

## **ANALYSIS OF CONTENT ALIGNMENTS BETWEEN THE NEW GRADE 7 GENERAL SCIENCE TEXTBOOK AND THE RESPECTIVE SYLLABUS**

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### **ABSTRACT**

The purpose of this study was to check the alignment between the new grade seven general science textbook prepared by the Amhara National Regional State Education Bureau (ANRSEB) and the respective national syllabus. To this end, purposive sampling and quantitative research approaches were used to see the alignments of students learning outcomes (SLOs), contents, and levels of cognitive development between the syllabus and the textbook. In addition, the distribution of the level of cognitive development was also checked. Checklists and rubrics were used as data collecting tools. The findings revealed that 79.22% of the SLOs were perfectly aligned, 3.9% were partially aligned and 16.88% were not aligned. In terms of content alignments, 88.46% were aligned, 7.69% were partially aligned and 3.82% were not aligned. In relation to levels of cognitive development, the overall alignment index (P) was 0.914. Results related to the distribution of level of cognitive development indicated that 89.47% were entertaining lower-order thinking and 10.53% were higher-order thinking. So, it is possible to conclude that the textbook has acceptable alignment with the respective syllabus, but it lacks perfect alignment. On this background, it is recommended that the textbook should be revised to make it perfectly aligned with the syllabus as well as to entertain higher-order thinking skills so that its users could satisfy the 21<sup>st</sup> c. skills. [*African Journal of Chemical Education—AJCE 13(1), January 2023*]

## **INTRODUCTION**

### **Background of the Study**

Education enables individuals and society to make all-rounded participation in the development process by acquiring and enriching knowledge, skills, and attitudes. Education teaches us how to think, how to work properly, and how to make a decision; in general, it teaches us how to lead a successful and meaningful life [1]. Science education is the one that fosters students' curiosity about the world, develops problem-solving skills, and enhances scientific thinking.

Every nation has its own national goals and aims which are prepared in the form of curricular element documents [2]. In developing countries, the quality of education exclusively depends on these curricular elements particularly the syllabus and the textbooks prepared for the learners. Appropriately designed aims and goals at the national level lead to the golden opportunity to have standardized textbooks [3]. Syllabus-textbook alignment takes to be a great concern to put into practice the national aims and goals. Textbooks are developed in such a way that the learning outcomes, pedagogical approach, contents, activities, and designed assessments presented in the textbooks are aligned with the syllabus. If there is no textbooks - syllabus alignment, it is difficult to achieve national goals to the desired extent which badly affects the quality of the education systems [2, 3].

Textbook is considered the backbone of the educational system because it plays an important role in instruction as it is the most used and easily available source of knowledge in the country. For

many teachers, the textbook is used to guide them in delivering their contents in the classroom. As for learners, the textbook serves as a framework to help them in organizing their learning both inside and outside the classroom [4]. Studies showed that students' learning is directly affected by the quality of textbooks, and they struggle with the textbook in that field because they can't learn anything from the textbook that they can't read [5, 6]. In line with its importance, they must align with the syllabus to enhance students' learning outcomes [7].

The alignments of textbook-syllabus ensure alignment of goals and objectives, instructions, and assessments. Therefore, the development of textbooks aligned with the syllabus is considered one of the basic steps in the implementation of the curriculum [8]. According to Bhatti, Jumani [9], a lack of proper alignment between textbook and syllabus will lead the teachers' instruction into other objectives other than the suggested objectives in the syllabus and this gap reflects a lack of coordination between syllabus developers and textbook writers.

Ethiopia is one of the developing countries in which the education system is being declined. The poor education system may arise from different corners (like the economical deficit, lack of skilled curriculum experts, lack of standardized available teaching materials, the mismatch between the teaching materials and the national aims, goals, and the like). Among the standardized teaching materials, textbooks take the lion's share of the system.

Currently, Ethiopia has introduced a new general educational roadmap. Due to the new roadmap, new textbooks have been prepared and they are under piloting in the current education

year (2021/22). Secondary school (Grades 9- 12) textbooks are prepared by the ministry of education (MoE) at the national level and elementary and middle school textbooks are prepared by the respective regional education bureaus. Among the different textbooks, the grade 7 general science textbook is one of the middle school textbooks prepared by the respective regions.

This study was an endeavor for investigating how many of the contents, learning outcome, and the designed level of cognitive development of the textbook, is aligned with the syllabus. The study also intended to check the inclusion of all the levels of development in the Bloom's cognitive domains. This newly prepared textbook is now being piloted; at this piloting stage conducting alignment analysis is very important to enhance the quality of the textbook. This was the reason why the researcher intended to do this alignment analysis study based on the alignments of the new Grade 7 general science textbook prepared by ANRSEB with the respective national syllabus prepared by MoE.

### **Statements of the problem**

The curricular documents are considered to be the road map for the attainment of the national aims and goals and there is a need for perfect alignment among the different curricular materials. Among the different alignments, textbook-syllabus alignment is the decisive factor for the achievement of the national goals and aims [10, 11]. For this purpose, textbooks should be developed in such a way that their contents are aligned with the syllabus document. If there is no

alignment between the textbooks and syllabus, it is not possible to achieve national aims and goals to the desired extent, and badly affects the whole system of education [12]. The grade seven general science textbook is one of the newly prepared curriculum materials in ANRSEB and as a new textbook, there is a need of checking its alignment with the national syllabus. To check this, there is a need for alignment analysis [13].

Therefore, this research was conducted quantitatively to check the alignments of the new Grade 7 General Science textbook prepared by ANRSEB and the respective syllabus prepared by MoE of Ethiopia using the following research questions:

- How much the SLOs in the textbook aligned with the SLOs in the syllabus?
- To what extent do the contents and sub-contents in the textbook align with the syllabus?
- Does the cognitive development level in the textbook aligned with the respective syllabus?
- To what extent cognitive development levels accommodate higher-order thinking in both curriculum materials?

### **Objectives of the study**

The general objective of the study was to examine the general alignments of the new grade 7 general science textbook which was prepared by the Amhara regional state with the respective national syllabus.

This alignment analysis research aimed to meet the following specific objectives:

- To see the alignment SLOs between the national syllabus and the grade seven general science textbook prepared by ANRSEB.
- To check the alignments of contents and sub-contents stated in the national syllabus and the new grade seven general science textbook prepared by ANRSEB.
- To check the cognitive development levels alignment between the new grade seven general science textbook prepared by ANRSEB with the national syllabus.
- To examine whether both curriculum materials promote higher-order thinking skills or not.

### **Operational Definitions**

*Alignment:* Is the agreement between the grade 7 general science textbook prepared by ANRSEB and the national syllabus prepared by MoE of Ethiopia (2021).

*Textbook:* In this research, the textbook refers to grade 7 general science students' textbooks prepared by Amhara regional state in 2021.

*Syllabus:* National curriculum elements document which specifically indicates the outline description of grade 7 general science subjects.

*Levels of cognitive development:* It exclusively reflects the Bloom's cognitive taxonomy.

### **Conceptual Framework of the Study**

The Ethiopian grade seven general science syllabus prepared in 2021 is a comprehensive document suggesting the benchmarks, themes, students' learning outcomes, and guidance for textbook development, assessment, and instructional strategies. The content consists of seven broad categories which are marked as chapters. The first chapter deals with basic science, the second and third chapters deal with chemistry, the fourth and fifth chapters deal with biology, and the last two chapters deal with physics. An important feature of the national Curriculum 2021 for general science for middle primary classes is that it outlines realistic, observable, achievable, and measurable students' learning outcomes. The rationale for the emergence of the 2021 curriculum is due to the different drawbacks of the older curriculum did not entertain the 21st-century needs of educational skills such as critical thinking, problem-solving, global and cultural awareness, digital literacy, oral and written communication, creativity, collaboration, decision making, developments of higher order thinking. To alleviate these shortcomings, a new curriculum framework and syllabus have been developed [14].

Alignment analysis involves observation and document analysis and indicated the analysis of what is contained in a message. Krippendorff [13] defined content analysis as a research technique for making replicable and valid inferences from the data to their context.

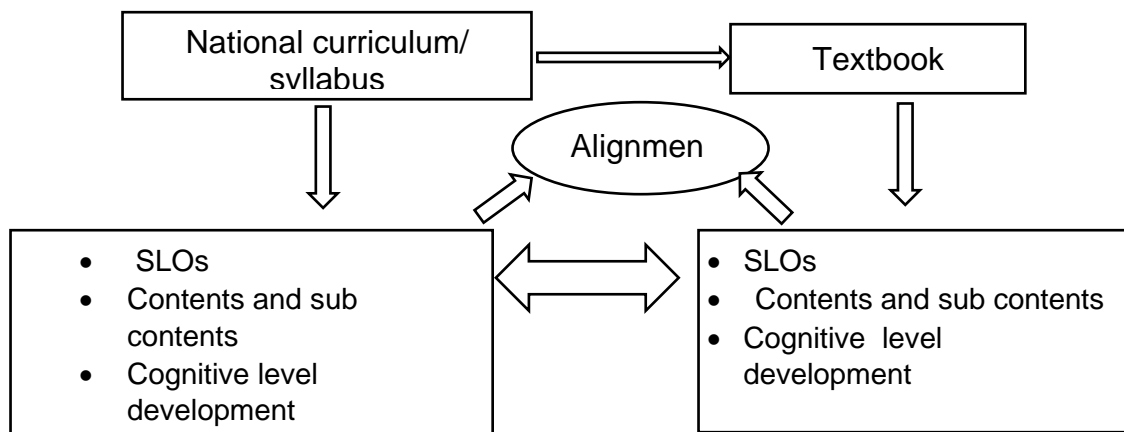


Figure 1: Conceptual Framework of the Study

**METHODOLOGY**

The research design was descriptive content analysis in nature and was mainly conducted through observational document analysis and survey of enacted curriculum (SEC) protocol which were adapted from scholars such as SAEED and RASHID [2] and Porter [15] .

A purposive sampling technique was used to select the textbook because of the accessibility of the textbook and the researchers’ proximity to the science subjects and the textbook is now being piloted.



The data were collected through document analysis using a checklist for content–syllabus alignment and rubrics content-syllabus alignment level of cognitive development/domain of Bloom’s Taxonomy.

National syllabus of general science grade 7(2021) MoE and Grade 7 general science textbook prepared by ANRSEB were used as data source documents.

The data were analyzed quantitatively, in this case, the SLOs and the contents alignments displayed with percentages and cognitive level development were analyzed and presented using Porter [15] alignment formula. Moreover, to evaluate the strength of alignment, Fulmer [16] table of critical values was employed. According to Fulmer's critical value, an alignment index less than 0.5 is very weak, 0.5-0.7 is weak,  $\geq 0.7$  is acceptable and 1 indicates perfect alignment.

## **DATA PRESENTATION, ANALYSIS, AND DISCUSSION**

In this section, the collected data were presented, analyzed, and interpreted quantitatively. They were presented with graphs and tables and interpreted with percentages and Porter’s alignment index.

### **Presenting and Analyzing the Alignments of Students Learning Outcomes (SLOs)**

The alignments of students learning outcomes given at the start of each chapter in the Grade 7 General Science students' Textbook prepared by ANRSEB and the national syllabus were analyzed and displayed in the following tables.

Table 2: Analysis of Alignments of Students Learning Outcomes (SLOs) Given in Chapter One

SLOs stated in the textbook	SLOs stated in the syllabus	Degree of alignment		
		Perfect	Partial	Not
Explain the nature of science.	Define science as a body of knowledge, the processes, and practices	√		
Describe the main branches of science	Describe the main branches of science	√		
Explain the difference between science and technology	Describe the difference between science and technology	√		
Explain how technology and science affect human behavior, practice, and ways of thinking	Relate how science and technology affect one's beliefs, practices, and ways of thinking	√		
Appreciate the contributions of famous scientists of Ethiopia to science and technology	Appreciate the contributions of outstanding scientists to science and technology	√		
Identify basic and derived units of measurements				√
Explain the concept of measuring physical quantities				√
Explain the difference between scalar, vector physical quantities, fundamental and derived physical quantities				√
Identify different laboratory tools	Identify different laboratory tools	√		
Demonstrate safe ways of using apparatus in the laboratory	Demonstrate safe ways of using apparatus in the laboratory	√		
Practice precautionary measures in the laboratory	Practice precautionary measures in the laboratory	√		
Apply laboratory safety rules and procedures	Exhibit knowledge of lab safety rules and procedures	√		
Identify potential hazards and implement appropriate safety procedures when conducting laboratory experiments	Identify potential hazards and implement appropriate safety procedures when working in the laboratory	√		
13	10	10		3

As vividly indicated in Table 1, the students learning outcomes described in chapter one of the textbook are moderately aligned with the national syllabus developed by Ethiopian MoE (2021). In the textbook, there are thirteen main SLOs described in the first chapter, among these, ten of them (76.92%) were perfectly aligned and three of them (23.08%) were not aligned with the syllabus.

Table 3: Analysis of Students Learning Outcomes SLOs Given in Chapter Two

SLO in the textbook	SLO described in the syllabus	Degree of alignment		
		perfect	Partial	Not
Use particle theory's postulates to explain the properties and behavior of materials.	Use particles theory's postulates to explain the properties and behavior of materials	√		
Classify matter as an element, compound, homogeneous mixture, or heterogeneous mixture concerning physical properties.	Classify matter as an element, compound, homogeneous or heterogeneous mixtures concerning its physical properties	√		
Describe the structure of solids, liquids, and gases in terms of particle separation, arrangement and types of motion	Describe the structure of solids, liquids, and gases in terms of particle separation, arrangement, and types of motion	√		
Differentiate between physical and chemical properties and changes of matter.	Differentiate between physical and chemical properties and changes in matter	√		
Appreciate that matter can be classified based on physical or chemical properties	Appreciate that matter can be classified based on physical or chemical properties	√		
Use properties of matter to identify substances and separate them	Use properties of matter to identify substances and separate them	√		
Demonstrate scientific inquiry skills in this unit: inferring, observing communicating, asking questions, classifying, comparing and contrasting, making models, designing experiments, drawing conclusions, and applying concepts	Demonstrate scientific inquiry skills along this unit: observing, classifying, comparing and contrasting, making mode, inferring, communicating, asking questions, designing experiments, drawing conclusions, applying concepts	√		
7	7	7		

As vividly indicated in Table 2, all the SLOs described in chapter two of the textbook are perfectly aligned with the national syllabus.

Table 4: Analysis of Students Learning Outcomes (SLOs) Given in Chapter Three

SLO in the textbook	SLO described in the syllabus	Degree of alignment		
		perfect	Partially	Not
Compare elements to compounds and how they are represented by symbols and formulae	Compare elements to compounds and how they are represented by symbols and formulae	√		
write symbols of common elements or compounds	Identify and write symbols of common elements or compounds.	√		
Name compounds given their formula and write the formula given the name of the compound	Name compounds given their formula and write the formula given the name of the compound.	√		
Use symbols and chemical formulae as a way of communicating information about elements and compounds.	Use symbols and chemical formulae as a way of communicating information about elements and compounds.	√		
State and apply the Law of Mass conservation to writing balanced equations	State and apply the Law of Mass conservation to writing balanced equations	√		
Interpret chemical formulae of compounds in terms of the elements present and the ratios of their atoms	Interpret chemical formulae of compounds in terms of the elements present and the ratios of their atoms	√		
6	6	6		

As brightly indicated in Table 3, all the SLOs described in chapter three are stated in the national syllabus. These indicated the perfect alignment of SLOs for the third chapter.

Table 5: Analysis of Students Learning Outcomes (SLOs) Given in Chapter Four

SLO in the textbook	SLO described in the syllabus	Degree of alignment		
		perfect	Part	Not
			ial	
Define a microscope	Define a microscope	√		
Explain the use of a microscope	Explain the use of a microscope	√		
Distinguish the different types of microscopes	Distinguish the different types of microscopes	√		
Describe the basic parts and functions of a microscope •	Describe the basic parts and functions of a microscope	√		
Use a microscope to observe objects	Use a microscope to view objects	√		
Define a cell	Define a cell	√		
Explain how the cell was discovered •	Explain how the cell was discovered and who discovered it	√		
Draw a cell and label its major parts	Draw a cell and label its major parts	√		
Describe the functions of the major structural parts of a cell	Describe the functions of the major structural parts of a cell	√		
Distinguish between unicellular and multicellular organisms •	Distinguish between unicellular and multicellular organisms	√		
Give examples of cell shape	Give examples of cell shape	√		
Explain why cell shape and structure vary •	Explain why cell shape and structure vary	√		
Discuss the differences between cell, tissue, organ, and organ system	Discuss the differences between cell, tissue, organ, and organ system	√		
Define respiration and write its chemical equation •	Define respiration and write its chemical equation	√		

Describe photosynthesis and its chemical equation •	Define photosynthesis and write its chemical equation	√
Develop scientific thinking and inquiry skills •		√
Develop and use a model to describe the structure and function of a cell. •		√
Analyze and describe the relationships of the hierarchical levels in the classification of organisms		√
18	15	15 3

As Table 4 indicated, the SLOs described in chapter four of the textbook had acceptable alignment with the national syllabus. In the syllabus, there are fifteen main SLOs described in the fourth chapter whereas there are eighteen SLOs in the textbook. Among these fifteen of them (83.33%) were aligned and three of them (16.67%) were not stated in the syllabus.

Table 6: Analysis of Students Learning Outcomes (SLOs) Given in Chapter Five

SLO in the textbook	SLO described in the syllabus	Degree of alignment		
		perfect	Partiall y	Not
Distinguish between living and nonliving things by describing the features that characterize living organisms •	Distinguish between living and non-living things by describing the features that characterize living organisms	√		
Discuss if movement i.e. locomotion can characterize all living things or not	Discuss if movement i.e. locomotion can characterize all living things or not	√		
Define classification and its purpose	Define classification and its purpose	√		
Explain the purpose of the scientific name	Explain the purpose of the scientific name	√		

List down the hierarchical levels in the classification of organisms	List down the hierarchical levels in the classification of organisms	√	
Describe the distinguishing characteristics of the kingdom Animalia, Plantae, Protista, Monera, and Fungi •	Describe the distinguishing characteristics of the kingdom Animalia, Plantae, Protista, Monera, and Fungi	√	
List common examples of animals, Plantae, Protista, Monera, and Fungi •	List common examples of animals, Plantae, Protista, Monera, and Fungi	√	
Describe the body plan of common animals, Plantae, Protista, Monera, and Fungi •	Describe the body plan of common animals, Plantae, Protista, Monera, and Fungi	√	
Describe habitats of animals, Plantae, Protista, Monera, and Fungi	Describe habitats of animals, Plantae, Protista, Monera, and Fungi	√	
Compare the five kingdoms of living things by describing their distinguishing characteristics		√	
Summarize the commonest examples of organisms belonging to each Kingdom.		√	
Describe the body plans of insects such as butterflies, amphibians such as frogs, mosses, liverworts, ferns, conifers such as junipers, flowering plants, Paramecium, Algae, and Mushroom		√	
Relate each Kingdom of organisms to their major habitat types as aquatic, terrestrial, or moist		√	
13	9	9	4

As vividly indicated in Table 5, among the thirteen SLOs in the textbook only 9(69.23%) are perfectly aligned and 4 (30.77%) are not aligned with the national syllabus in the fifth chapter.

Table 6: Analysis of Students Learning Outcomes (SLOs) Given in Chapter Six

SLO in the textbook	SLO described in the syllabus	Degree of alignment		
		perfect	Partially	Not
Describe the shape of the earth	Describe the shape of the earth	√		
Identify the evidence supporting the shape of the earth •	Identify evidence supporting the shape of the earth	√		
	List local and global ideas about the shape of the earth			√
• Name dimensions (circumferences, diameters, and angular distances) of the earth	Name dimensions (circumferences, diameters, and angular distances) of the earth	√		
•	Recognize all parts of the earth			√
Describe the organization and contents of the parts of the earth •	Describe the organization and contents of the different parts of the earth	√		
Differentiate between rotation and revolution of the earth	Demonstrate movements of the earth (revolution and rotation)	√		
Describe the interaction between the hydrosphere, biosphere, atmospheric, and lithosphere •	Explain different observations about the earth in terms of the nature and behaviors of the parts of the earth		√	
Explain effects of motions of earth •	Explain effects of motions of the earth	√		
Construct a model of the earth	Construct model of earth and use it to explain phenomena related to its motion	√		
Develop science process skills	Identify atmospheric and lithospheric systems			√
Explain water and carbon cycles on earth's spheres	Explain their cycle effects on the earth		√	
	Describe the measuring techniques for too-big (Earth) and too-small (continental drift) quantities measurement and estimation			√
10	13	7	2	4



As shown in Table 6, there are thirteen SLOs in the syllabus, among these, 7 (53.85%) were perfectly aligned, 2 (15.38%) were partially aligned, and 4(78%) were not aligned with the textbook for the sixth chapter.

Table 7: Analysis of Students Learning Outcomes (SLOs) Given in Chapter Seven

SLO in the textbook	SLO described in the syllabus	Degree of alignment		
		Perfect	Partially	Not
Describe the terms motion, force, work, and energy •	Describe the term motion and the term force	√		
Explain the various types of motion	Identify types of motion (motion on a straight line, circular motion, rotary motion, and curvilinear motion )	√		
Develop the skill of manipulating numerical problems related to motion, force, and energy •	Show those types of motion in the class.	√		
Analyze data to identify patterns or relationships •				√
Explain the various effects of force	List all effects of force		√	
Appreciate how the concepts of force, motion work, and energy are related	Explain gravitational force			√
Explain the real application of rectilinear & Newton’s laws of motion	Demonstrate the pulling/pushing activity of force	√		
	Relate the effects of force with their daily life experience			√
	Identify different measuring scales on measuring devices of force			√
	Define energy as a property of matter that can be converted			√
List different forms of energy	List all forms of energy	√		
Name parts of measuring device of force	Explain which energy is converted to other forms of energy.			√
	List sources of energy			√

Differentiate between a renewable and non-renewable sources of energy	Distinguish between renewable and non-renewable forms of energy.	√		
Explain the conservation of energy	Describe how energy is used wisely.	√		
	List the strategies for the conservation of energy			√
11	16	7	1	8

As indicated in Table 7, there are 16 SLOs in the syllabus. Among these, 7 (43.75%) are perfectly stated, only 1 (6.25%) are partially stated, and 8 (50%) were not stated in the textbook for the seventh chapter.

### Presenting and Analyzing the Alignments of Contents

In this section, the alignments of contents and sub-contents stated were analyzed between the national syllabus and the new grade seven general science textbook prepared by the Amhara National Regional state education bureau

Table 8: Analysis of Overall Contents Alignment

Chapters	Contents in the Syllabus	Contents in the Textbook	Degree of alignment		
			perfect	partial	Not
One	1. Basic concepts of science	1. Basic concepts of science	√		
	1.1 The nature of science and its Branches	1.1 Nature of science	√		
	1.2 Scientific measurements	Branches of science			√
	1.3 Common laboratory equipment, uses, safety rules, and procedures in science laboratories	1.2 Common laboratory equipment, uses, safety rules, and procedures in science laboratories	√		
Two	2. Matter and our surrounding	2. Matter in Our Surroundings	√		

	2.1 Characteristics and nature of matter	2.1 Characteristics and nature of matter	√
	2.2 Physical and chemical properties of matter	2.2 Physical and chemical properties of matter	√
	2.3 Classification of substances (in terms of composition and observable properties)	2.3. Classification of substances with composition and Observable properties	√
	2.4 Changes Around Us: Physical and chemical changes	2.4 Changes around Us: Physical and Chemical Change	√
	2.5 Separation of mixtures and their application periods	2.5 Separation of mixtures and their application	√
Three	3. Elements, Compounds, and Chemical Reactions	3. Elements, Compounds, and Chemical Reactions	√
	3.1. Elements and their representation	3.1. Elements and their representation	√
	3.2 Compounds and their representation	3.2. Compounds and their representation	√
	3.3 Simple chemical reactions and equations	3.3 Simple Chemical reactions and Equations	√
	3.4 Uses Of Chemical Reactions in Every Day Situation	3.4 Uses of Chemical reactions in an everyday situation	√
Four	<b>4. Cell as a basis of life</b>	<b>4. Cell as the Basis of Life</b>	√
	4.1 Microscope	4.1 Microscope	√
	4.1.1 history of the invention of the Microscope	4.1.1 History of Invention of Microscope	√
	4.1.2. Types of microscope	4.1.2 Types of microscope	√
	4.1.3. Basic parts of a compound microscope	4.1.3 Basic Parts of Compound Microscope	√
	4.2 Cell	4.2 Cell	√
	4.2.1 What is a cell?	4.2.1 What is a cell?	√
	4.2.2. The discovery of cell	4.2.2 The discovery of cell	√
	4.2.3. Structure of a cell	4.2.3 Structure of a cell	√
	4.2.4. Cell shape and size	4.2.4 Cell shape and size	√
	4.2.5. Multicellular organisms and multicellular organism	4.2.5 Unicellular and multicellular organisms	√
	4.2.6. Cell, Tissue, Organ, and Organ system	4.2.6 Cell, Tissue, Organ, Organ system, and organism	√

	4.2.7. Respiration and Mitochondria	4.2.7 Respiration and mitochondria	√		
	4.2.8. Photosynthesis and Chloroplast	4.2.8 Photosynthesis and chloroplast	√		
Five	5. Living things and their diversity	5. Living things and their diversity	√		
	5.1 Living Things	5.1 Living Things	√		
	5.1.1. Characteristics of living things	5.1.1 Characteristics of living things	√		
	5.1.2. Classification and scientific names of organisms	5.1.2 Classification and Scientific names of organisms	√		
	5.1.3. Hierarchy in the classification of organisms	5.1.3 Hierarchy of classification	√		
	5.2. Kingdoms of Life	5.2 Kingdoms of Life	√		
	5.2.1. Kingdom Animalia	5.2.1 Kingdom Animalia	√		
	5.2.2. Kingdom Plantae	5.2.2 Kingdom Plantae	√		
	5.2.3. Kingdom Protista	5.2.3 Kingdom Protista	√		
	5.2.4. Kingdom Monera	5.2.4 Kingdom Monera	√		
	5.2.5. Kingdom Fungi	5.2.5 Kingdom Fungi	√		
Six	6. Earth in space	6. The Earth	√		
	6.1 Shape & Dimensions	6.1 Shape and dimensions	√		
	6.2 Parts of the Earth	6.2 Parts of the earth	√		
	6.3 Movements of the Earth	6.3 Movements of the earth	√		
	6.4 Earth's subsystems	6.4 Earth's subsystems	√		
	6.5 carbon and water Cycles	6.5 Carbon and water cycles	√		
Seven	7. Motion, Force, Energy, and energy resources	7. Motion, Force, Energy, and Sources of Energy	√		
	7.1 Definition of motion	7.1 Definition and types of motion	√		
	7.2 types of motion	7.2 Definition of force and gravitational force		√	
	7.3 motion in a straight line	7.3 effects of Force			√
	7.4 Forces	7.4 Measuring forces		√	
	7.5 Force and motion	7.5 Definition of Energy		√	
	7.6 Energy (Forms and Conversion of Energy, source of energy, Conservation of energy)	7.6 Energy (Conversion of Energy, energy source, conservation of energy)	√		
total	52	52	46	4	2

As shown in Table 8, most contents and sub-contents stated in the syllabus were encompassed in the textbook. There are about fifty-two main and sub-contents stated in the syllabus and the textbook. Among these, 46(88.46%) contents are aligned and 4(7.69%) were partially aligned and 2(3.84%) were not aligned between the syllabus and the textbook.

### Analyzing the Alignments of Cognitive Levels Development

In this section, efforts were made to analyze the alignments of the levels of cognitive development between the syllabus and the textbook prepared by the Amhara National Regional state education Bureau.

Table 9: Level of Cognitive Development in the Textbook (Table A)

Chapter	Level of cognitive development/Bloom's Taxonomy						subtotal
	Remember	Understand	Apply	Analyze	Evaluate	Create	
1	2	7	3	0	0	0	12
2	3	1	2	1	0	0	7
3	1	4	1	0	0	0	6
4	6	6	2	2	0	2	18
5	3	8	2	0	0	0	13
6	2	5	2	1	0	0	10
7	2	5	1	2	0	0	10
Subtotal	19	36	13	6	0	2	76

Table 9 indicates terms that are used to indicate the cognitive development levels expected from the students' learning outcomes in the textbook. Among the 76 terms 68 (89.47%) indicate the lower-level thinking skills (remember, understand and apply levels).

Table 10: Level of Cognitive Development in the Syllabus (Table B)

Chapter	Level of cognitive development/Bloom's Taxonomy						Subtotal
	Remember	Understand	Apply	Analyze	Evaluate	Create	
1	4	3	3	0	0	0	10
2	0	1	4	1	0	0	6
3	1	4	1	0	0	0	6
4	4	8	1	2	0	0	15
5	3	5	0	1	0	0	9
6	4	7	2	0	0	0	13
7	6	5	5	0	0	0	16
Subtotal	22	33	16	4	0	0	75

As shown in Table 10, most of the terms indicated that the cognitive development levels expected from the students' learning outcomes in the syllabus are the lower-level thinking skills, among the 75 terms 71(96.67%) are concentrated at remember, understand and apply levels.

Table 11: Ratio Table for Table 9

(table a<sub>i</sub>)

Level of cognitive development/Bloom's Taxonomy							
Chapter	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
1	0.0263	0.0921	0.0395	0	0	0	0.1579
2	0.0395	0.0132	0.0263	0.0132	0	0	0.0921
3	0.0132	0.0526	0.0132	0	0	0	0.0789
4	0.0789	0.0789	0.0263	0.0263	0	0.0263	0.2368
5	0.0395	0.1053	0.0263	0	0	0	0.1711
6	0.0263	0.0658	0.0263	0.0132	0	0	0.1316
7	0.0263	0.0658	0.0132	0.0263	0	0	0.1316
Subtotal	0.25	0.4737	0.1711	0.0789	0	0.0263	1

Table 11 is a ratio table constructed from Table 9 by dividing each cell to total number of terms in the textbook that indicate cognitive level development (which is 76).

Table 11: Ratio Table for Table 10(table b<sub>i</sub>)

Level of cognitive development/Bloom's Taxonomy							
Chapter	Remember	Understand	Apply	Analyze	Evaluate	Create	Subtotal
1	0.0533	0.04	0.04	0	0	0	0.1333
2	0	0.0133	0.0533	0.0133	0	0	0.08
3	0.0133	0.0533	0.0133	0	0	0	0.08
4	0.0533	0.1067	0.0133	0.0267	0	0	0.2
5	0.04	0.0667	0	0.0133	0	0	0.12
6	0.0533	0.0933	0.0267	0	0	0	0.1733
7	0.08	0.0667	0.0667	0	0	0	0.2133
Subtotal	0.2933	0.44	0.2133	0.0533	0	0	1

Table 12 is a ratio table constructed from Table 10 by dividing each cell to total number of terms in the syllabus that indicate cognitive level development (which is 75).

Table 12: Absolute Value Discrepancy Table /table  $a_i$ - table  $b_i$ /

Chapter	Level of cognitive development/Bloom’s Taxonomy					
	Remember	Understand	Apply	Analyze	Evaluate	Create
1	0.027	0.0521	0.0005	0	0	0
2	0.0395	0.0002	0.027	0.0002	0	0
3	0.0002	0.0007	0.0002	0	0	0
4	0.0256	0.0277	0.013	0.0004	0	0.0263
5	0.0005	0.0386	0.0263	0.0133	0	0
6	0.027	0.0275	0.0004	0.0132	0	0
7	0.0537	0.0009	0.0535	0.0263	0	0
Sum( $\Sigma$ )	0.0433	0.0337	0.0423	0.0256	0	0.0263
Overall alignment index(p)	<b>0.914</b>					

The values of the discrepancy table (Table 13) was formulated using Table 9 up to Table 12 to calculate the overall alignment index for the levels of cognitive development using Porter's formula (2002) in four steps. The first step was creating two parallel tables of frequencies for the textbook and the syllabus. The second step was computing the ratio, Table 11 and Table 12(table  $a_i$  and table  $b_i$ ) by dividing the value of each cell by the total number of cells (n) in the respective table. The third step is calculating the absolute value discrepancy between each cell in the ratio tables of the corresponding tables. The fourth step is computing the alignment index using Porter’s formula (2002) as shown below.



$$P = 1 - \sum_{i=1}^n \frac{|a_i - b_i|}{2}$$

Where **p** is the alignment index, **n** is the sum of the number of cells in the table and **a<sub>i</sub>** and **b<sub>i</sub>** are values at the **i<sup>th</sup>** cell in the ratio table **a** and **b**. The value of the calculated alignment index (P=0.914) showed that the level of cognitive development stated in the national syllabus has an acceptable alignment with the cognitive level of development described in the textbook. The value of the alignment index runs from **0 to 1** and the larger the alignment index the strength of the alignment between the comparable materials.

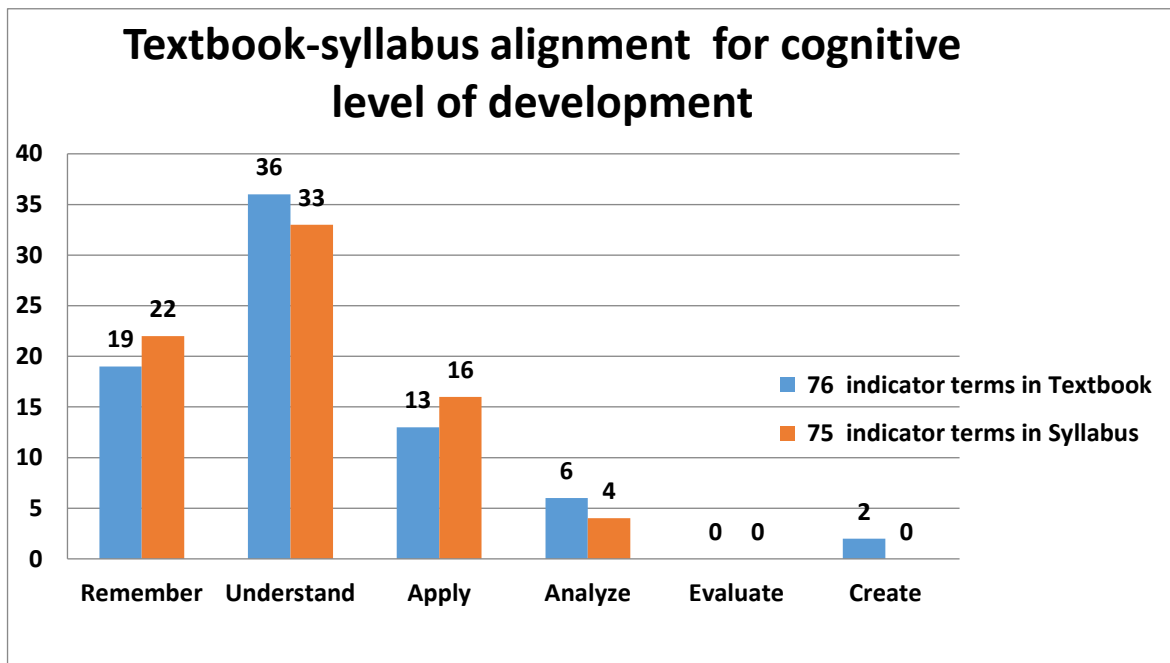


Figure 2: Bar graph for textbook-syllabus overall alignments of cognitive level development

As indicated in Figure 2, the cognitive levels of development stated in the syllabus are acceptably aligned with those described in the textbook.

## **DISCUSSION AND INTERPRETATION**

The newly prepared general science textbook encompasses seven chapters on which the first chapter is deals about basic concepts of science, the next two chapters deal about chemistry contents, the 4<sup>th</sup> and 5<sup>th</sup> chapters deal about biology contents, and the 6<sup>th</sup> and 7<sup>th</sup> chapters deal about physics contents. The focus of this study was on examining the alignments of this textbook with the national syllabus.

Regarding the first research question, concerning the alignments of SLOs between the textbook and the syllabus. As it was indicated in Tables 1 to 7, there are 76 SLOs stated in the national syllabus and 78 SLOs in the textbook. Among these SLOs, 61(79.22%) of them were aligned, 3(3.90%) were partially aligned, and 13 (16.88%) were not aligned. From this, it is possible to conclude that the SLOs described in the textbook were not perfectly aligned with the SLOs stated in the national curriculum. As with this alignment, it is possible to say that the textbook was prepared to satisfy the national aims and goals, but it lacks perfect alignment. Since the textbook should be an embodiment of the syllabus. Scholars researched that textbook-syllabus alignment enhanced the

students' attainment by reducing the gap between the curriculum developer and the implementer (Hume & Coll, 2010). According to Bhatti, Jumani [9], a lack of proper alignment between textbook and syllabus will lead the teachers' instruction into other objectives other than the suggested objectives in the syllabus and reflects a lack of coordination between syllabus developers and textbook writers. This thought of scholars indicated the need for perfect alignment between the textbook and the syllabus.

Regarding the second research question, contents and sub-contents were analyzed and the finding indicated that 88.46% of the contents were aligned, 7.69% were partially aligned, and 3.85% were not aligned between the textbook and the national syllabus. As scholars indicated the contents of the textbook should refer to the contents of the syllabus[3, 11]. From this result, it is possible to disclose that, in terms of content alignment the textbook was prepared in a good alignment with the syllabus even if it lacks perfect alignment.

Regarding the third research, the finding indicated that the overall alignment index (p) was 0.914. This value indicated the existence of good alignment for the cognitive development levels between the textbook and the syllabus. As scholars indicated that content alignment indicated the quality of the textbook [3, 16].

Regarding the fourth research question, Figure 2 indicated that most of the cognitive development levels listed were the lower level thinking both in the textbook and the syllabus. In the textbook there are 76 cognitive level development terms, among them, 68(89.47%) are lower-level

indicator terms and only 8(10.53%) are higher order thinking level indicator terms. As different scholars indicated that the 21<sup>st</sup>-century learning needs to develop the higher-order thinking ability of students. In this respect, both the textbook and the syllabus were designed to satisfy only lower-level thinking. But the roadmap developed by MoE indicated one of the reasons that the need of changing the curriculum was integrating higher-order thinking in the curriculum materials which was not included in the previous curriculum materials [14]. But the general science grade seven curriculum documents did not scaffold higher order thinking skills.

## **SUMMARY, CONCLUSION AND RECOMMENDATION**

### **Summary**

The purpose of this study was to check the alignment of the grade seven general sciences textbook with the national syllabus in terms of content, students learning outcomes, and level of cognitive development as well as to examine the extent of the curriculum documents entertain higher-order thinking skills. In Ethiopia, different attempts were made to have a quality textbook that aligned perfectly with the national syllabus but the x-textbooks, in general, were blamed for content overload and misalignment with the national goals and aims as well as unable to promote higher order thinking skills. The government attempted to minimize this problem by performing curriculum changes, the 2021 curriculum change was one of them [14]. This research was focused

on examining the alignments between the newly prepared grade seven textbook and the 2021 syllabus using the following research questions

- How much the SLOs stated in the national syllabus aligned with at the start of each chapter aligned with the described SLOs in the newly prepared grade seven general sciences textbook?
- What are the contents and sub-contents' degrees of alignment between the syllabus and the textbook?
- Does the new Grade 7 General Science textbook cognitive level development align with the respected syllabus?
- To what extent cognitive development levels scaffold higher-order thinking?

These research questions were answered through quantitative research design and the finding of this study revealed that even though there was a lack of perfect alignment, most SLOs stated in the syllabus were aligned with the SLOs described in the students' textbooks. In the textbook there are 78 SLOs whereas in the syllabus there were 76 SLOs, among these 61 of them were perfectly aligned, 3 of them were partially aligned, and 13 of them were not aligned. Regarding the content alignments, among 52 contents 46 of them were aligned. Regarding the alignments of the cognitive development level, the overall alignment index was 0.914 which indicated that reasonably acceptable alignment between the textbook and the syllabus. But the stated levels of cognitive

development were mainly indicated as a lower level of thinking both in the national syllabus and in the textbook.

### **Conclusion**

In view of the results and discussions, it was concluded that the students learning outcomes stated at the start of the newly prepared grade seven general science textbook was aligned in a reasonably acceptable manner but not perfectly aligned with the syllabus. But the cognitive level development described in the national syllabus does not contain all the necessary levels of cognitive development. It indicates only the lower level of cognitive development in the Bloom Taxonomy.

### **Recommendation**

The newly prepared grade seven general science textbook was prepared as per the national syllabus which revealed reasonable alignment but lacks perfect alignment. In addition, both the syllabus and the textbook did not address all the levels of cognitive development, in Bloom's Taxonomy. Therefore, there is a need of reconsidering these levels of cognitive development to satisfy the need for 21<sup>st</sup>-century learning issues. When a new curriculum is put together or when a major revision is done at any level, several learning trajectories need to be incorporated into the curriculum. It is essential to discuss the learning trajectory that leads to the expected outcomes. So,

this research highly recommended to Ethiopian MoE reconsiders the syllabus in terms of the level of cognitive development and perfect alignment cases to enhance the quality of the textbook.

### **Limitations of the study**

The limitation of this study was that it was unable to assess the alignments of designed activities, teaching methods, and evaluation strategies between the textbook and the national syllabus.

### **Future research**

There are many cases for future study concerning to the alignment issues of general science textbook for grade seven. To list two of them,

- Studying the textbook-syllabus alignment in terms of the designed teaching strategies, designed activities, and designed assessment techniques.
- Conducting comparative study concerning of the overall aspects of the general science textbooks within different regions.

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