिनियम, 2002 की धारा 4 द्वारा प्रतिस्थापिता

THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolve to constitute India into a [1]**SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the[2] unity and integrity of the Nation;

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION**.

1. Subs, by the Constitution (Forty-Second Amendent) Act. 1976, sec. 2 for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs, by the Constitution (Forty-Second Amendent) Act. 1976, sec. 2 for "unity of the Nation" (w.e.f. 3.1.1977)

THE CONSTITUTION OF INDIA

Chapter IV A

FUNDAMENTAL DUTIES

ARTICLE 51 A

Fundamental Duties - It shall be the duty of every citizen of India-

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the national constantly rises to higher levels of endeavour and achievement;

[1](k) who is parent or guardian to provide opportunities for education to his/her child or, as the case may be, ward between age 6 and 14 years.

1. Subs. By the Constitution Sec. 04 (Eighty-Six Amendment) Act, 2002

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- Pramod Kumar T.K. Joint Secretary (Academics), Central Board of Secondary Education
- Dr. Sweta Singh, Joint Secretary (Academics), Central Board of Secondary Education

Dedicated to:

Sh. Pramod Kumar T.K.

(15th April 1971 to 25th May 2021)

Joint Secretary (Academics)
Central Board of Secondary Education

You will always be in our memories...

PREFACE

Core function of CBSE as one of the national Boards of Assessment is to conduct certificate examination at the end of secondary and senior secondary classes. It is essential that the Board ensures validity and reliability of its assessment instruments to achieve these goal. In the recent past, the Board has been taking many steps to upgrade itself in the field of Assessment and Evaluation. A dedicated Assessment Centre is being established within the Board to focus on the quality of Assessment and Evaluation. As part of this endeavour, a comprehensive study of Assessment Instruments used in AISSE 2020 was carried out in collaboration with Azim Premji University, Bengaluru. One of the recommendations of the study is to develop standards for item development. These standards are expected to facilitate validity and reliability of assessment instruments.

Keeping this in mind, this Handbook on Assesment and Item development has been developed by the Board in collaboration with Azim Premji University and Central Square Foundation. It details out the standard operating procedures in the development of assessment instruments by incorporating best international practices. It also elaborates the underlying principles on test item development and provides guidelines for item developers and reviewers.

To facilitate the process of item development and quality assurance, checklists and templates have been provided in the Handbook. I am sure that the examination functionaries involved in the item development process shall be immensely benefited by this handbook. It is also expected that inputs from this document are used by practising teachers for school-based formative and summative assessments.

Manoj Ahuja, IAS

Chairman, CBSE

Contents

Introduction

"If you intend to evaluate how your knowledge is applicable, transfer it to others." — Eraldo Banovac.

The Central Board of Secondary Education in its endeavor to enhance the quality of Board examination, conducted a Qualitative and Quantitative analysis of Board examination papers (AISSE 2020) and the student responses in collaboration with Azim Premji University, Bengaluru and Central Square Foundation, New Delhi. This exercise was done to get inputs for improvement in the process of development of Assessment tools. It was felt that the important findings and results from the study should be formalised to establish technical standards for development of Assessment tools.

Objectives of the Handbook

Assessments enable students to provide evidence of what it is that they know and can do. This evidence is then used to make inferences regarding student's knowledge and understanding around the academic content which serves as the source for the learning activities that follows. It is critical that the Assessment items that are used to make these inferences assess the critical learning outcomes that they are supposed to be assessing (validity) in a consistent way (reliability). In order to produce items that are 'fair' and are of good quality, teachers and item writers should follow some basic guidelines.

This handbook is intended to provide guidance for test developers who are creating the questions or tasks for learning assessments. It describes the **role of an assessment framework for item writing, characteristics and development of high quality assessment instruments; guidelines for writing good items, including the construction of marking guides;** and some essential factors that should be taken into account by test developers that relate to the design of a test. The characteristics of different response formats and the importance of a rigorous item review process at different stages of test development are covered. This handbook concludes with how developing a team of experienced test developers is essential to creating a successful assessment program.

How to use the Handbook?

Item developers may thoroughly go through the book before planning for item development.

- *Study the design of question paper as per curriculum*
- *Develop a blueprint as per instructions given in the handbook*
- *Frame the items by keeping in mind the guidelines and checklists*
- *Map the items with learning outcomes and the domains as per template*
- *Get the items peer reviewed using the checklists.*
- *Record all the stages of the process and feedback*

Glossary

Blueprint	A description of how the test will be constructed, including the details of the proportion of items that will assess different domains and skills and the response formats.
Competency based assessments	Assessments that are designed to measure generic knowledge and skills that are cross curricular or that go beyond any particular school curriculum.
Constructed response item	An item for which the student constructs or generates a response to the question.
Contextual information	Data collected through questionnaires on a range of topics that are useful to policy and in understanding the test results in context.
Curriculum based assessments	Assessments that are based on measuring students' understanding/ knowledge of a curriculum or part of a curriculum.
Distracters	The incorrect options provided in a multiple-choice item.
Domain	The area of learning that is the focus of an assessment (E.g reading, science, writing, problem solving).
Content areas	The content categories (or sub-domains) that are to be included in the test which are specific to the domain. For example, in Mathematics, typical content categories are number, space, measurement and statistics.
Item descriptors	Description of what the item intends to measure.
Items	The questions or tasks used in an assessment.
Key	The correct or only acceptable answer to a multiple-choice item.
Marking Scheme	The description of the marking/scoring categories that are used to categorise and score a student's answer.
Multiple- choice item	An item that presents several options as answers, from which the student selects one.
Response formats	The ways in which students need to respond to the items (E.g multiple-choice, closed constructed-response, short open-response).
Stem	The part of the item that contains the question or task (E.g in a multiple choice item, the part that introduces the options)
Stimulus material	The prompt or context on which one or more items is based. For example, in a reading test, the stimulus is often a prose text made up of one or more paragraphs. In a Mathematics test, the stimulus may be a diagram or a graph.
Target population	The population that the assessment is attempting to describe.
Test developers	Those responsible for producing test content, including contributing to the test design, writing items, helping to interpret trial data to select items for the main survey, and interpreting main survey data for reporting.

Chapter 1 : Key Stages in Test Development

In education, large-scale assessments provide an estimate of student learning or achievement in one or several domains or subject areas. The design of appropriate assessment instruments is of crucial importance. The process of designing and implementing assessment instruments involves:

- Development of Assessment Framework (including test blueprint)
- Development of test items
- Review of test items
- Translation of test items
- Finalisation of Items
- Development of final test instruments or question papers

Designing assessments for Board examination is guided by the CBSE curriculum document. The curriculum document outlines the set of learning outcomes and competencies across the respective classes and subjects.

The following chart depicts the key processes involved in development of test instruments or question papers for the CBSE Board examination.

1. Development of Assessment Framework	2. Development of test blueprint or table of specifications	3. Item development as per guidelines and standards
4. Peer review of items	5. Moderation of items, answer keys and marking scheme	6. Selection of items which adhere to quality standards
7. Double Translation (by two independent translators) and reconciliation by another	8. Finalization of items for the Question Paper	9. Development of test instrument or question paper as per the Blueprint
10. Quality review and check of the question papers	11. Translation of common instructions across question papers	

Chapter 2 : Assessment Framework

This chapter describes assessment frameworks and their purposes. We will also discuss the importance of the assessment framework for item development.

The development of an assessment framework is an iterative process, which takes place step by step. The work on the assessment framework should begin before the items are developed, so that framework is available in a draft form to guide the team of item writers. However, it is also important that the framework is seen as a work in progress- flexible enough to be modified in the light of teaching-learning process and learning outcomes. However, from the perspective of a large scale assessment used primarily for summative purposes, the assessment framework can guide the teaching- learning process.

Development of the assessment framework should include a team of academic experts, curriculum experts and assessment/evaluation experts. It will be of value to bring together people from different perspectives to draw on a wide range of expertise and opinion.

Assessment Framework

- An assessment framework is a description and discussion about what an assessment intends to measure. It also helps them to understand what the assessment results mean.
- The framework includes a definition of "**domain**" -the area of learning that is being measured. It explains which aspects of the domain are covered in the assessment. The framework also outlines how the assessment is constructed, by highlighting the proportion of items for each of the aspects of the learning domain that makes up the assessment. Further, it describes the response or item formats that are used, the length and the number of items in the assessment. The framework may also outline how results of the assessment may be reported.

Purposes of an Assessment Framework

- One important purpose of assessment frameworks is that it underpins the **validity** of the assessment by making explicit what the aim of the assessment is, and what it will cover in terms of knowledge, skills and content.
- Another purpose of assessment framework is to define the terms relating to assessment. This helps people working on assessment communicate clearly without any confusion.
- If the assessment intends to measure trends in performance, the assessment framework helps ensure that the test is measuring the domain in a **consistent way over time**. For example, the proportion of items measuring each aspect of the content is documented

in the framework. This is a guide to ensure that the balance of aspects remains the same from one year to the next. Sometimes, when it is necessary to change an assessment a new aspect of a domain might be added to the curriculum, and the new aspect needs to be reflected in the assessment. The framework needs to describe the change, and explain why the change is being made. In this way, there is a **record to help interpret any change in results**.

- For item writers or people involved in test development, the assessment framework is specifically important as it provides guidance for writing items, by explaining which learning domains or areas need to be covered, how they are defined and what proportion of the test should focus on each domain. At the review stage, the framework can be used to validate how well the assessment instrument has met its purpose.

An assessment framework should be developed collaboratively, involving input and feedback from stakeholders such as education agencies and teachers, domain experts and item writers. Those involved in developing an assessment framework feel some ownership of the assessment. This increases the likelihood that the results of the assessment will be taken seriously, and ultimately will have an impact on improving learning.

Importance of Assessment Framework for Item Development

A good test instrument (commonly referred to as a question paper in the context of school based assessments) depends upon a clear idea around the purpose of assessment, its outcomes, and which domains (sometimes referred to as the 'subject' or 'learning area') are to be included in the assessment. An assessment framework provides this information, among other things, and is therefore very important for good item writing.

The following parts of an assessment framework are particularly important for a test developer or paper setter:

- fundamental purpose of the test
- the target population
- the range of content and skills to be assessed
- the different response formats to be used
- the length of the assessment and the duration of the test.

The Key Components of an Assessment Framework

For assessments which are based on curriculum, much of the content of the assessment is predetermined, and the definitions of the learning domains and areas or learning outcomes covered are clearly articulated. For other assessments, such as competency-based, generally need more detailed frameworks because they do not refer to any pre-existing design or set of descriptors. Irrespective of the type of assessment, the framework needs to include the key components to ensure it guides a robust assessment.

The essential components of any learning assessment framework are -

1. An explanation of the purpose of the assessment and who is being assessed.

The framework should state the **aim of the assessment**: for example, 'accreditation for individuals at the end of a stage of schooling', 'a report on a system's performance', or 'monitoring progress of a cohort over time'. The framework should also specify the target population according to jurisdiction (for example national, state or a smaller entity) and whether by class or age.

2. A definition or description of the learning domain

It is important for the assessment framework to be explicit about **what is being assessed**. Just naming the domain, or subject, is not sufficient. Conceptual understandings of even apparently well-known domains differ, and change. For example, the definitions of reading proficiency have varied over time and across education systems, from simply being able to pronounce words, to the ability to explain the meaning of words, to comprehending texts and using information from texts, extending even to enjoying and appreciating text.

For curriculum based assessment, it is important that the assessment framework refers to the curriculum's document for definition and description of the learning domain.

3. Outline of the domain content area

This part of an assessment framework lists and describes the **content categories (or subdomains)** that are to be included in the test. These content areas are specific to the domain, for example, typical content areas in science are biology, physics and chemistry. In reading, content areas are often represented as text types: narration, information, persuasion, and so on. In mathematics, typical content categories are number, space, measurement and statistics.

The content categories may vary according to age or class level. For example, in Trends in International Mathematics and Science Study (TIMSS) mathematics, the Grade 4 content domains are number, geometric shapes and measures, and data display, whereas for Grade 9 they are number, algebra, geometry and data and chance. Both the scope and the limitations of what is to be assessed need to be clearly outlined.

4. Outline of the competencies to be measured

Competencies or specific skills, also referred to as 'processes', 'cognitive domains' or 'aspects', are the ways of thinking, or intellectual approaches, that develop as students become increasingly proficient in a domain. Similar to the content areas of the domain, the competencies to be addressed in the assessment need to be outlined and explained in the framework.

As learning outcomes are broad statements unable to capture the expectations in terms of skills to be demonstrated by students, it is important to break learning outcomes into specific

competencies. This will help item authors to develop valid items. For example, the following broad learning outcome-can be broken down into following concept-specific competencies-

Distinguishes states of matter (solids, liquids and gases) based on the physical properties (shape, volume, density, etc.) with reference to particle theory.

can be broke down into following concept-specific competencies-

1. Explains the characteristics of particles of matter.
2. Observes three states of matter due to variation in characteristics of particles of matter.
3. Explains change of state of matter - melting, freezing, evaporation, condensation, sublimation.
4. Describes effect of change of temperature and pressure on different states of matter.

Competencies may also be defined in a generic way, using a broad set of cognitive approaches, like those in the National Achievement Survey (NAS) for Class-10 assessment framework's description of skills for Science and Social Sciences, as shown in the table below.

Table.1. : Example of generic competencies under NAS- Class X, Science and Social Science Assessment Framework

Skills Classification for Test Construction in Science and Social Science

Knowing (Skill 1): *In items testing this process, students are expected to recall or recognize terms, facts, symbols, units and basic scientific/ social concepts. They select appropriate apparatus and measurement devices for conducting experiments/ investigations.*

Applying (Skill 2): *In items in this cognitive domain are designed to involve the application of knowledge and understanding in straightforward situations. The terms testing 'applying' require students to compare, contrast and classify, and to interpret information in light of a concept. Students are also expected to use and apply their understanding of concepts and principles in the known situations. Simple, i.e., single step problems requiring a numerical solution are also included.*

Reasoning (Skill 3): *In items testing 'reasoning', students need to demonstrate their ability to solve problems, draw conclusions and make decisions. For this, students are required to analyse a problem (perhaps in new situation), identify relationships, determine underlying principles, devise and explain strategies for problem solving*

In other assessments, competencies are defined in a way that is domain specific. For example, writing is one of the domains in the South East Asian Primary Learning Metrics program. Five skill areas have been identified as fundamental to writing literacy: *generating ideas; controlling text structure and organisation; managing coherence; using vocabulary; and controlling syntax and grammar.*

5. Specifications for designing and operationalising the assessment

5.1 Test Blueprint

A key step in the process of operationalising the assessment involves determining the **proportion or percentage of items** in each content area and cognitive domain. This is referred to as the 'test blueprint'.

The proportions assigned represent the relative importance of each category of content aea and cognitive domain. For example, in the cognitive domains of Knowing, Applying and Reasoning in the NAS Class X assessment (Table 1), the recommended distribution of items is in the ratio 1:2:1. This suggests that applying is judged to be the most important of the skills in the subjects of Science and Social Science at Class X.

The proportions assigned to different content or cognitive domains may differ across class or grades, even when the categories themselves are the same. An example of this is found in the American National Assessment of Educational Progress (NAEP) reading assessment framework for 2013, as shown in the table below.

Table 2. Proportion of items (in percentage) across text types in NAEP's Reading Assessment Framework for three grades

Grade	Text type : Literary	Text type : Informational
4	50	50
8	45	55
12	30	70

In the NAEP reading framework, the content (text type) areas have different proportions for Grades 4, 8 and 12. For example, there is a larger proportion of items about informational texts in the Grade 8 assessment than in the Grade 4 assessment. There is an even larger proportion in the Grade 12 assessment. This implies that reading informational texts becomes more important as students advance through the grades.

In some assessments, the proportions of items for each area are given as ranges, not single numbers. This is especially useful in the early stages of an assessment's development, to allow for adjustments to be made based on the experience of implementing the assessment.

The process of preparing a test blueprint has been covered in detail in Chapter 4.

5.2 Mode of Test Delivery & Item/Response Formats

An assessment framework should specify whether the assessment will be delivered via paper-and-pen or via computer-based mode of delivery. It should also specify the formats in which students will need to respond to the items. The framework should answer the following questions-

- Will the assessment require students to respond only to multiple choice items?
- Will they need to construct short answers?
- Will they need to write essays?
- Or will the assessment require students to respond in a variety of formats?

In order to decide regarding which response formats to be used, test developers need to think about the nature of the domain and which formats can validly capture information about the students' knowledge, skills and understanding. In most of the large-scale, paper-and-pen assessments the range of response formats is limited by practicality. **Multiple choice items and short constructed response items** (where students write a short answer) are the most manageable formats, in terms of both cost and reliability of marking.

5.3 Test Length and Number of Items

The assessment framework should include a statement about the time students will be given to answer the set of items, and how many items will be included in each test. These pieces of information are important for test takers and administrators of the tests, as well as for item writers.

Several factors can affect the time students take to complete a test, such as the age of the students (older students can handle longer test times) and students' familiarity with the item response formats in the assessment, as well as the difficulty of the items included in the test. Enough time should be allowed to enable most students to attempt most items. The longer the test, the more time needs to be allowed. It is recommended that information about the amount of time taken by students to complete test items is collected during piloting or field trialling.

Anastasi assures us that "other things being equal, the longer a test, the more reliable it will be". According to Benjamin D Wright (1992), the right test length translates to :

- Enough items to clarify the test's purpose and replicate out a uni-dimensional variable (or construct being measured)
- Enough person responses to each item to confirm item validity and provide a calibrated definition of the variable.
- Enough item responses by each examinee to validate the relevance of this examinee's performance.
- Enough responses by each examinee to enable precise-enough inferences for the decisions for which the test was constructed and administered.

5.4 Additional components of an Assessment Framework

Some assessment frameworks include a section on how the results of the assessment will be reported. Even if reporting is not explicitly discussed in a framework, it must be considered when the framework is being developed, because what is to be reported will influence how the test is shaped. For example, if a requirement in a test of mathematics is to report on different sub-domains (such as algebra and geometry), sufficient items must be included on each sub-domain to allow meaningful results to be obtained for reporting purposes.

Chapter 3 : Preparation of Test Blueprint

The test blueprint (also sometimes called the table of specifications) is a critical document that summarises the structure of an assessment, determines how the test is designed and developed, and subsequently how the resulting test data is analysed and reported. The test blueprint is part of the assessment framework and has been described in Chapter 2.

A test Blueprint provides a tabulated list of following information about a test (or any form of assessment).

A. Which strand/topic/subtopic/aspect of the content/curriculum will be assessed?

B. Which cognitive processes/skills would be assessed?

C. What will be the item format?

D. What will be the length of the assessment in terms of items and item wise time allocation?

E. What will be the proportion of A and B in the assessment?

F. What will be the distribution of expected level of item difficulties in the test?

A detailed and exhaustive blueprint may additionally describe :

- What are the learning outcomes (if the system has a set of well defined standards) that would be assessed?
- What kind of stimulus material would be appropriate for the item?

Structure of a Test Blueprint

A typical Test Blueprint is a two-way table, in which the **content areas** (topics and/or subtopics) are listed in the left-hand column of the table while the **cognitive domains** (competencies) are shown across the first row of the table. Inner elements of the matrix represent weightage given to each of the content areas and cognitive processes, in terms of the number or percentage and/or score points. Ideally, time allocation to major elements of the matrix is also a part of the Test Blueprint.

Table 3. Tentative layout of a test blueprint

Class: ..... Subject ..... Assessment.....

Content Areas		Cognitive Levels				Item Format					Item Difficulty Level			Total items	Suggested Testing time
Main topic	Subtopics	BTL1	BTL2	BTL3	BTL4	SL-1	SL-2	CR-S	CR-L	PT	E	M	C		
		X,Y													
Total															

BTL- Blooms Taxonomy Level
SL- Selected response (1-MCIs; 2-True/False, Match, or any other)
CRS- Constructed response short answer type (two or less than 2 sentences)
CRL- Constructed response long answer type
PT – Performance task
E - Easy
M - Medium
C - Challenging
(X,Y)- (No of items, marks/value point)

Purpose of Test Blueprint

The blueprint helps educators in designing and using their assessments in a systematic manner, thus, improving the quality of assessment in terms of reliability and validity. The purpose may be operationalised in the following manner:

- defining the parameters of an assessment before construction
- guiding item writers or teachers in creating assessments as per predefined parameters
- reviewing an externally developed assessment (like developed by freelance resources or subject matter experts) for alignment with the purpose, appropriateness of the content and cognitive complexity, etc (this is usually done against a blue-print checklist)
- helping teachers evaluate whether their classroom processes cater to the content and cognitive demands of the blueprint

Important Steps Involved in the Development of Test Blueprint:

Step 1. Identify the learning outcomes for topics and sub-topics

The first step is to identify the learning outcomes for each chosen topic and its subtopics. Within the chosen subject/sub-topics, the item developer can use the cognitive domain of Bloom's Taxonomy in the building of a test.

Step 2. Identify the cognitive domain (level of the taxonomy) appropriate for assessment of content

After the learning outcomes have been finalised, the item developer then proceeds to the task of developing a blueprint of the test and lists out the skills that are going to be tested for each domain as shown in the table given below.

Table 4. Structure of a test blueprint

Content Areas		Cognitive Levels (Bloom's Taxonomy)					Difficulty Levels			Item Format Types			**Total Items**	**Testing time**
Main Topic	Sub-topics	L1	L2	L3	L4	L5	Easy	Med	Diff	SR	CR1	CR2		
Total Items														

The table is completed with the weighting percentage along with the number of items that each test should include to cover the specified contain and cognitive areas at which each outcome is taught. With the weights and the number of questions in each cell, the item developers also get an idea of how much emphasis the test is putting on those content areas as well as on the cognitive domain.

Step 3.Decide the response/item formats to be included in the test

This includes the type of response formats or item formats to be incorporated in the test. This can be coupled with the levels of Bloom's Taxonomy by closely analysing and choosing the verbs in the questions. The test may include selected response items such as multiple choice, matching, True/False; or constructed response items like short or long items.essay items, etc.

Step 4. Calculate the total number of items to be tested and the time required to complete the test

Once the blueprint provides the information regarding the content areas, cognitive levels to be tested, the next step is to define the total number of item types to be included with the overall length of the test and the time limit allotted to complete the Blueprint as shown in the table 4, given above.

Step 5. Review the Test Blueprint

The next step requires the item developer to review the preliminary draft of the Blueprint. The item developers need to ensure that all the important topics have been covered in the table as per Assessment framework. In addition, the number of items or test questions should match the time allotted for the test. He/she may even get the document reviewed by peers. Once finalised, the item developers can proceed towards creation of the exam paper.

Chapter 4 : The Process of Item Writing

This Chapter describes the item writing process. In particular, it describes the characteristics of good items in a test, the guidelines for writing items, discusses creating the stimulus material; the use of different item/response formats; and initial drafting of items.

The purpose of learning assessments is to collect information about where students are in their learning. The usefulness of that information depends both on the quality of the items – the test tasks or questions – and on the way the items are put together to make the assessment instrument.

It is important to note that the quality of a test depends largely on how clearly the test meets its purpose and on the accuracy with which the items match a well-designed blueprint. Good items are *clear, relevant to the curriculum, and focused on one aspect of learning*. They provide *engaging, genuine tasks that are fair to students* of different language and cultural backgrounds.

Creating quality items and tests is a challenging and resource-intensive process, but is crucial if an assessment is to provide valid and reliable information on student achievement.

4.1 Understanding what makes a good test and a good item

Good tests are designed around an assessment framework (see Chapter 2 in the handbook). The assessment framework, which includes the assessment blueprint, maps out the key content areas and cognitive domains of the aspect of learning and specifies the balance of different elements.

A **good test** focuses on measuring what students know, understand and can do, and measures only what it intends to measure. It is equitable to all students and is free from any form of bias on the basis of gender, ethnicity or other student background characteristics that do not relate to the aspect of learning in focus. A good test contains material that is interesting to students, so that they are motivated to engage with the material and thereby demonstrate what they are capable of. A good test should also provide information about the proficiency of all students taking the test: from the highly competent to the least able students.

Every item in the test should contribute to establishing and understanding where students are in the aspect of learning in focus – that is, every item should contribute to the purpose of the assessment. The test developer must have a clear idea of the skill or knowledge that each item measures. Items should be constructed so that they are meaningful and are relevant to the aspect of learning in focus. All items should be independent of each other: that is, proficiency in answering one item should not affect the ability to answer another item in the test. This means that every item adds uniquely to building the picture of students' proficiency.

In summary, a good test:

- provides a fair and balanced representation of the aspect of learning in focus
- contains items covering a wide range of difficulty
- includes concepts that are central to the aspect of learning in focus
- avoids giving advantage or disadvantage to any group of students on the basis of gender, ethnicity or any other background characteristic
- is interesting to the test takers.

A good item:

- contributes independently to building the picture of students' skills, knowledge and understanding
- can be justified for inclusion in the test in terms of the skill or knowledge that it measures
- does not include trivial or irrelevant features.

4.2 Item Stimulus and Context

An early step in developing good tests and good items is deciding on the context and selecting or creating a stimulus. 'Stimulus' refers to the prompt or context on which an item is based. The stimulus material provides the context for an item. It may be a piece of text, a diagram, a graph, a table, a map, a chart, or a combination of these.

Most test development begins with the selection or creation of appropriate stimulus material. Reading tests are usually based on extended texts that lend themselves to a series of items or a unit that addresses a range of relevant skills. Mathematics and science tests may include short stimulus material, such as several numbers to be added or an equation to be completed. Mathematics and science items may also include a more complex stimulus, such as a graph, chart, table, or diagram with a series of associated items addressing a range of skills.

The stimulus material should clearly present the main features to be assessed. It should not contain superfluous, repetitive, or unnecessary detail. Good stimulus material has the following characteristics:

- It is substantive and worth examining closely.
- It is likely to be of interest to the target audience.
- It is well written and well designed.
- It is optimally challenging, not too hard or too easy.
- It does not pose spurious challenges.
- It is factually correct.

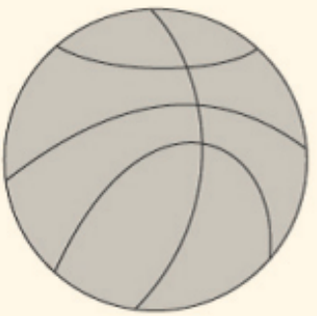
- It offers opportunities for searching questions.
- It is self-contained.

Where appropriate, providing some context for the stimulus material is important. Context may be provided through a heading or a brief introduction. For example, an extract from a science fiction novel might be introduced as follows: "This piece of writing is from a novel set in the future." Images should preferably be an intrinsic part of the stimulus material, supplying additional meaning. If images are included simply as decoration, they should not assist students in understanding the text.

In the lower classes (grades) especially, the stimulus may be supported by illustrations in the form of pictures or diagrams that make the content interesting and help students to interpret the context. Illustrations are helpful to students of any age with poor or average reading skills – an important support when the domain being assessed is not reading.

Figure .1. Example of a good stimulus : An illustration that supports the context

Mani wants to show the size of the Earth, Moon and Sun. He will use a basketball, baseball, and golf ball.



basketball

baseball

golf ball

Which arrangement is best?

	Earth	Moon	Sun
a.	Baseball	Basketball	Golf Ball
b.	Golf Ball	Baseball	Basketball
c.	Golf Ball	Basketball	Baseball
d.	Baseball	Golf Ball	Basketball

Source: International Benchmark Test Sample Questions: Science Year 4 [2]

Where a test is to be translated in more than one language, the stimulus should not pose any linguistic problems when translated. Often, more than one item is based on a single stimulus. Students only have to consider the stimulus once, and then they can use the information from it to answer several items. A 'test unit' consists of the stimulus material and the item(s) based on that stimulus.

Avoiding Bias

The stimulus and contexts used across a test should be equitable to all students. This does not mean that every context or stimulus will be equally appealing to every student – an impossible goal. Rather, the test developer should aim for diversity in order to avoid context-related bias. Bias occurs when much of the test gives advantage or disadvantage to one group or subgroup of students. A text based on a distinct dress style may cause gender bias, or a text based on a particular geographical area, culture or food habits may give advantage to a distinct group of students.

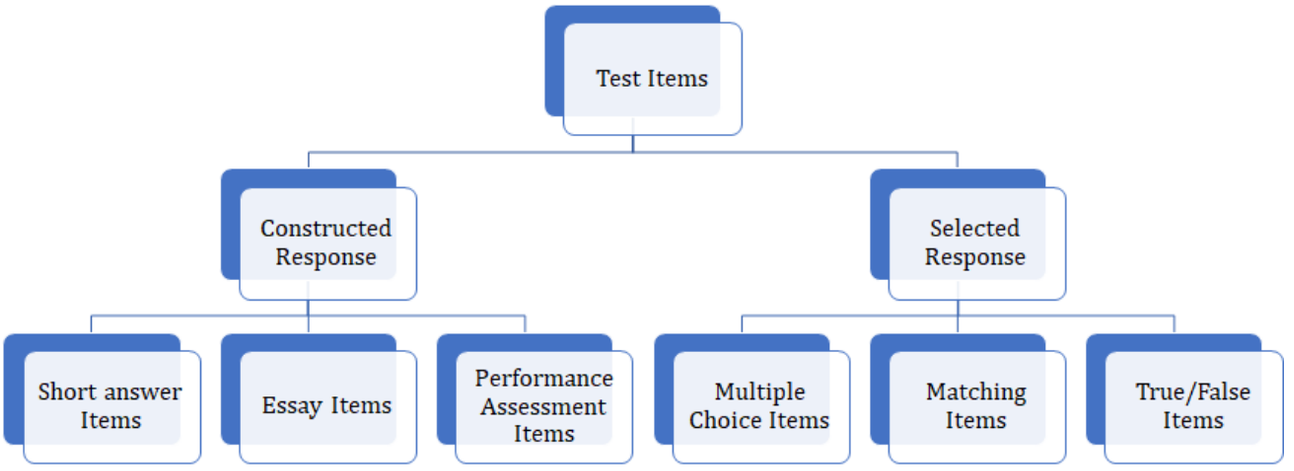
This kind of problem could be overcome, either by allowing adaptations of the terminology in different parts of the country, or by including stimulus materials featuring a variety of regional contexts and terms, so that all students would likely encounter both culturally familiar and unfamiliar material.

Sensitivity

The test developer must take great care to avoid giving offence, frightening or upsetting test takers. The emotional well being of a student affects how the student performs in an assessment task. Contexts such as trauma, violence, abuse or any controversial issues should be avoided. Sensitive topics such as religion, politics and poverty should be carefully considered, taking into account grade appropriateness and community attitudes associated with a topic.

4.3 Item/ Response Formats

The two major item or response formats are **Constructed Response and Selected Response**. Constructed response items require students to supply their own responses. They include short answers, essay and performance assessments. Selected response items require the students to choose an answer from a set of two or more options. Common types of selected response items include multiple choice items, true/false items and matching items.



Closed constructed-response items require a very short response such as one or two words, or a numeric response. They are called 'closed' because there is only one acceptable response, or a very restricted range of acceptable responses. Closed constructed-response is a useful format when the answer would be quite obvious in a multiple-choice format due to lack of plausible distractors. A disadvantage of closed constructed-response items is that they may need to be manually scored, which adds to the cost of the overall assessment process. Even though the acceptable range of responses is very small, a marking guide must be carefully constructed, to allow for all possible varieties of acceptable response.

Short open-response items require the student to generate or construct their answer, rather than select from a set of options. The distinguishing feature of open-response items (compared with closed constructed response items) is that a wide range of responses is acceptable. Responses to short open-response items include short written explanations, mathematical expressions, drawings and diagrams, analysis or evaluation. Adequate space on the paper and adequate time must be provided for answering such items.

Selected Response Items : Multiple-choice items are written so that there is only one correct answer, so they can be reliably scored. Multiple-choice items are generally faster for students to answer compared to constructed-response items. Therefore, a greater number of items can be included in a test meaning that a wide range of content can be covered. Multiple-choice items are also relatively easy to administer and mark, especially when marking is done by machines. For large samples, machine marking is quick and easy and saves costs. However, good multiple choice items are not easy to construct and require skilled test developers. If distractors (incorrect responses) are not plausible, it becomes easy for students to guess the correct response. This interferes with the accurate measurement of students' skills.

A multiple-choice item is made up of: a stem (the part of the item that introduces the options); one key (the correct or only acceptable answer); typically three or four distracters (incorrect options).

4.4 Aligning learning outcomes with item types

Selected response items, and more specifically multiple-choice items, are useful when there is a requirement to cover a significant amount of content in a short time. In comparison, constructed response items should be used when they are the best method for collecting evidence about student performance on particular learning outcomes.

The following table is a summary of how learning outcomes might best be aligned with item types.

Table 5: Aligning learning outcomes with item types

	Selected Responses	**Constructed Response**		
	Multiple Choice, Matching	**Essay, Short Answer**	**Performance Assessment**	**Other Assessment Techniques**
Demonstrate knowledge and understanding	Generally used for assessing knowledge	Can be used to assess knowledge and understanding	Not generally used	Can use instruments such as interview to assess knowledge, but is time consuming
Solve problems and reason	Can be used to assess problem solving and reasoning; is difficult to write	Written descriptions of complex problem solving can be used	Can be used to monitor students as they solve problems, and, then infer the ability to reason and solve problems	Can ask students to describe out loud what they are doing
Demonstrate performance skills	Generally not used to assess the actual skill, but can be used to assess the knowledge component related to the skill		Can watch students as they perform the skills and make decisions as to how well they are being performed	Can use interview schedule to assess the communication part of the performance and knowledge part of the performance

Create products	Can assess knowledge part of the ability to create products, but cannot use these to assess the products themselves	Can assess how well the students create the product and then assess quality of the product itself	Can ask student about the procedure they are using to create the product itself

4.5 Initial Drafting of Items

Test developers design items according to the specifications in the framework and blueprint, including the response format, content, and skills to be assessed. Test developers need to keep in mind the duration of the test and the wide range of abilities of the students in each class level.

- **Creating Item Descriptors** - the test developer should create an item descriptor (sometimes called a question intent) at an early stage in the development of the item. The item descriptor describes what the item intends to measure. An item descriptor helps the test developer to focus on the purpose of the item, and how it relates to the domain. Later, it helps reviewers to evaluate whether the item's purpose is valid, and whether the item has fulfilled its purpose. Later still, item descriptors can be used in building reports on an assessment for teachers, parents, students and systems.
- **Intrinsic & Extrinsic Item Difficulty**- items in an assessment should cover a wide range of difficulty, in order the proficiency of students with varying levels of ability can be measured and described.

  Writing items with different intended levels of difficulty requires the test developer to have sound content knowledge and a good technical understanding of how items work. For example, in a reading assessment, items can be made more difficult by asking about information that is implicit rather than explicit in the text. In a mathematics assessment, all other things being equal, a problem that requires division is likely to be more difficult than a problem that requires multiplication. Clearly these examples focus on skills and knowledge that are **intrinsic** to the subjects of reading and mathematics respectively, and good test developers manipulate the levels of difficulty of items using these kinds of characteristics, which depend on the nature of the domain. However, there are some factors that can contribute to item difficulty that are **extrinsic** to the domain or subject. These factors should not be used to make items more or less difficult because they do not contribute to outcomes that indicate students' skills and knowledge in the domain of interest.

Some of the features of items that make them unintentionally or extrinsically difficult are:

- items containing long and complex sentences;
- items that include difficult vocabulary;
- lack of clarity about the kind of response required (for constructed-response items);
- unnecessarily complex illustrations and diagrams;
- items in a maths or science assessment that require a lot of reading;
- topics or texts that are not accessible to the students;
- items that favour a particular gender, group, community, religion or state

• Item Bias

Students bring a diversity of cultural knowledge and understanding to a test. They should not be penalized or advantaged by life experiences that are not relevant to the knowledge, skills, and understanding that the test is intended to assess. For example, items about a popular male sport might disadvantage females. Items can also be biased if they upset some students but not others. Stimulus material should not breach ethical, cultural, or other sensitivities. There should be no chance that some students could be offended, frightened, or upset by the test material. The test development manager should sensitize item writers to various forms of bias. Review panels should be encouraged to look out for test or questionnaire items that might be biased or cause offense.

Overall, the Items should be written in the simplest and clearest language possible. The wording should be sufficiently simple so that students can reasonably be expected to be able to read it:

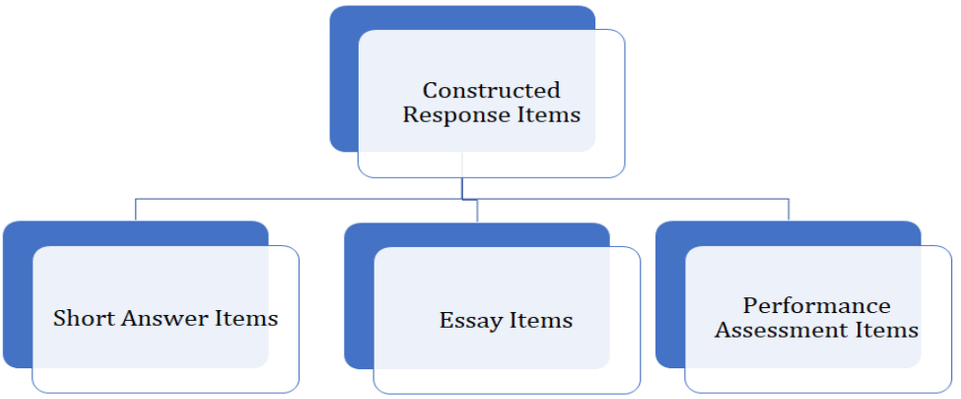
- Avoid difficult vocabulary.
- Avoid long sentences.
- Do not use convoluted sentences.
- Do not use difficult logic.
- Avoid ambiguous or vague questions.
- Avoid double negatives.
- Avoid inconsistency (for example, using different units of measurement in the options or different terms to refer to the same thing).
- Do not use vague wording or unfamiliar terms that are not adequately defined.

We will be discussing more detailed and specific guidelines for writing constructed- response and multiple choice items in the following chapters.

Chapter 5 : Creating Constructed Response Items

Types of Constructed Response Items

One way to classify constructed response items is shown in the following figure.



5.1. Short Answer Items

Short answer items are designed to produce a brief response, usually a word or phrase, from students. They are mostly used to assess basic levels of knowledge and understanding of students.

Short answer items do not particularly follow a standard format. They may include items like 'complete the sentence', 'find the missing word', and 'explain the concept with charts and diagrams'. The length of the response is usually restricted to, at the most, a few lines. Students may also have the option of responding in bullet point form.

Examples of a few short answer items taken from CBSE's sample question paper for Science (Grade IX, 2011-12) are given below:

Q. A passenger in a moving train tosses a coin which falls behind him. State the type of motion of the train.

or

Q. State the processes involved in conversion of a green tomato to red.

Short answer items are a good choice for item writers in specific situations since they :

- are particularly well suited to quantitative problems and problems requiring the interpretation of graphs, etc.
- allow better sampling of the curriculum.

However, item writers should also consider the following while making their choice since short answer items:

- require comprehensive and reliable marking rubrics
- are generally time consuming to score.

5.1.1. Guidelines for Creating Short answer type items

Item writers should keep in mind the following aspects while framing short answer type questions:

- Make sure that the items are relevant and appropriately assess the learning outcomes.
- Make sure that the language in the items is clear and appropriate for the students attempting the assessment.
- Make sure that the items are free from unintentional clues.
- Make sure that the items have one clearly correct answer.
- Make sure that the items clearly specify how the respondent has to answer them.
- Structure the item so that the response is as short as possible.
- Use the direct-question format in preference to the complete-the sentence format.
- Make sure that the blanks for the student responses are long enough to write their answers.
- Avoid copying text straight from the text books and converting it into a short answer item.
- Create a marking key and apply it consistently.

5.2. Essay Items

Essay items are designed to elicit a response of one or more paragraphs from students.

Teachers can write highly challenging items that ask students to analyse, compare, draw complex conclusions, or evaluate in a written form. Generally, answers to the essay type items require a basic response format which follows the following structure:

1. *Introductory section/aims/outcomes*
2. *Summary of the main points and ideas*

3. *Results generated/ issues relating to the topic*
4. *Conclusion and upcoming actions*

Some example of essay items taken from the CBSE's sample question paper for Social Science (Grade IX, 2011) are given below:

Q. Explain the four requirements of the production of goods and services. What are the items that come under physical capital? (5marks)

or

Q. Explain the circumstances that helped the middle class in bringing social and economic changes in France in the 18th Century. (5 marks)

Essay items are beneficial in several situation as they are :

- Generally the best way to measure complex learning outcome
- More likely to eliminate guessing if they are well constructed.

On the other hand, essay items:

- are difficult to construct because of the complexity associated with constructing comprehensive and reliable marking rubrics, gaining inter-marker consistency and addressing the halo effects associated with hand-writing, grammar and spelling, etc.
- Can lead to a limited sampling of the curriculum.

5.2.1. Guidelines for Creating Essay type items

Item writers should keep in mind the following aspects while framing essay type questions:

- Write the question in simple, clear and direct language; make sure you provide enough information to ensure that the students know exactly what is required in the task.
- Carefully consider the amount of time the students need to answer the essay item and make it clear to the students.
- Use essay items to assess higher-order cognition skills, they should be written at the cognitive level indicated by the verb in the standard or learning outcome.
- Use simple and clear language in the item.
- Make sure that the marking rubrics are constructed in advance

5.3. Performance Assessment Items

Performance assessment items assess student skills in carrying out an activity or producing a product in a context that closely resembles real-life situations. These are sometimes referred to as 'authentic assessment items'. These items are primarily used in assessing those subjects that have a performance component, like art, language, social studies, music, drama, dance, etc.

Some basic examples of performance assessment items include:

- Carry out a conversation (in Spanish) with a Spanish tourist explaining about the tourist destinations in India.
- Create 2 useful toys out of paper.
- Give a live demonstration of a pre-created piano lesson.

Performance assessment times prove to be advantageous since they:

- Make assessment more meaningful and relevant for students and, as a consequence, students may be more motivated to learn.
- Allow the assessment of process as well as product.

However, performance assessment items can also be disadvantageous since they:

- Generally assess a small part of the curriculum in a very deep way, which could mean that results are not generalizable across the curriculum.
- Are time consuming to construct, administer and mark.

5.3.1. Guidelines for Creating Performance assessment items

While constructing performance items, item writers can keep the following guidelines in mind.

I. Select an appropriate performance task:
   - make sure it is the most direct assessment of the learning outcome.
   - try and make sure it encompasses more than one learning outcome.
   - select a task that assesses learning outcomes that are 'teachable'.

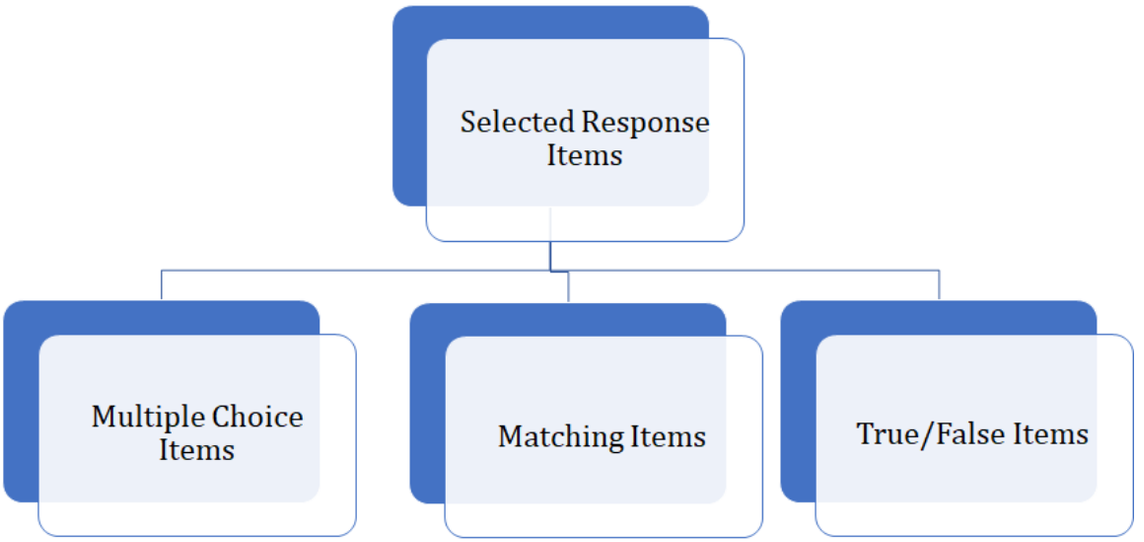
II. Make sure that the administrative instructions clearly specify what it is the students have to do. The instructions should:
   - be clear.
   - describe the purpose of the task.
   - clearly specify the criteria for marking the response.

III. Develop clear marking rubric (essentially) the same as essay items:
   - rating scales and checklist are typically used as rubrics for performance items

Chapter 6 : Creating Selected Response Items

Types of Selected Response Items

The types of selected response items can be classified as following :

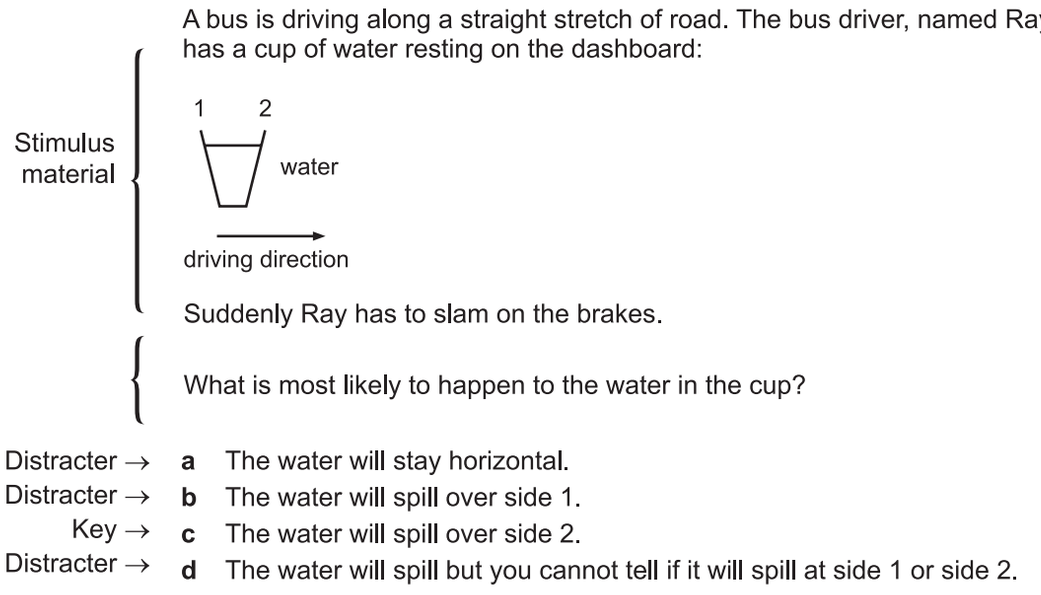


6.1. Multiple Choice Items

A multiple-choice item (MCI) consists of a lead sentence, the stimulus, the question or the stem, the distractors or the incorrect options and the key i.e. the answer.

- **Direction Line/Lead Sentence:** directs a student to use the stimulus or provides related information about the stimulus.
- **Stimulus:** is the information required in order to answer the item (only used if it is necessary to answer the item).
- **Stem:** is the text that states the question or the problem which is clearly aligned to a learning outcome.
- Key: refer to the correct or best alternative.
- **Distractors:** are the incorrect but plausible answers.
- **Rationales:** refer to the justifications that explain why a certain distractor is plausible, yet incorrect, or demonstrates a common misconception.

Figure : Structure of a Multiple Choice Item



When to Use Multiple Choice Items

MCIs can be used to assess a wide range of learning outcomes including simple recall of knowledge, analysis of phenomena, application of principles and interpretation of cause and effect relationships. They are also useful when there is a need to cover a significant amount of content in a short time. While they are not that useful for measuring performance skills, they can be used to assess some aspects of the knowledge pre-requisites of the performance.

Some of the advantages and disadvantages listed below would also help teachers decide when to use MCIs.

Advantages of Multiple-Choice Items

- MCIs are versatile as they can be used to assess a wide range of learning outcomes.
- They are reliable as outcomes can be marked.
- Good quality MCIs maximise the validity of the assessment as students can attempt numerous items in a given amount of testing time, resulting in broader sampling of course content.
- MCIs that are carefully constructed can provide valuable feedback to the student.
- They are efficient.

Disadvantages of Multiple-Choice Items

- They are difficult to construct.
- They are not adaptable to assess certain learning outcomes including articulating an explanation, displaying thought processes, etc.

- They are susceptible to guessing.

6.2. Guidelines for Writing Multiple Choice Items

There are several guidelines for effectively developing multiple choice items. The following section provides details and examples on how to increase validity and reliability of multiple-choice items.

1. Align items to the learning outcomes

The item should always be aligned to a learning outcome. Items should not be created in isolation but should always be measured in terms of whether they actually assess the learning outcome.

Example: Science

Learning outcome: To explain the properties of images formed by spherical mirrors for different positions of an object	
The centre of the reflecting surface of a spherical mirror is a point called a. Radius (R) b. Centre of curvature (C) c. Focus (F) d. Pole (P) *This item may be assessing an important learning outcome, but is it assessing the desired learning outcome?*	**Better…** To get a virtual image of an object with a concave mirror, where should the object be placed? a. between the pole and focus* b. beyond the centre of curvature c. at the focus d. between the centre of curvature and focus

Example: English

Learning outcome: To infer meaning from the context	
Which one of the following is a synonym for the word 'kind'? a) sincere b) compassionate* c) passionate d) harmless *The above item does not assess the learning outcome as no context has been provided.*	**Better…** 'The old man was patient and kind to everything that had life……' Which one of the words best describes the old man? a) sincere b) compassionate* c) passionate d) harmless

Example: Social Science

Learning outcome: To explain the characteristics of various landforms	
In India, Thar is the name of a a) plateau b) plain c) desert* d) coastal area *The above item does not assess the learning outcome*	**Better…** Select a landform which experiences scanty rainfall, wide range of temperature from day to night, and has very little vegetation a) mountains b) plain c) desert* d) coastal area

2. An item should assess an important concept

It is easy to construct multiple choice items that measure trivial, irrelevant or otherwise unimportant aspects of learning. We need to guard against this and make sure each question measures the important aspects of learning.

Example: Science

Learning outcome: To explain Law of Gravity: Sir Isaac Newton discovered the Law of Gravity. The law states that 'Every particle of matter in the universe attracts every other particle with a force that is directly proportional to the product of the masses of the particles and inversely proportional to the square of the distance between them.'
What was Sir Isaac Newton's profession? a) Physicist* b) Mathematician c) Scientist d) Business Man *Is this assessing an important part of the learning outcome?*

Example: Mathematics

Learning outcome: To find out the midpoint of a line segment	
Under the topic of Coordinate Geometry, we learn about..... a) values of trigonometric ratios b) properties of real numbers c) calculation of mode d) midpoint of a line augment* *Is this assessing an important learning outcome?*	**Better…** What is the midpoint of the line segment AB, where A is (-4,2) and B is (6,-6)? a) (-1,2) b) (1,-2)* c) (-1,-2) d) (-2,1)

Example: English

Learning outcome: To perform character analysis	
What was the name of the servant? a) Peter* b) Mathew c) Sam d) Timothy *Is this assessing an important learning outcome?*	**Better…** Which characteristic do you think best describes the servant in the story? a) devoted* b) honest c) happy d) secretive

3. Items should be written in unambiguous, simple and clear language

The words used in an item should eliminate all elements that are irrelevant to the actual question and concentrate on being precise and to the point. The question must assess the knowledge or skill that is supposed to be assessed and the students should not be stopped from demonstrating the knowledge or skill because of the sophistication of the language.

Example: Science

Learning outcome: To explain the properties of baking soda	
Gita decided to take flowers for her friend's birthday. While she was plucking flowers from her garden, she was stung by a bee. What should Gita use in order to ease the irritation and pain? a) common salt b) baking soda* c) bleaching powder d) washing soda	**Better…** The irritation and pain caused by a bee sting can be eased by a) common salt b) baking soda* c) bleaching powder d) washing soda *How has this stem improved?*

Example: Mathematics

Learning outcome: To use the unitary method in calculations	
Seema had to buy fruits from the market. She went to the nearest shop with a total of INR 100 and asked the shopkeeper to give her apples which were priced at INR 20/apple. How many apples did she take back? a) 5* b) 7 c) 10 d) 12	**Better…** How many apples can a person buy with INR 100 if each apple costs INR 20? a) 5* b) 7 c) 10 d) 12 *How has this stem improved?*

Example: Social Science

Learning outcome: To relate type of vegetation with the land-type	
When the Ganga-Brahmaputra rivers meets near the ocean, they form a vast delta which is covered with a thick forest. What is this forest called? a) tropical rain b) montane c) mangrove* d) deciduous	**Better…** Which type of forest is found in the Ganga-Brahmaputra delta? a) tropical rain b) montane c) mangrove* d) deciduous

4. Follow grammatical consistency between the stem and the options

If the stem or distractors have confusing grammatical elements, it may automatically give away the key. Students are often test wise i.e. they use clues to select the correct answer, that are not related to the knowledge or skill being assessed.

Example: Chemistry

Learning outcome: To identify the properties of an atom	
The smallest unit of an element having the properties of that element is <u>an</u> ..... a) molecule b) proton c) atom* d) particle *Can you guess the answer?*	**Better…** The smallest unit of an element having the properties of that element is ..... a) a molecule b) a proton c) an atom* d) a particle *How has the item improved?*

Example: English

Learning outcome: To Comprehend the meaning of word	
'At first the infant, mewling and puking in the nurse's arm's In the line above, 'mewling and puking' show the child's_____. a) stubborn b) helplessness* c) recklessly d) naughty *Can you guess the answer?*	**Better…** 'At first the infant, Mewling and puking in the nurse's arm's In the line above, 'mewling and puking' show the child's_____. a) stubbornness b) helplessness* c) recklessness d) naughtiness *How has the item improved?*

Example: Biology

Learning outcome: To understand the design and function of the lungs	
In the human body, the _____ are designed to maximise the area for exchange of gases a) heart b) stomach c) lungs* d) small intestine *Can you guess the answer?*	**Better…** Which one of the following is designed to maximise the area for exchange of gases in the human body? a) heart b) stomach c) lungs d) small intestine *How has the item improved?*

5. Items should be written so as not to give away the answer

The stem should avoid giving away the key in the particular question or anywhere else in the question paper. The items and the entries question paper should be reviewed by a third party to identify potential clues that might give away the correct answer inappropriately.

Example: Biology

Learning outcome: To explain the functions of spinal cord	
Which one of the following is responsible for reflex action? a) the cerebellum in the hindbrain b) the hypothalamus in the midbrain c) the reflex arc in the spinal cord* d) the cerebrum in the upper brain *Can you guess the answer?*	**Better…** Which one of the following is designed to maximise the area for exchange of gases in the human body? a) cerebellum b) hypothalamus c) spinal cord* d) cerebrum *How has the item improved?*

Example: Social Science

Learning outcome: To explain the types of forest from conservation perspective, and their significance	
Which type of forest is best for the rural community of the surrounding areas? a) reserved forests b) village forests c) community forests* d) protected forests	**Better…** Which type of forest is best for sustainable livelihood? a) reserved forests b) village forests c) community forests* d) protected forests

6. Items should be constructed so that the question is located in the stem

All the necessary information should be in the stem, otherwise, students will be able to judge the likelihood of each option (with its additional information) independently, modeling bad test taking behavior, and increasing the likelihood of getting the answer to the question correct without knowing the skill being measured.

Example: Social Science

Learning outcome: To locate various state capitals in the geographical map	
Chandigarh lies to the a) north of Delhi* b) south of Delhi c) east of Delhi d) west of Delhi *Can you hide the option and still answer the item?*	**Better…** The location of Chandigarh as compared to Delhi is a) north* b) south c) east d) west *How has the item improved?*

7. Items should rarely be framed in the negative

Remember tests are really a poor substitute for individualised interactions between the teacher and the student. It is hard to imagine a teacher ever asking students what is NOT the answer to a problem, so why should an item be designed to ask students what is not the correct answer to a problem? If it is necessary to ask the question in the negative, then the negative request can be highlighted by underlining, italics, bold face or capitalization.

Example: Statistics

Learning outcome: To explain the basic terms used in statistics	
Which of the following is NOT a measure of a central tendency? a) median b) mode c) standard deviation* d) arithmetic mean *Why should the student be asked to identify what is not the answer to a question?*	**Better…** Which one of the following indicates how spread out numbers are from the central tendency? a) median b) mode c) standard deviation* d) arithmetic mean *How has the item improved?*

Example: Biology

Learning outcome: To explain the function of chloroplasts	
Chloroplasts perform none of the following functions except: a) reproduction b) photosynthesis* c) respiration d) transpiration	**Better…** Which one of the following is a function of chloroplasts? a) reproduction b) photosynthesis* c) respiration d) transpiration *How has the item improved?*

Example: Social Science

Learning outcome: To explain the activities that are covered under different sectors of the economy	
Which one of the following activities is not covered under the primary sector of the economy? a) agriculture b) animal husbandry c) garment manufacturing* d) pisciculture	**Better…** Which one of the following activities is under the secondary sector of the economy? a) agriculture b) animal husbandry c) garment manufacturing* d) pisciculture *How has the item improved?*

Example: Physics

Learning outcome: To explain the effects of refraction in our day to day lives	
Which one of the following situations is not caused due to refraction of light except a) seeing an inverted image in a shiny spoon b) objects in the rear view mirror of a car appearing farther than they actually are c) formation of infinite images when standing between two mirrors d) being able to see a clear image through spectacles*	**Better…** Which one of the following is based on the principles of refraction of light? a) seeing an inverted image in a shiny spoon b) objects in the rear view mirror of a car appearing farther than they actually are c) formation of infinite images when standing between two mirrors d) being able to see a clear image through spectacles* *How has the item improved?*

8. Items should have no repetitions in the options

Distractors in the items should be appropriately created to eliminate mundane repetitions. A careful analysis of the item would facilitate rephrasing in such a way that it does not appear repetitive. If not, it just adds burden to the students and potential confusion to the test taker.

Example: Chemistry

Learning outcome: To explain the composition of ozone	
How is ozone obtained? a) if 3 atoms of oxygen unite into a molecule, we get ozone* b) if 3 atoms of oxygen unite into 2 molecules, we get ozone c) if 3 atoms of oxygen unite into 3 molecules, we get ozone d) if 3 atoms of oxygen unite into 4 molecules, we get ozone *Why do you think repetitions in the options can lower validity?*	**Better…** Ozone can be obtained when 3 atoms of oxygen unite into how many molecule/molecules? a) 1* b) 2 c) 3 d) 4 *How has the item improved?*

Example: Biology

Learning outcome: To explain the importance of iodine in the diet	
Why is it important for us to have iodised salt in our diet? a) iodine is essential for the fat, carbohydrates and protein metabolism in the body b) iodine is essential for the synthesis of thyroxin* c) iodine is essential for the secretion for hormones in precise quantities d) iodine is essential for the regulation of blood sugar levels	**Better…** We need to have iodine in our diet because it is essential for the a) metabolism of fats, carbohydrates and protein b) synthesis of thyroxin* c) secretion of hormones in precise quantities d) regulation of blood sugar levels *How has the item improved?*

9. Items should have only one correct or clearly best answer

Be sure that there is only one complete and best answer. The incorrect options (distractors) should be plausible but inferior to the correct answer. The rest of the alternatives should not overlap and should be mutually exclusive.

Example:

Learning outcomes: To identify the diverse forms of sports
Which one is the odd one out? a) billiards b) cricket c) hockey d) football *What is the correct answer to this item?*

10. Options in items should be phrased in such a way that there are no opposites

Repetitions or opposite alternatives tend to eliminate diversity in the distractors. Distractors need to be created in such a way that each one is plausible.

Example: Physics

Learning outcome: To explain Universal Law of Gravitation	
The universal law of gravitation successfully explains that: a) tides occur due to the moon and the sun* b) tides do not occur due to the moon and the sum c) tides occur only due to the moon d) tides occur only due to the sun *Notice that options (a) and (b) are opposites*	**Better…** The universal law of gravitation successfully explains that: a) tides occur due to the moon and the sun* b) there is no force that binds us to the earth c) other planets exert no force on the earth d) only moon causes the occurrence of tides *How has the item improved?*

11. The options should be plausible and similar in context, phrasing and length

All distractors must be similar in nature and homogeneous. Also, distractors should be plausible, even if it means that the number of distractors have to be reduced. Answers from previous examinations and common student errors could be a good source for creating plausible distractors. Alternative options that are not plausible should be avoided.

Example: Physics

Learning outcomes: To explain the use of convex mirrors in different situations
Convex mirrors are used a) as headlights in a car to get a powerful parallel beam b) as rear view mirror in vehicles, to see the traffic behind* c) to concentrate sunlight for heating purposes d) as a magnifying glass to see enlarged images *If a student chooses option (a) or (c), then he/she is confused between the uses of concave and convex mirrors. If he/she chooses option (d), then he/she confused between the concept of mirror and lenses*

12. Absolute terms such as 'always', 'all', 'never', 'only', 'none' to be used sparingly

The test question should be simple and clear. It should mirror good instruction and be relevant to the learning outcomes. Absolute terms often interject confusion and distract students from answering with what they know. As such, they should be used sparingly.

Example: Teacher Competence

Learning outcome: To explain the relevance of achievement tests
Achievement tests help students to improve their learning by a) encouraging them all to study hard b) informing them of their progress c) giving them all a feeling of success d) preventing any of them from neglecting their work *What is the correct answer to this item? How can a weak student get this item correct without really knowing the answer?*

13. Phrases such as 'all of the above' and 'none of these' to be used sparingly

These options tend to dilute the effectiveness of other distractors. If 'none of the above' is actually the answer, then the significance of the item in terms of relevance to the learning outcome is reduced. The assessor will not be able to establish if the student actually knows the answer or not. In either case, students can use partial knowledge to arrive at a correct answer.

Example: Mathematics

Learning outcome: To explain what is arithmetic progression	
Progressions with equal common difference are known as a) Harmonic Progression b) Geometric Progression c) Arithmetic Progression* d) None of the above	**Better…** Progressions with equal common difference are known as a) Harmonic Progression b) Geometric Progression c) Arithmetic Progression* d) Constant Progression

Example: Chemistry

Learning outcome: To explain the fundamental laws governing a chemical reaction	
A chemical reaction involves a) only breaking of bonds b) only formation of bonds c) both breaking and forming of bonds* d) None of these	**Better…** A chemical reaction involves a) a change of atoms from one element into another b) the appearance or disappearance of atoms c) the making or breaking of bonds between atoms* d) a change in the state, colour or temperature

14. Ensure the answer options do not overlap with each other

The distractors should be mutually exclusive of each other and not result in options that overlap and thereby create confusion.

Example: Mathematics

Learning outcome: To use the relationship between time, speed and distance in different contexts	
If a person is traveling at a speed of 10 km/hour, what distance will be covered in 5 hours? a) upto 20 kms b) upto 30 kms c) upto 40 kms d) upto 50 kms *What is wrong with this item?*	**Better…** If a person is traveling at a speed of 10 km/hour, what distance will be covered in 5 hours? a) 20 kms b) 30 kms c) 40 kms d) 50 kms *How has the item improved?*

When constructing MCIs, avoid

- items based on trivial information
- taking items directly from the textbook, or using verbatim phrasing
- unfamiliar vocabulary or language structures
- question based on opinions
- cultural and gender biases

Additional points regarding development of options

- Use plausible distractors
- Vary the position of the key
- Place the options in logical or numerical order
- Distractors not chosen by any students should be replaced
- Use true statements that do not correctly answer the question rather than obvious wrong statements
- Use letters for bulleting the options as students may get confused when the answers are in numerical form.

6.1.2. Guidelines to vary the Item Difficulty

1. Use familiar content

Do not try to trick students by placing information into the question that is beyond the scope of the instruction or learning outcome being measured.

Learning outcome: To explain what happens when acid reacts with metal carbonate and hydrogen carbonate	
Which gas is given out when limestone reacts with sulphuric acid? a) oxygen b) hydrogen c) carbon dioxide* d) sulphur dioxide	**Easier…** Which gas is given out when calcium carbonate ($CaCO_3$) reacts with sulphuric acid (H_2SO_4)? a) oxygen b) hydrogen c) carbon dioxide* d) sulphur dioxide

Comments: The question has become more comprehensible because the chemical name of limestone and the chemical formula for limestone and sulphuric acid have been mentioned. Please keep in mind that if the learning outcome demands that the student should be well versed with both common names and chemical names of compounds, then the first version is more suitable. However, if the target learner group is not yet familiar with the common name, when we can provide the chemical names and formulae, as we have none in the second example.

2. Use simple vocabulary

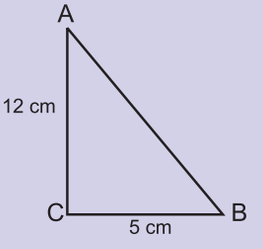
Do not be tempted to make the question more difficult by adding difficult vocabulary, particularly if it is not related to the learning outcome.

Learning outcome: To identify the synonyms	
The synonym for the word 'livid' is a) lively b) bright c) tasteless d) angry*	**Easier…** Another word that means the same as 'livid' is a) lively b) bright c) tasteless d) angry*

Comment: The question becomes easier because the word synonym has been replaced with an explanation.

3. Provide a stimulus

If a graphic or picture (stimulus) is part of instruction and the learning outcome then include it with the test question even if you think it might make the question easier.

Learning outcome: To calculate the area of a right triangle	
The area of a right triangle with base 5 m and altitude 12 m is a) $50m^2$ b) $30\ m^{2*}$ c) $9\ m^2$ d) $15\ m^2$	Ea**sier…** The area of a right triangle is a) $50m^2$ b) $30\ m^{2*}$ c) $9\ m^2$ d) $15\ m^2$ 

Comments: The question has become because of the stimulus in the form of a diagram. Once again, the stimulus, in this case, may be provided if we want to make the item easier.

Chapter 7 : Bloom's Taxonomy and Item Development

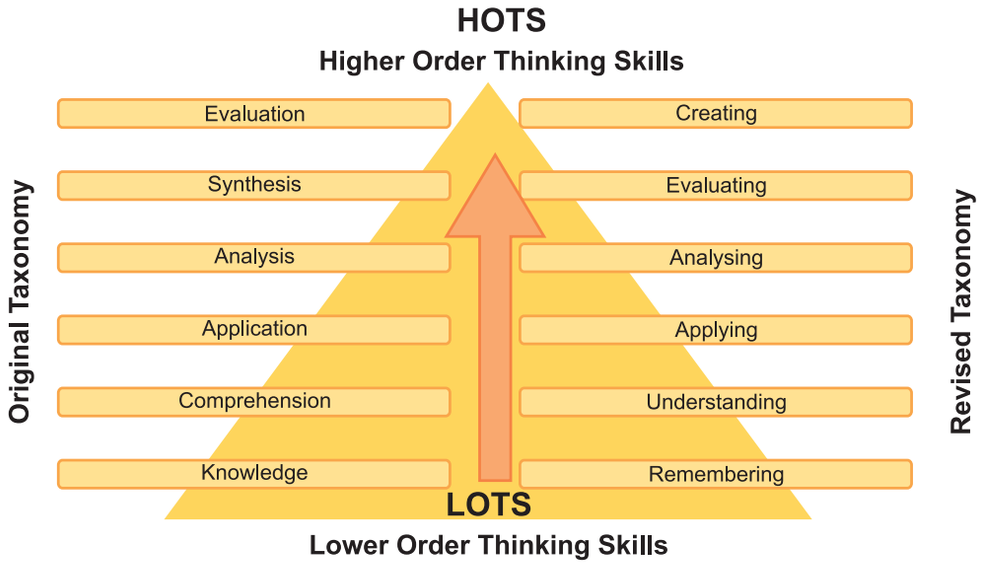
Bloom's Taxonomy of educational outcomes is a framework which classifies statements of what the teachers expect or wants the students to learn as a consequence of their instruction. "Taxonomy" means 'a set of classification principles', or 'structure', and "Domain" simply means 'category'. This theoretical account is generally classified under three broad areas or domains. The compilation divided the three domains further into levels that run from the simplest to the most complex behaviors.

- The Cognitive – knowledge based Domain, consisting of six layers;
- The Affective – attitudinal based Domain, consisting of five layers; and,
- The Psychomotor – skills based Domain, consisting of six layers

For the purpose of development of test items in the examination conducted by the Board, we will restrict ourselves to the cognitive domain. Bloom's taxonomy of Cognitive Domain provides an excellent structure for preparing, designing, assessing and measuring the effectiveness of instruction and learning. This structure also functions as a checklist, by which a teacher can ensure that teaching is planned to deliver all the necessary development for students. This framework has been widely used across the globe in teaching, learning, and assessment activities.

7.1 Higher order Thinking Skills and Lower Order Thinking Skills:

In 2001, Lorin Anderson (a former student of Bloom) with a team of experts, revised Bloom's Taxonomy with the aim of making it more relevant to the needs of students and teachers of the 21st Century. The revision was called Taxonomy for Teaching, Learning, and Assessment. The most obvious change in the new version was that the nouns in the original taxonomy were replaced with a series of action verbs, as shown below:



This taxonomy was specified in hierarchical steps, moving along a development continuum of increasing cognitive complexity in which the lower-order thinking skills are subsumed by the higher-order thinking skills. For example, if a students is functioning at 'applying' level, then it is understood that he has also mastered the material at remembering and understanding (Bloom, 1956). This new taxonomy, thus, reflected a more active form of thinking as these series of action words describe the cognitive processes by which they work.

7.2 Application of Bloom's Taxonomy in specifying the learning outcomes:

Learning outcomes refer to what the teacher wants the student to learn upon completion of the chapter or a unit. Clearly defined learning outcomes help teachers to measure the learning outcomes of their learners. Thus, learning outcomes are clear and unambiguous descriptions of the teachers' expectations of the students. These learning outcomes contain verbs or actions associated with a cognitive process and an outcome or knowledge that the student should acquire/construct: that is to say 'the student will be able to…'

The cognitive domain can help with learning outcomes by acquiring answers to questions like the ones given in the following table.

Remembering	" What do I expect the learner to know?"
Understanding	" Can learners interpret what they know?" " Can they extrapolate from what they know?"
Applying	" Can learners see the relevance of this idea to that situation ?"

Analysing	" Can learners analyse elements of the subject field?" " Can they analyse relationships in the field?" "Can they analyse organizational principles?"
Evaluating	" Can the learners make judgements based on internal evidence?" " Can they make judgments based on external evidence?"
Creating	" Can the learners produce unique communication in the field ?" " Can they develop a plan or a proposed set of operations?" " Can they derive a set of abstract relationships?"

Bloom Taxonomy of Educational outcome (1979) provide a ready-made list of verbs, which is helpful for teachers when writing learning outcomes as illustrated the following table.

Use of action words for writing learning outcomes :

Level	**Level attributes**	**Action verbs**	**Question**	**Expected Learning outcomes**
Remembering	Memorization, recognition or recall of facts.	List, recite, define, name, match, quote, recall, identify, recognize, label	What is…? How is..? Where is…? When did happen? List three… Who was…?	By the end of the year the students will be able to… *recite the poem or state the formulae or state historical facts*
Understating	Demonstrating an understanding of ideas by organising, giving description and organising main ideas.	Compare, contrast, demonstrate, outline, rephrase, translate, summarize	How would you classify the type of…? How would you compare…? State in your own words…?	By the end of the year the students will be able to... *explain the poem or formulae or historical events in own words*

Applying	Correct use of facts, rules, or idea.	Calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model	How would you use…? What examples can you find…? Solve____ using what you have learned…? How would you organise_____ to show…? How would you show your understanding?	By the end of the year the students will be able to… *derive meaning from or of the poem* *or* *the formulae* *or* *historical events.*
Analysing	Breaking down information into component parts. Making inferences and finding evidence to support generalisation.	Classify, outline break down, categorise, analyse, diagram, illustrate	Why do you think? What is the theme..? What motive is there…? List the parts… What inference can you make…?	By the end of the year the student will be able to… *differentiate between the different aspects/content of the poem, or formulae or historical events.*
Evaluating	Judging the value or worth of information or ideas. Presenting and defending opinions about information, validity of ideas etc.	Choose, support, relate, determine, defend, judge, grade, compare, contrast, argue, justify, importance, criteria, prove, disprove, assess, influence, perceive, value, estimate, influence, deduct	What is your opinion…? How would you prove…? Disprove…? Would it be better if…? Why did they (the character) choose…? What would you recommend…? How would you rate…?	By the end of the year the student will be able to… *differentiate between which part of the poem is more valuable/applicable.*

Creating	Combining parts to make a new whole. Combining elements in a new pattern or proposing alternative solutions.	Design, formulate, build, invent, create, compose, generate, derive, modify, develop	How would you improve…? What would happen if…? How could you change (modify) the plot (plan)…? What could be done to minimize (maximize)…? What way would you design…?	By the end of the year the student will be able to *create a new poem.*

Since the main aim of the learning outcome is to provide a relevant and useful basis for constructing test questions, they must be constructed in such a way that they contain verbs that describe observable, achievable actions and specific levels of thinking because these can then be tested.

Understanding the learning outcomes with reference to Bloom's taxonomy will help an item writer to frame quality assessment items.

Chapter 8 : Preparation of Marking Scheme

Marking schemes are written guides that help teachers mark constructed response items in a systematic and objective manner. Broadly the following principles should be followed while preparing marking scheme:

1. Marks should be awarded in line with specific skill and content assessed in the question.
2. More marks should be allocated based on the volume of the content and the time taken by the student to respond to a question.
3. Marks should be awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme. Therefore, rubrics should accommodate such answers.
4. Further information should be provided wherever to eliminate subjectivity in evaluation.
5. Details about value points should be provided wherever required.
6. No level should be defined in the rubrics for negative marks.
7. The nature of responses expected from the students for a question in each subject based is different. Therefore, different templates (samples provided in the below sub-section) need to be followed for each subject.

1. Sample marking scheme - Science

Mark Scheme Notes:

- Detailed break-up of marks should be provided for every expected response
- If there are multiple sub-questions, detailed break-up of marks should be provided for each sub-question
- Further information should be provided wherever necessary to make the criteria of evaluation more clear

Class: 10	Subject: Science
Content domain: Materials	Cognitive level: Analysis
Marks: 3	Time: 5 minutes
Learning outcome: Derives, writes and balances the chemical equations from narrative descriptions of different types of chemical reactions (combination, decomposition, displacement, double displacement, oxidation and reduction).	

Item stem: A student observed the copper powder turning black after some time in the given set up.

a) What was the colour of the reactant in the china dish?

b) Write a chemical equation for the given situation.

c) How can the reaction be reversed to obtain the reactant present in the china dish back? Express your answer in the form of a balanced chemical equation.

d) Name the process taking place in (c). Mention the agents responsible for it.

Marking scheme:

Part	Mark	Answer	Further Information
a)	½	Brown	Accept reddish brown
b)	½	$2Cu + O_2$ -----> $2CuO$	Balancing is not mandatory
c)	½	$CuO + H_2$ ------> $Cu + H_2O$	Accept Cupric Oxide is reduced to copper
d)	½+½+½	redox/oxidation and reduction ½ Oxidising agent = CuO ½ Reducing agent = H_2 ½	Accept the terms oxidizing agent and reducing agent if specific names are not written

Class: 10	Subject: Science
Content area: How things work?	Cognitive level: Understand
Marks: 3	Time: 5 minutes
Learning outcome: Describes magnetic field due to current carrying through a straight conductor and circular loop and electromagnetic induction.	

Item stem: Two straight conductors of length 10cm each are placed parallel to each other. Each is connected to batteries in such a way that equal current flows in the opposite direction. Explain with the help of the pattern of field lines, the distribution of magnetic fields in this case.			
Marking scheme:			
Part	**Mark**	**Answer**	**Further Information**
	1	Identification of the field lines, being in a circular loop carrying current.	
	1/2	Representation of the field in concentric circles near the conductor	
	1	Representation of concentric circles appearing as straight line near the conductor	½ mark if the lines appear parallel
	1/2	Representation of size of concentric circles becoming wide as one move away from the conductor	

2. Sample marking scheme - Mathematics

Mark Scheme Notes:

Marks are of the following three types:

Method mark (M-mark) :

- Method marks are to be awarded if the method is correct, even if the answer is not.
- Awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

Accuracy mark (A-marks)

- Marks are for the correct answer
- Awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

Justification of method marks (JM) :

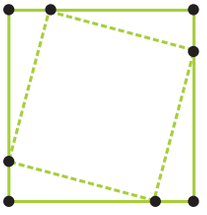
- Marks are dependent on the method. They have to be justified.

Any Equivalent Form (AEF) :

- Any equivalent form of the given answer statement.

Follow through (FT) :

- The symbol FT implies that the A indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A marks are given for correct work only. A marks are not given for fortuitously 'correct' answers or results obtained from incorrect working.

Class: 10	Subject: Mathematics
Content area: Geometry	Cognitive level: Evaluate
Marks: 6	Time: 7 minutes
Learning outcome: Verifies as well as proves theorems and axioms relating to lines, angles, triangles, quadrilaterals and circles.	
Item stem: For the given figure- 1. Prove that the area of the bigger square is (p + q)2. 2. Find the sum of the area of 4 triangles outside the smaller square and inside the bigger square. 3. Find the area of the smaller square.  ABCD and EFGH are square AE = DF= CG = HB = p ED = q EF = r Is there sufficient information given to prove that in a right angle triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides? Justify your answer.	

Marking scheme:	
Marks	Answer
M1	Finds the length of the side of the bigger square by adding p and q and arrives at the required result.
M1	States or implies that the 4 triangles are equal in area and that the height is q and the base is p (or vice versa).
A1	Proves that the sum of the areas of the 4 triangles is 2pq.
A1	States that the area of the smaller square is r^2.
M1	Uses the sum of the areas of the smaller square and the 4 triangles (whatever answers arrived at above) and equates it to the area of the bigger square.
JM1	Arrives at $p^2 + q^2 = r^2$ using the above and states that there is sufficient information

Class: 10	Subject: Mathematics
Content area: Numbers	Cognitive level: Apply
Marks: 3	Time: 5 minutes
Learning outcome: Solves simple problems on heights and distances (which includes understanding of angle of elevation and depression).	
Item stem: The rod AC of the TV dish antenna is fixed at right angles to the wall. AB and a rod CD are supporting the disc as shown in the Fig 4. (i) At what angle should AC and CD be inclined such that AC = 1.5m and CD = 3m long? (ii) Justify if it is possible to incline the rods if AC = 3m and CD = 1.5m?	

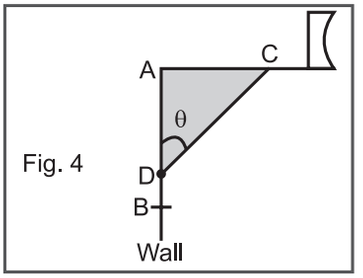


Fig. 4

Marking scheme:	
Marks	**Answer**
M 0.5	Uses the sine relationship for angle θ correctly. AC/CD=sinθ
M0.5	Uses the numerical values of AC and CD to find sin θ. sinθ=1/2
A1	Arrives at the correct value for θ . sinθ=sin30°. θ=30°

AEF1	Argues that this is not possible by arriving at the modified value $\sin\theta=2$ (Or states that the value of $\sin\theta$ cannot be greater than 1. In this case dependent on correct use of formula for $\sin\theta$ previously) Or Alternatively states that, Hypotenuse is the longest side in a right-angled triangle i.e. CD > AC. But given CD < AC, hence this is not possible.

3. Sample marking scheme - Language

Mark Scheme Notes:

- Granular level assessment outcomes need to be defined for every question.
- Detailed information and samples should be provided for giving value points.
- Alternative correct answers and unexpected approaches in students' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated. Nonetheless, the content must clearly be related to and derived from the text.

Question 1:

This question tests the following writing assessment outcomes
(8 marks)

1) convey ideas convincingly using appropriate term of address, salutation, subscription and the layout of a formal letter
2) organize the content and structure the ideas logically, sequentially, cohesively
3) use a range of vocabulary and sentence structure appropriate to the content and the context
4) make accurate use of spelling, punctuation and grammar

Q.No.	Question	Marks
1.	You are XYZ, the school captain of your school in Village Pimpli, District Pali. Your school has been selected to host the Chetan Chavan Cricket Trophy for the nearby village schools. But your school grounds are in a very bad condition due to thunderstorms, cyclone and encroachments by daily wage labourers' settlements. Write a formal letter to Mrs. Leelavati Para, the Sarpanch of your village asking her to call a meeting of the villagers for Shramadan and Arthadan to clear and prepare the school grounds. Give a detailed plan of action to clear the grounds in about 100 words. 4 marks are available for the content, 4 marks for expression, style of writing, use of appropriate words and sentences, spelling, punctuation, grammar and the use of the appropriate layout of a formal letter **Notes on task** The responses might use the following ideas: • The hosting of the Trophy and the need for a play ground • Involving the villagers and preparing a list of volunteers • Clear grounds from encroachment by labourers, removing fallen trees, grass and shrubs. • Create a pitch, spectator stands • Contribute to build a boundary wall, tents for players • other action points relevant to the topic • Minimum value points : 3	8

Marking criteria for Question 1: Formal Letter Writing

Use the following table to give a mark out of 8 for writing.

Level	Marks	Description
3	6-8	Highly effective style capable of conveying the ideas convincingly, logically and clearly incorporating all the points mentioned in the given task, appropriate layout of a formal letter viz addresses, salutation, subscription, and ending. Carefully structured content with a beginning, middle and end with highly relevant ideas presented cohesively. Highly effective register, relevant and appropriate sentences for conveying the ideas precisely and effectively. Spelling, punctuation and grammar are almost always accurate.

2	3-5	Inconsistent style, expression sometimes awkward but meaning clear incorporating almost all the points of the given task, lay out of a formal letter almost followed accurately. Ideas generally well sequenced and related to the given topic maintaining overall cohesion of ideas. Range of vocabulary is limited but conveys the overall meaning and the purpose of the writing. Spelling, punctuation and grammar mostly accurate, with occasional minor errors but does not impede communication.
1	1-2	Expression unclear and most of the points of the given task not incorporated in the answer, layout partially followed affecting the format of the letter. Poor sequencing of ideas but ideas are related to the given topic in a disjointed manner exhibiting a lack of coherence of ideas. Very limited vocabulary or copying from the original text. A lot of errors in spelling, punctuation and grammar impeding communication.

Question 2 : Directed Writing: Paragraph Writing

This question tests the following writing assessment outcomes (10 marks)

1) articulate an exph

Q.No.	Question	Marks
2	Answer the following question in about 200 words. Wanda, the little Polish girl from the story *The Hundred Dresses* is teased, mocked and bullied by classmates but exhibits good values. In your classroom, are there children who speak different languages, and belong to different cultures from your own? How do your classmates treat them? Narrate an incident which you have experienced in your class related to bullying or teasing. How was the issue resolved? How did you react to the incident and how did you feel when it was resolved? Write down your main points in a box before starting. 4 marks are available for narrating the situations and incidents in the class, 6 marks for expression recognizing and appreciating cultural experiences and articulating the ideas critically and logically using appropriate words and sentences, spelling, punctuation and grammar with a beginning, middle and an end **Notes on task** The responses might use the following ideas: The student should write any incident in his/ her school life related to bullying. It could be an incident of simple teasing based on physical appearance, disability, timidity etc. Suggested Points: New students – bullied, teased, incidents - Hurt and shocked, Teacher finds out- Makes committee of children- Children help resolve the problem – Teacher helped students understand through book reading Now no bullying	10

Marking criteria for Question 2: Paragraph Writing

Use the following table to give a mark out of 10 for writing a paragraph

Level	Marks	Description
3	8-10	*Highly effective style* capable of conveying subtle meaning and the point of view of the writer indicating the ability to critical thinking and persuasive writing. *Carefully structured* content with a beginning, middle and end presented cohesively. A wide range of *sophisticated vocabulary* and well-formed sentences used appropriately for the target audience and purpose. Spelling, punctuation and grammar are almost always accurate.
2	4-7	*Effective style* capable of narrating an incident with surface meaning only indicating a general ability to think and write about an incident without a deeper understanding of the issues from a critical perspective Ideas *generally well structured* sequenced logically. Effective register and appropriate choice of words and sentence patterns for audience and purpose. Spelling, punctuation and grammar generally accurate though with some errors.
1	1-3	*Inconsistent style*, expression sometimes awkward and unclear impeding the articulation of the ideas and the point of view of the writer. *Poor sequencing* of idea. *Very limited vocabulary* or copying from the given text. *Persistent errors* in spelling, punctuation and grammar impede the ideas and point of view tried to be conveyed in the paragraph

4. Sample marking scheme: Social Science

Mark Scheme Notes:

- Detailed break-up of h should be provided for every expected response
- If there are multiple sub-questions, detailed break-up of marks should be provided for each sub-question
- Further information should be provided wherever necessary to make the criteria of evaluation more clear

Class: 10	Subject: Social Science
Content Area: Contemporary India II Topic: Integrated: Agriculture, Resource and Development and water resource	Cognitive level: Understand
Marks: 3	Time: 5 to 6 minutes

Learning outcome: Examines phenomena, events and their occurrence in order to explain cause and effect relationship between them

Item Stem: The pictures below show a type of agriculture practised in some parts of India.

i. Explain any 2 features of agriculture shown in the above pictures.

ii. Mention one likely challenge that may be faced by the farmers practicing this type of farming after few years?

Marking scheme:

Expected Answer	**Score**
(i) Gives a detailed description of the features: (any 2) • Large size of the farms • Use of machines • Use of chemical fertilizers, pesticides and irrigation to increase productivity (ii) Likely challenge: (any one) • Over irrigation leading to water logging which increases the salinity and alkalinity of the soil • Too much use of chemical fertilizers and pesticides may lead to water and land pollution	3

• Explains both the features of agriculture correctly but for (ii) unable to write the challenges faced OR • Explains only one feature of agriculture and for (ii) writes the challenge correctly	Partial marks: 2
• Explains only one feature of agriculture correctly and unable to write the second feature of agriculture and the challenge • Unable to write the features of the agriculture correctly but writes only the challenge correctly	Partial marks: 1
• Irrelevant and wrong answer	Score: 0

Class: 10	Subject: Social Science
Content area: Contemporary India II Topic: Manufacturing Industries	Cognitive level: Create
Marks: 5	Time: 8 to10 minutes
Learning outcome: Examines and evaluates collected /given information in order to construct views /arguments /ideas on its basis	
Item stem: Read the news article given **Telangana pollution control board holds review meeting on industrial waste** TNN | May 19, 2020, 18:47 IST Hyderabad: Following repeated complaints of foul smell in industrial areas as well as a minister's recent tweet about industrial effluents, the member secretary of Telangana State Pollution Board (TSPCB), held a review meeting on Tuesday. Member secretary observed that there has been an increase in the number of complaints received from the public especially regarding odour in residential areas of Kukatpally, Miyapur, Tellapur, Nacharam. She added that complaints had been received about the dumping of effluents in nallahs in Jeedimetla and Mallapur industrial areas and stringent actions will be taken against non-complying industries. http://timesofindia.indiatimes.com/articleshow/75828196.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst Imagine you - being a Board member of an industrial unit located in this area - have received a notice from the pollution control board. Create a detailed plan on what measures you would be taking to resolve this issue.	

Marking scheme:	
Expected Answers	Score
The detailed plan outlined should cover the following points or any other relevant points. There should be coherence in the articulation of the thoughts i. Minimizing the use of water for processing by reusing and recycling it ii. Harvesting rainwater to meet water requirements iii. Treating hot water or effluents before releasing them in rivers/ ponds/ other water-bodies iv. Fitting smoke stacks with electrostatic precipitators, fabric filters, scrubbers and inertial separators v. Disposing wastes like garbage, industrial effluents, glass, harmful chemicals etc. after treating them and only in designated areas like landfills vi. Providing green belts (afforestation) for nurturing ecological balance and beautifying the area	5
All the points have been articulated in the plan as keywords only without outlining the details	Partial marks: 4
Only 3 to 4 relevant points have featured in the plan with some details	Partial marks: 3
Only 2 points have featured in the plan with some details and there is coherence in the flow of thought	Partial marks: 2
Only 2 points have featured in the plan and mentioned only as keywords OR only 1 point has been mentioned either in the form of a keyword or with some detail	Partial marks: 1
Irrelevant points discussed in the plan	Score 0

Chapter 9 : Checklist and Templates

1. Template for Blueprint

Examination:...

Class................................. Subject:.................................

Maximum Marks............. Duration: ....

Topic	Learning outcome	Competency statement	Cognitive Level	SR (1)	CR (1)	CR(2)	CR(3)	CR (5)	Total
			R						
			U						
			Ap						
			An						
			Ev						
			Cr						
			R						
			U						
			Ap						
			An						
			Ev						
			Cr						
			R						
			U						
			Ap						
			An						
			Ev						
			Cr						
			R						
			U						
			Ap						
			An						
			Ev						
			Cr						

			R						
			U						
			Ap						
			An						
			Ev						
			Cr						
			R						
			U						
			Ap						
			An						
			Ev						
			Cr						
Total									

*SR–Selected Response Items CR–Constructed Response Items

Distribution of marks across cognitive level:

Level	Marks	Percentage
Remember (R)		
Understand (U)		
Apply (Ap)		
Analyze (An)		
Evaluate (Ev)		
Create (Cr)		

Distribution of marks across difficulty level:

Level	Marks	Percentage
Easy		
Average		
Difficult		

2. Template for Item mapping

Examination:……..

Class…… Subject:……..

Maximum Marks:….. Duration: ……

Question No.	Type of question (SR/CR)	Marks	Topic	Concept	Learning Outcome	Cognitive level	Difficulty level

3. Template for Creation of Constructed Response Items

Item Id		Date	
Class		Subject	
Topic		Cognitive level	
Weightage		Time required	
Course outcome/s addressed			
Learning outcome			
Competency statement			
Item stem			
Marking scheme	Follow the template as suggested in Chapter 9		
Source			
Item writer/Translator			
Moderator			

4. Template for Creation of Multiple Choice Questions

Item Id		Date	
Class		Subject	
Topic		Cognitive level	
Weightage		Time required	
Course outcome/s addressed			

Learning outcome		
Competency statement		
Item stem		
Key		Reason for choosing the distractor. E.g. - Identifying misconceptions, Identifying gaps in learning, etc.
Distractor 1		
Distractor 2		
Distractor 3		
Source		
Item writer/Translator		
Moderator		

5. Checklist for Competency statement (To be used by item developer / reviewer)

S.No.	Please check the following for items-	Mark ✓ if Yes and Mark ✗ if No
1	Competency statement is derived from the learning outcome statement.	
2	Competency statement is specific- addresses one cognitive skill for a concept.	
3	Competency statement uses a verb which is measurable and attainable.	
4	Competency statement is relevant for the concept to be assessed.	

6. Checklist for Item Quality Checklist (To be used by item developer / reviewer)

S.No.	Please check the following for items-	Mark ✓ if Yes and Mark ✗ if No
1	**Validity of items**	
1.1	Aligned to the learning outcomes to be assessed.	
1.2	Aligned to the competency to be assessed.	
2	**Quality concerns in stems and prompts w.r.t. factual and conceptual accuracy and language**	

2.1	Is the information in the stem/prompt factually and conceptually accurate?	
2.2	Does the stem/prompt avoid being unnecessarily wordy/providing extraneous information?	
2.3	Does the stem/prompt use negatives only when necessary?	
2.4	Does the stem/prompt avoid complex, ambiguous, and/or tricky language?	
2.5	Is the stem/prompt free of grammatical errors?	
2.6	Does the stem/prompt present one clearly formulated question?	
2.7	Does the stem/prompt contain all information necessary for a response?	
3	**Specific Quality Concerns in Constructed-Response Prompts (Write NA if not applicable)**	
3.1	Does the prompt clearly communicate what is expected from students to get full marks?	
3.2	Does the prompt have sufficient breadth to support a full range of responses?	
3.3	Does the prompt elicit the format of response intended/ expected?	
3.4	Does the prompt focus on a concept not easily tested in multiple-choice format?	
4	**Quality Concerns in Options/Distractors for Multiple-Choice Items (Write NA if not applicable)**	
4.1	Is there one, and only one, clearly correct answer?	
4.2	Are options independent of each other? Are there no options with the same meaning?	
4.3	Are distractors based on reasonable misconceptions and errors?	
4.4	Are options parallel in structure, degree of specificity, and/or length? Are there no unnecessarily wordy options?	
4.5	Do options avoid repetitive wording?	
4.6	Are options sufficiently plausible and reasonable for item discrimination?	

4.7	Is the correct answer not clued by the item stem, such as absolutes or words repeated in both the stem and options?	
4.8	Are options in logical order?	
4.9	Are there no absolute words, such as always and all, in only one option?	
4.10	Are there no misleading and/or tricky options?	
4.11	Are there no all-inclusive options?	
5	Quality Concerns in Item Art (Graphics) and Stimuli	
5.1	Does the art/stimulus avoid clueing the correct answer to an item?	
5.2	Does the art/stimulus contain appropriate and accurate labels?	
5.3	Is the art/stimulus not confusing or overwhelming?	
5.4	Is the art/stimulus clear, accurate and sufficient to answer the item?	
5.5	Is the art/stimulus significantly free from copyright issues?	
5.6	Is the art/stimulus necessary, relevant and useful to answer the question?	
5.7	Is the art/stimulus likely to be interesting/engaging to students?	
5.8	Is the art/stimulus pitched at appropriate grade/age/reading level?	
6	**Item Bias and Sensitivity Issues**	
6.1	Is the item accessible to the greatest number of test-takers?	
6.2	Is the item free from bias in the areas of- gender, caste, religion, socio-economic class/status/regional diversity, age, culture, physical appearance?	
6.3	Is the item language unbiased towards a particular linguistic group?	
6.4	Is the item sensitive to special-needs groups?	
6.5	Does the item avoid offensive, disturbing or controversial information?	

7. Checklist for Blueprint

S.No.	Please check the following for blueprint-	Mark ✓ if Yes and Mark ✗ if No
1	All the content domains are uniformly addressed.	
2	All the learning outcomes which can be assessed using pen and paper test are included	
3	There are sufficient competencies belonging to higher order cognitive abilities (For example: Remember-30%, Understand -40%, HOTS-30%).	
4	Is there a good spread of questions belonging to different difficulty levels? (For example: Easy-30%, Moderate-40%, Difficult- 30%)	
5	Total marks matches the maximum marks	

8. Checklist for Question paper

S.No.	Please check the following for question paper-	Mark ✓ if Yes and Mark ✗ if No
1	Instructions to the candidates are accurate and not ambiguous.	
2	The questions are sequenced from easy to hard difficulty levels	
3	Questions with diagrams/ illustrations are on the same page or on adjacent pages	
4	Questions based on passage should be on the same page or on adjacent pages	
5	Marking scheme for SR questions in the tool are well distributed between options A, B, C and D	
6	Questions with diagrams/illustrations are interspersed with dense text items	
7	Font size is age appropriate and space is used judiciously to avoid unnecessary lengthiness	
8	Printing and layout are clear	

9. Checklist for marking scheme

S.No.	Please check the following for marking scheme-	Mark ✓ if Yes and Mark ✗ if No
1	Does the marking scheme also take care of alternate answer/s?	
2	Is the weightage of marks proportional to the volume of the content and the time taken by the student to respond to a question?	
3	Are clear directions given to reduce the subjectivity in the marking scheme?	
4	Are detailed value points with steps given in the marking scheme?	
5	Is there a minimum value point given in the marking scheme for a particular question?	
6	Is there alignment between the cognitive process expected to attempt an item and cognitive process expected in the solution as provided in the marking scheme?	
7	Is there a gradual complexity in the marking schemes between lower complexity to higher complexity items?	

10. Style guide

Unit developing the question papers needs to finalize the style guide in advance.

Domain	Specifications	Suggested
Language variant	Hindi/English/Any other	Hindi/English
Formality	Form of address for students	Formal
	Form of address for adults	Formal
Notation of numbers, math symbols and time	Numerals (Indian or any other)	Indian
	Division sign	÷ or /
	Multiplication sign	×
	Date format	DD-MM-YYYY
	Time format	am/pm

Punctuation and typographic conventions	Decimal separator	.
	Thousands separator	,
	Quotation marks	‘ ’
	Dialogues	“ ”
Measurement units	System	SI
	Temperature	°C unless specified
	Unit symbol	SI
	Position of unit symbol (bidi)	after the value
	Currency	Rs.
	Font size	11 & 14 for heading
	Font type	Arial

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