DOI: https://doi.org/10.71317/kjard.2.4.2026.230

The Kashmir Journal of Academic Research and Development

Journal homepage: https://rjsaonline.org/index.php/KJARD

Comparative Analysis of Cognitive Demands: Assessing Alignment between Student Learning Outcomes and End-of-Chapter Exercises in Grade 8 Science Textbooks

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ARTICLE INFO

Received:
February 08, 2026
Revised:
March 02, 2026
Accepted:
March 26, 2026
Available Online:
April 03, 2026

Keywords:

Bloom's Taxonomy, Cognitive Levels, Exercise Question, Students Learning Outcomes.

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ABSTRACT

This research work presents a comparative analysis of cognitive demands, assessing alignment between Student Learning Outcomes (SLOs) and end-of-chapter exercises in Grade 8 Science textbooks. The objectives of this research were to discern and categorize the cognitive level of each Student Learning Outcome (SLO) that appear in the chosen Grade 8 Science textbooks according to the Revised Bloom's Taxonomy and to recognize the cognitive level of exercise questions at the end of chapters found in the chosen Grade 8 science textbook according to the Revised Bloom's Taxonomy, and also to determine the extent of cognitive alignment between the SLOs and the exercise questions at the end of the chapters through a statistical measure while considering command words. This investigation utilized a quantitative descriptive content analysis design. According to the findings, 72% of SLOs comprised the Understanding level while 9% at the Applying level, 9% at the Creating level, 7% at the Analyzing level, and remaining 3% at the Remembering level. Fifty-seven percent of the exercise questions aligned with the SLOs cognitive levels, while 43% did not align. On the other hand, 68% of the Multiple-Choice Questions (MCQs) were based on remembering level of Bloom's Taxonomy, while the remaining 32% of MCQs in targeted units were based on the Understanding level, indicating that the textbooks' MCQs primarily focused on rote memorization. In conclusion, most of the SLOs targeted the Understanding level but majority of the exercise questions -namely MCQs and fill in the blanks (FIBs)- reflected the Remembering cognitive level. Therefore, study recommended that the cognitive level of textbook exercises should aligned with the cognitive levels of the target SLOs. This development should be carried out by Bureau of Curriculum (BOC) in collaboration with Balochistan assessment and Examination Commission (BAEC).

Introduction

The Paradigm Shift in Competency-Based Education

Within the modern era of globalization, the structure of education has evolved from a conventional approach towards a curriculum based on competency development. In the past, the conventional model of learning emphasized rote memorization and the accumulation of information within the minds of passive learners. The current era requires that learners be able to think critically and solve problems effectively.

This requirement is embodied by education policy through the construction of curricula based on competency and student learning outcomes (SLOs). SLOs clearly state what the learner is expected to know, understand, and be able to do at the end of that particular academic period or textbook unit. In the case of science education, such change is crucial. Science is essentially a subject that is empirical and ever-evolving; its teaching should therefore extend beyond definition into promoting critical thinking and hypothesis formation. Thus, new curricula for Grade 8 science promote both Lower Order Thinking Skill (LOTS) and High Order Thinking Skill (HOTS)

Textbooks as the Operational Curriculum

Whereas the national curriculum is responsible for defining or explaining the philosophies of a particular education area or system. The printed textbook is the key practical tool and manifestation of the national curriculum as the core instructional medium. It transforms general policies on curriculum content into detailed daily lesson plans, instructional content, and assessment procedures.

For teachers, textbooks represent the ultimate guide for implementing curriculum lessons, significantly influencing how they go about teaching and using class time. Students consider the textbook as a final authority on learning information as well as the key source for academic survival in class. Where classrooms lack adequate materials for learning and teaching, as well as sufficient teacher professional development programs, textbooks automatically become the true curriculum.

The Role of End-of-Chapter Assessment

Apart from presenting the prose itself, the textbook must create an internal structure to facilitate learner self-regulation and evaluation by the teacher. This is done through the use of end-of-the-chapter exercise questions. The exercises are no filler text, rather they are essential instructional techniques. In theory, the use of end-of-the-chapter questions accomplishes two things: reinforces the knowledge acquired in that section and provides low-stake formative milestones.

From a cognition standpoint, when textbooks present learning objectives that require learners to "evaluate" or "analyze" certain scientific phenomena, then the end-of-the-chapter exercises should give learners the chance to engage with such dimensions of analysis. When textbooks do not align their exercise questions with their learning objectives, the result is a disconnected experience for the learner. While learners get to be introduced to noble, high-level learning objectives at the beginning of each chapter, they get tested in rote memorization of facts in the exercise sections at the end.

Problem Statement

It can be said that there is a disjunction between the high-level cognitive objectives defined in the Student Learning Outcomes (SLOs) in curriculum and textbook and the actual cognitive processes involved in textbook chapter exercises. Whereas national education policy statements and Grade 8 science syllabi emphatically promote cognitive skills such as analysis, Evaluating, and creativity in science education, textbook exercises often involve low-level cognitive requirements such as memorization and simple recall.

At Grade 8, children reach an important period when they move from concrete to abstract systematic thinking. If textbook exercises do not mirror the same cognitive processes involved in their intended SLOs, teachers will automatically adjust their everyday teaching strategies towards preparing students for low-level tests. In other words, students score highly on exams simply because of rote learning and yet remain incapable of applying advanced levels of inquiry and problem-solving. The current study aims to bridge the empirical gap by analyzing the discrepancies between intended SLOs and textbook exercises at the Grade 8 level.

Rationale

Evaluating Grade 8 science textbooks is vital for several reasons:

- **Significant Developmental Stage:** The eighth grade is the main transition stage to secondary education, which involves strengthening basic principles of physics, chemistry, and biology.
- **Based on Facts:** This research gives practical diagnostic feedback to the concerned parties in regards to areas that the textbook lacks, based on factual findings.
- **Making Teaching Easier:** By identifying the weaknesses, this research makes it easy for teachers to design additional assessments outside the scope of the textbook.

- **Balancing the Playing Field:** The importance of this research is that it ensures that the book, which may be the only resource available to a learner, contributes to cognitive development in science.

Research Objectives

- Discern and categorize the cognitive level of each Student Learning Outcome (SLO) that appears in the chosen Grade 8 science textbook according to the Revised Bloom's Taxonomy.
- Recognize and categorize the cognitive level of all exercise questions at the end of chapters found in the chosen Grade 8 science textbook according to the Revised Bloom's Taxonomy.
- Determine the extent of cognitive alignment (based on command words) between the SLOs and the exercise questions at the end of the chapters (keeping in view command words) through a statistical measure.

Research Questions

- What is the percentage distribution of cognitive levels (Remembering through Creating) within the Grade 8 science Student Learning Outcomes (SLOs)?
- What is the percentage distribution of cognitive levels within the end-of-chapter exercise questions of the Grade 8 science textbook?
- To what extent do the cognitive levels required by the end-of-chapter exercise questions align with the cognitive levels mandated by the SLOs?

Delimitations

This study is bounded by the following specific parameters:

- **Content Area Limitations:** This research is exclusively limited to the content area of the Grade 8 science syllabus and its associated textbook.
- **Domain of Cognitive Evaluation:** This analysis confines itself exclusively to the cognitive domain of Anderson & Krathwohl's Revised Bloom's Taxonomy (2001). Neither the affective nor the psychomotor domains come into play here.
- **Limitations on Questions:** This analysis confines itself only to the stated objectives at the beginning of each chapter and to those questions appearing in the End-of-Chapter Exercises sections.

Literature Review

Theoretical Framework: Revised Bloom's Taxonomy

In assessing educational alignment, an effective and universally applicable framework should be used for describing the mental processes of humans. In this regard, the present research is based on the Revised Bloom's Taxonomy proposed by Anderson and Krathwohl (2001) after Benjamin Bloom's initial classification published in 1956. The Revised Bloom's Taxonomy involves the transformation of originally used nouns into verbs and division of the structure into two dimensions – the Knowledge Dimension and the Cognitive Process Dimension.

Specifically, the Cognitive Process Dimension includes six hierarchical levels of mental operations:

[LOTS: Remembering] -> [Understanding] -> [Applying] -> [HOTS: Analysing] -> [Evaluating] -> [Creating]

Thus, LOTS include the first two levels of mental operations – remembering (recalling appropriate knowledge from one's long-term memory) and understanding (deriving meaning from presented messages). Furthermore, applying (implementing or carrying out a procedure) refers to procedural mental activity. Finally, HOTS involve analysing (breaking information into parts, and determining the relationships between parts), evaluating (making judgments according to certain criteria and standards), and creating (combining information elements to create something meaningful).

In science instruction, excessive emphasis on LOTS confines learners to mere recall while including HOTS ensures that they become competent in designing investigations, analyzing data discrepancies, and assessing socio-scientific arguments.

The Construct of Curriculum Alignment

Curriculum alignment in educational research involves the harmony of structure of the three major elements of an educational institution such as intended curriculum (policy and SLOs), implemented curriculum (instruction), and assessed/attained curriculum (assessment tests and exercises in textbooks). Webb (1997) was the first researcher who used curriculum alignment in his work where he maintained that there needs to be harmony between the test tools and learning objectives of an educational institution if it aims to offer effective and equitable education.

When the assessment tests are aligned with learning objectives, a smooth process of education takes place. On the other hand, failure to align these two components leads to inconsistency in educational activities. In case the assessment tests in a particular textbook fail to align with the set objectives, the data gathered will not reveal anything about attaining the objectives.

Textbooks and Cognitive Development in Early Adolescence

Eighth graders, who range between ages 13 to 15 years old, are at an important point in their cognitive development according to Piaget's developmental psychology. As learners progress from concrete to formal operations, the brain becomes capable of engaging in abstract thinking, forming hypotheses, and reflecting on one's own thought processes. (Piaget, 1972)

Learning science provides an opportunity for this cognitive development to take place. Nevertheless, such cognitive development necessitates the establishment of a scaffolded environment (Vygotsky, 1978). If learning materials give explanations in advanced narratives accompanied by elementary questions for recall purposes, such cognitive development is inhibited. Failing to provide learners with exercise that is cognitively demanding may lead to the development of a superficial strategy repertoire. (Biggs & Tang, 2011).

Review of Empirical Studies on Textbook Assessment

Indeed, numerous studies conducted internationally reveal a common trend: the majority of textbook activities emphasize low-order cognitive processes rather than higher-order thinking skills (Chiappetta, Fillman, & Sethna, 1991; Kesidou & Roseman, 2002). For example, analysis of middle school science textbooks has found that more than 70% of end-of-chapter questions are classified at the remembering and understanding levels of Bloom's Taxonomy, while only a small proportion require students to evaluate, analyze, or create (Chiappetta et al., 1991; Anderson & Krathwohl, 2001). Furthermore, studies using Porter's model of alignment have shown that curriculum standards frequently emphasize higher-order cognitive processes through verbs such as investigate, analyze, and deduce. However, these intended learning outcomes are often reduced in textbooks to lower-level comprehension and recall questions, resulting in misalignment between curriculum expectations and instructional materials (Porter, 2002; Porter, McMaken, Hwang, & Yang, 2011). Therefore, it is crucial to conduct an empirical analysis of the Grade 8 science textbook to determine the extent to which it promotes higher-order thinking skills.

Methodology

Research Design

In this investigation, a design that makes use of quantitative descriptive content analysis was chosen. Content analysis is an empirical research method which involves making replicable and valid inferences from texts to their context of use. Since the main focus of this study would involve quantification of the frequency of categorical variables (the different levels of Bloom's taxonomy) in fixed texts (SLOs versus textbook questions), using non-experimental descriptive methods is the most objective choice.

Target Sample

The target population includes the approved Grade 8 Science textbook by the Secondary Education Department. The research sample included only one particular textbook which was approved by the respective BOC and Textbook Board. Specifically, each Student Learning Outcome (SLO) across the six chapters, as well as the exercise questions at the end of each chapter in this textbook, were covered in the complete census sample without any possibility of sampling error.

Data Collection Procedure

The researcher reviewed the textbook (six chapters) page by page, copying the SLOs of the six chapters and the end-of-chapter exercise questions into a database.

Data Analysis

The collected data were analyzed using both descriptive statistics. Total counts and percentage distributions for each of the six Bloom's Taxonomy levels were calculated separately for the SLOs and exercise questions.

Findings

Table 1 shows the SLOs, their cognitive levels, the cognitive levels of the exercise questions, their alignment, and the relevant text.

Chapter/Topic	SLO No	Cognitive Level	Exercise Question's Cognitive Level				Alignments	Relevant Text
Unit no 1			**MCQs**	**FIBs**	**RRQs**	**ERQs**		
Ecology								
Biogeochemical Cycle	1.1	U	R	U	U		Yes	Yes
Relation Between Oxygen and Carbon cycle	1.2	U					No	Yes
Global Warming	1.3	U	U		U		Yes	Yes
Energy flow in eco system	1.4	U	U			U	Yes	Yes
Food web	1.5	U			R		No	Yes
Ecological interaction and relationship	1.6	U	R		R	U	Yes	Yes
Resources of ecosystem	1.7	U				R	No	Yes
Ecological relationship	1.8	U	R				No	Yes
Role of human in improving environment	1.9	U	U	U	ANA		Yes	Yes
Unit 2								
Human Nervous System								
Function of Human Nervous System	2.1	U	U	U	U	U	Yes	Yes
Sketch and label nervous system	2.2	APP					No	Yes
Working of brain	2.3	U				APP	No	No
Parts of brain	2.4	U	R	R	U	U	Yes	Yes
Structure of cerebrum	2.5	U	R	R	U	U	Yes	Yes
Reflex Arch	2.6	APP	R	R	R	APP	Yes	Yes
Types and function of neurons	2.7	U		R			No	Yes
Plan to maintain a healthy brain	2.8	C			U		No	Yes
Match the brain function	2.9	U					No	Yes
Massages flow from brain	2.10	U					No	No
Transmission of massages	2.11	APP					No	Yes
Role and Function of Neuron	2.12	U					No	No
Damages in nervous connection	2.13	ANA					No	No
Unit 3								
Variation Heredity and Cell Division								
Variation and Adaptation	3.1	U	U	U	U		Yes	Yes
Difference between Variation and Adaptation	3.2	U		U	U		Yes	Yes
Sources of Variation from environmental and Genetic factors	3.3	U	U		U		Yes	Yes

Adaptations affect the chances of survival	3.4	U					No	Yes
Genetics	3.5	U			U		Yes	Yes
Gene and Chromosome	3.6	U	R		R		No	Yes
DNA Structure and Composition	3.7	U		R			No	Yes
Model of DNA	3.8	C				U	No	No
Mitosis and Meiosis	3.9	U		R			No	No
Phases of Mitosis and Meiosis	3.10	U	R	R	U	U	Yes	Yes
Unit 6								
Chemical Reactions								
Chemical Reactions	6.1	R	R	R	R	R	Yes	Yes
Law of conservation of Mass	6.2	APP	R			U	No	Yes
Chemical Equation	6.3	U	U		R		Yes	Yes
Types of Reactions	6.4	U	U	R	R/APP	U/APP	Yes	Yes
Endothermic and exothermic reactions	6.5	U	U			U	Yes	Yes
Endothermic and exothermic reactions in daily life	6.6	U					No	Yes
Design a car	6.7	C					No	No
Formation of ionic Bonds	6.8	U		U	U	U	Yes	Yes
Formation and types of covalent Bond	6.9	U	R			U	Yes	Yes
Ionic and covalent compound	6.10	R	R	R			Yes	Yes
Cross and dot structure	6.11	APP				APP	Yes	Yes
Unit 9								
Force and pressure								
Force	9.1	U	R	R		U	Yes	Yes
Effect of unbalanced force	9.2	ANA	R	U	R	U	No	No
Mass density	9.3	U	U	U	U	U	Yes	Yes
Pressure	9.4	U	R	R	U		Yes	Yes
Relate Pressure with Force and Area	9.5	U	U	U		U	Yes	Yes
Effects related to pressure	9.6	U				U	Yes	Yes
Effect of Force in the presence of air Pressure	9.7	ANA	R		ANA	ANA	Yes	Yes
Hydraulic Elevator	9.8	C	R	U	U	U	No	No
Rocket Propulsion	9.9	C	R	U	U	U	No	No
Unit 12								
Our Universe								
Star, Galaxy, milky way and Black holes	12.1	U	R	R	U	U	Yes	Yes
Types of Galaxies	12.2	U	R	R	U	U	Yes	Yes
Life of Star	12.3	U	R		U	U	Yes	Yes
Birth and Death of our sun	12.4	U	R	R	R	U	Yes	Yes
Hubble space, telescope and space probe	12.5	U	R	R		U	Yes	Yes
Advancement in space technology	12.6	ANA			R		No	No

Table 1 shows the alignment of the cognitive levels of the SLOs with the corresponding exercise questions.

Chapter/Topic	SLO no	Cognitive Level	Exercise Question's Cognitive Level			
Unit no 1			**MCQs**	**FIBs**	**RRQs**	**ERQs**
Ecology						
Biogeochemical Cycle	1.1	U	R	U	U	
Relation Between Oxygen and Carbon cycle	1.2	U				
Global Warming	1.3	U	U		U	
Energy flow in eco system	1.4	U	U			U
Food web	1.5	U			R	
Ecological interaction and relationship	1.6	U	R		R	U
Resources of ecosystem	1.7	U				R
Ecological relationship	1.8	U	R			
Role of human in improving environment	1.9	U	U	U	ANA	
Unit 2						
Human Nervous System						
Function of Human Nervous System	2.1	U	U	U	U	U
Sketch and label nervous system	2.2	APP				
Working of brain	2.3	U				APP
Parts of brain	2.4	U	R	R	U	U
Structure of cerebrum	2.5	U	R	R	U	U
Reflex Arch	2.6	APP	R	R	R	APP
Types and function of neurons	2.7	U		R		
Plan to maintain a healthy brain	2.8	C			U	
Match the brain function	2.9	U				
Massages flow from brain	2.10	U				
Transmission of massages	2.11	APP				
Role and Function of Neuron	2.12	U				
Damages in nervous connection	2.13	ANA				
Unit 3						
Variation Heredity and Cell Division						
Variation and Adaptation	3.1	U	U	U	U	
Difference between Variation and Adaptation	3.2	U		U	U	
Sources of Variation from environmental and Genetic factors	3.3	U	U		U	
Adaptations affect the chances of survival	3.4	U				
Genetics	3.5	U			U	
Gene and Chromosome	3.6	U	R		R	
DNA Structure and Composition	3.7	U		R		
Model of DNA	3.8	C				U
Mitosis and Meiosis	3.9	U		R		
Phases of Mitosis and Meiosis	3.10	U	R	R	U	U
Unit 6						
Chemical Reactions						
Chemical Reactions	6.1	R	R	R	R	R
Law of conservation of Mass	6.2	APP	R			U

Chemical Equation	6.3	U	U		R	
Types of Reactions	6.4	U	U	R	R/APP	U/APP
Endothermic and exothermic reactions	6.5	U	U			U
Endothermic and exothermic reactions in daily life	6.6	U				
Design a car	6.7	C				
formation of ionic Bonds	6.8	U		U	U	U
Formation and types of covalent Bond	6.9	U	R			U
Ionic and covalent compound	6.10	R	R	R		
Cross and dot structure	6.11	APP				APP
Unit 9						
Force and pressure						
Force	9.1	U	R	R		U
Effect of unbalanced force	9.2	ANA	R	U	R	U
Mass density	9.3	U	U	U	U	U
Pressure	9.4	U	R	R	U	
Relate Pressure with Force and Area	9.5	U	U	U		U
Effects related to pressure	9.6	U				U
Effect of Force in the presence of air Pressure	9.7	ANA	R		ANA	ANA
Hydraulic Elevator	9.8	C	R	U	U	U
Rocket Propulsion	9.9	C	R	U	U	U
Unit 12						
Our Universe						
Star, Galaxy, Milky Way and Black Holes	12.1	U	R	R	U	U
Types of Galaxies	12.2	U	R	R	U	U
Life of a Star	12.3	U	R		U	U
Birth and Death of Our Sun	12.4	U	R	R	R	U
Hubble Space Telescope and Space Probe	12.5	U	R	R		U
Advancement in space technology	12.6	ANA			R	

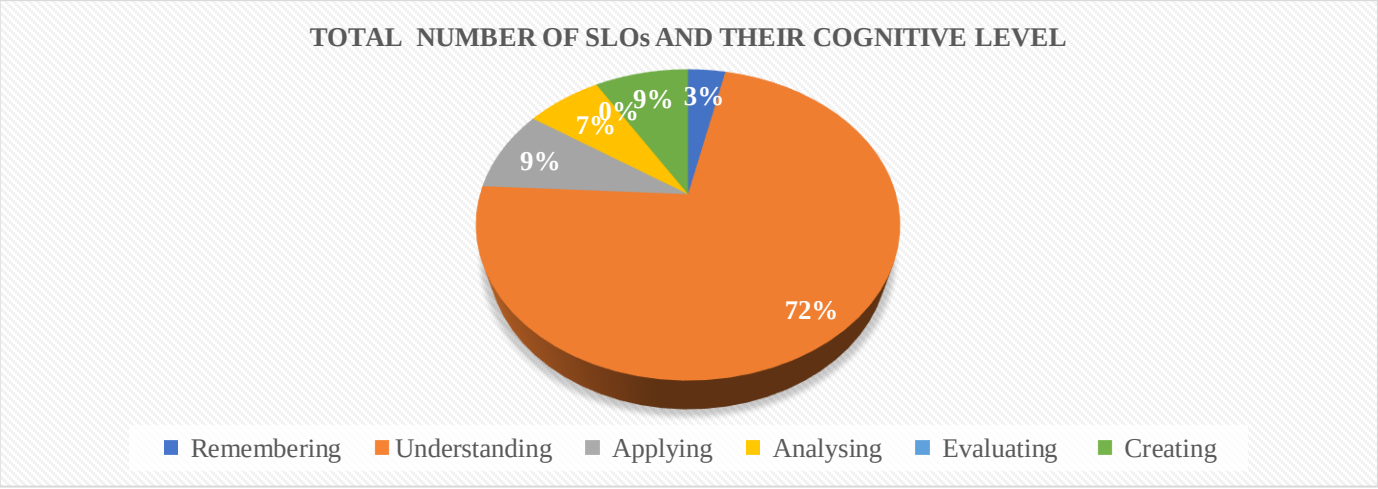

Figure 1 shows the total number of SLOs and their cognitive levels. According to the figure, 72% of the SLOs comprise the Understanding level, while 9% are at the Applying level, 9% are at the Creating level, 7% are at the Analysing level and the remaining 3% are at the Remembering level.

EXERCISE QUESTIONS ALIGNED WITH THE COGNITIVE LEVELS OF SLOs

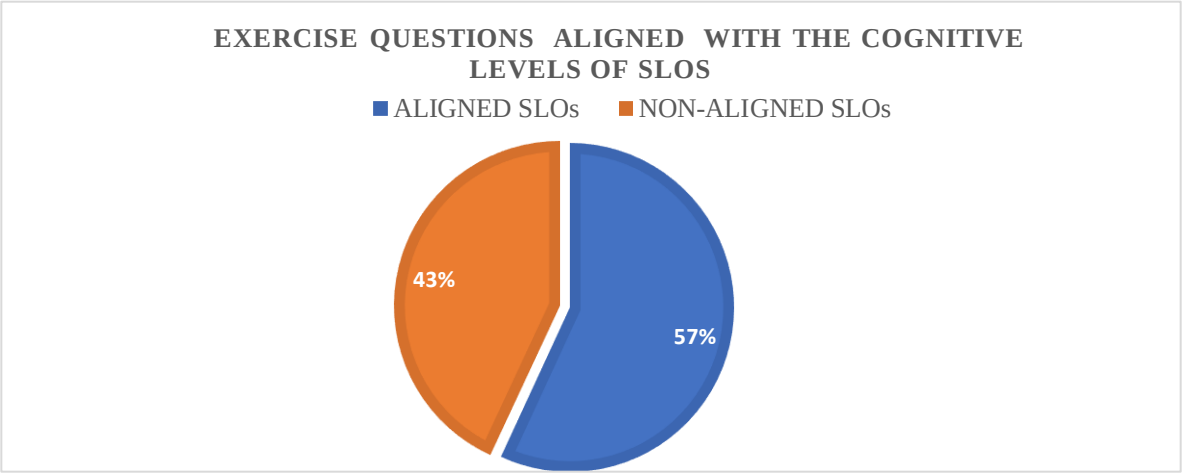

Figure 2 shows the data regarding the alignment of exercise questions with the cognitive levels of the SLOs. According to figure, 57% of exercise questions are aligned with the cognitive levels of the SLOs, while 43% of the exercise questions are not aligned.

MCQ's Cognitive Levels

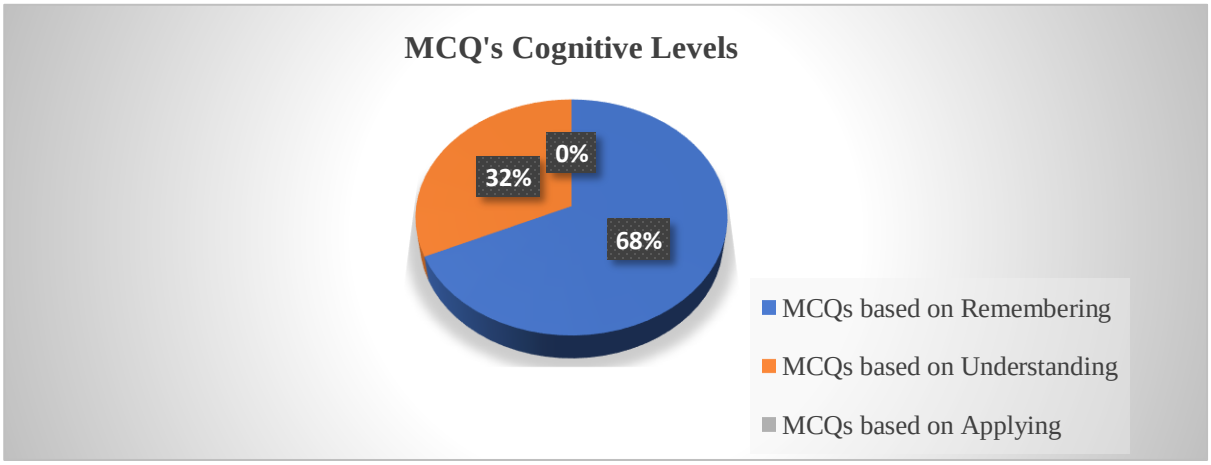

Figure 3 shows the data regarding the cognitive levels of the MCQs. As shown, 68% of the MCQs are based on the Remembering level of Bloom's Taxonomy, while the remaining 32% of the MCQs in the targeted units are based on the Understanding level. This indicates that textbook's MCQs focus exclusively on lower- order thinking skills.

Discussion

Data have been gathered from six chapters of the grade 8 Science textbook. The reason behind selecting data from six chapters is that BAEC regularly conducts board exams for the middle standard (Grade 8th). Since BAEC works on assessment, it is necessary for the researchers to find the relationship between the cognitive level of SLOs and the cognitive level of exercise questions. According to educationists, there must be a strong relationship between the cognitive level of SLOs and exercise questions.

This study focused on the alignment between SLOs and exercise questions in the Grade 8 Science textbook through the interpretation and analysis of their cognitive level or demand by using Bloom's revised taxonomy. Results revealed that a number of assessment exercises fail to match the intended SLOs. This partial alignment implies that students may not be offered the chances to cover the cognitive skills required by the official curriculum.

In general, the findings of the current study seem to corroborate the earlier research studies that have stressed and focused on the significance of constructive alignment in learning outcomes and assessment. In the words of Biggs and Tang (2011), efficient learning can occur only when exercise questions are aligned with the learning outcomes of the chapters. Also, Anderson and Krathwohl (2001) noted that Bloom's Revised Taxonomy can serve as an important framework for making sure that assessments are aligned with the cognitive levels of learning goals. The current findings show that the Grade 8 Science textbook involves SLOs for HOTs, while the exercise questions in the textbooks still focus on LOTs levels, especially remembering.

Conclusion

The first chapter of Grade 8 Science is related to Life Sciences, titled “Biogeochemical Cycles.” This chapter has 9 SLOs, and all the SLOs have an Understanding cognitive level. It was observed that 50% of the exercise questions aligned with the cognitive level of the SLOs.

The data were also collected from Chapter 2, titled “Human Nervous System,” which contains 13 SLOs. The cognitive level of eight SLOs is at the Understanding level, three SLOs are at the Applying level, one SLO is at the Analysing level, and one is at the Creating level. Here it was observed that 50 percent of the exercise questions had no alignment with the cognitive level of the SLOs. It was also observed that mixed SLOs were found, meaning one SLO covered many topics. Here, 90 percent of SLOs followed the command word “Describe”.

“Variation, Heredity and Cell Division” is the topic of Chapter 3. This chapter consists of ten SLOs: nine SLOs of the Understanding cognitive level and one is of Creating. It was observed that 50% of the cognitive level of exercise questions aligned with the cognitive level of SLOs. In all, the chapter exercise questions consist of MCQs, Fill in the blanks, Short Answer Questions (SAQs) and Extended Response Questions (ERQs). Most of the MCQs having a Remembering cognitive level question, fill in the blank also at the Remembering cognitive level, three short answer questions from Understanding level.

Chapter 6 which was selected as sample unit, consists of eleven SLOs; seven SLOs have an Understanding cognitive level, two have Remembering, one has Analysing and two have Creating. Most of the cognitive levels of the exercise questions aligned with the cognitive levels of the SLOs. In this chapter’s exercise, 70% of exercise questions’ cognitive levels align with the SLOs’ cognitive levels. Specifically, 57% of MCQs are from Remembering level and 43% of MCQs is from Understanding level. Fill in the blanks is comprises of 90% of Remembering and 10% of Understanding level fill in the blanks. Meanwhile SAQs consist of 80% of Remembering questions and 10% question is of Understanding level and 10% question is of Applying level. In ERQs 12% is of Remembering level and 63% of question are at the Understanding level which shows the main reflection of SLOs in ERQs and 25% are at the Applying and Creating levels.

The next sample chapter is chapter 9, Force and pressure, which consists of nine SLOs, in these 9 SLOs, 5 SLOs’ consist of Understanding cognitive level, 2 SLOs comprises of Analysing cognitive level and 2 SLOs includes Creating cognitive level. 77% of MCQs belong to Remembering cognitive level, this reflects that MCQs are not following Cognitive levels of SLOs. While the remaining MCQs are of Understanding level. 40% of Fill in the blanks consist of Remembering FIBs and 60% of Understanding level FIBs. SAQs consist of 66% of Understanding level and 34% of SAQs are of both Remembering and Analysing level questions. In ERQs all the questions are of Understanding level except one that is from Analysing level.

The last chapter i.e. “Our Universe” includes 6 SLOs and five out of six SLOs belongs to Understanding level and one SLO having Analysing cognitive level. How ever items developed to assess the mentioned SLOs do not have alignment because they correspond to Remembering level.

Recommendations

1. The cognitive level of exercises should be aligned with the cognitive level of SLOs.
2. This development should be carried out by BOC in collaboration with the BAEC.
3. A teacher training program should be arranged regarding the cognitive alignment of exercise questions with SLOs.

4. A strong coordinating mechanism should be strengthened between BOC and BAEC.
5. The role of BAEC should be extended regarding the formation of summative and formative assessment frameworks.
6. It is recommended that the textbook developers at federal and provincial level update exercise questions to ensure that all cognitive levels are reflected.

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