Educational Journal
Volume-V, Issue-I, May, 2026
DOI: https://doi.org/10.3126/ej.v5i1.95839
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# Alignment of the Grade Nine Science and Technology Textbook with the National Curriculum

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## Abstract

*The alignment between textbooks and the national curriculum is essential for maintaining consistency, quality, and effectiveness in education despite of the central role of textbooks in classroom instruction. The alignment of the textbooks with the national curriculum often remains underexamined hence raising concerns about the consistency of envisioned learning outcomes. Hence this research was carried out to analyze the alignment of the textbook with the national curriculum in terms of objectives, content and methodology. Two documents i.e., Science and Technology curriculum and its text book developed by the Curriculum Development Center, Nepal were analyzed qualitatively through document analysis. For the analysis of the data, descriptive analysis and content analysis methods were used and then presented thematically. The result indicates that the text book is aligned with the objectives and content of the curriculum except some sequential misalliances. The curriculum objectives seem to be fulfilled but some objectives do not clearly define the content and number of objectives are not seen uniform with the ratio of teaching hours of the respective units. The strong student-centered pedagogical recommendation with activities and projects reflects foundation of the constructivist approach of the curriculum design. The finding of this research will contribute for the revision and improvement of curriculum and development of the aligned textbook. This study strongly recommends systematic revision of science textbooks to ensure full alignment with its national curriculum for effective pedagogical implementation and achieving learning outcomes. Moreover, related government agencies should focus on the alignment during the development of the textbooks.*

***Keywords****: Alignment, Curriculum, Science and Technology, Secondary Level, Teaching*

## Introduction

Curriculum is the guideline of teaching learning process as written plan of action thereby distinguishing it from actually what happens in school (Mahroof & Saeed, 2021). The curriculum is a set of learning needs that involves goals, subject matter, teaching plan and experiences. It transfers the societal values and norms through the teaching learning process in

the educational institutions. The curriculum reflects forms of knowledge, habits of thinking, and cultural practices that a society considers important enough to pass on to succeeding generations (Triche, 2002) as revamping of child's experience to "the organized body of truth" (Dewey, 1902) and sum of all the learning experiences planned and directed by the school (Dhanapala, 2021)). It is the product of mutual consensus among all the stakeholders such as curriculum specialists, educational managers, parents, students and teachers. It specifies the learning outcomes to be achieved after classroom instruction. Curriculum guides a teacher, educational manager, textbook/instructional material developer, and examiner.

Textbooks are the major equipment in teaching and learning that are the base of teacher and students. Text books provide a guideline for achieving aims and objectives of the curriculum, serve as an instructional material during teaching and help to prepare students for final examinations. Textbooks are generally used in school and colleges which play an important role to accomplish the objectives of curriculum in the context of countries like Nepal. Textbooks are the inseparable part of educational process in all subject providing supplements to teaching material, ideas and activities throughout the academic year (Wotring et al., 2021).) written by one or more teachers especially by subject expert. Vojíř & Rusek, (2019) stated that the nature of textbook is designed in such a way that varies naturally according to the level of education. Textbooks are the fundamental source of instructional materials which saves time and are the most convenient tools to make teaching learning more purposeful. As the classification of education varies worldwide and authors refer to the levels quite approximately, only simple categories are used to classify the textbooks (Mahroof and Saeed, 2021).

Curriculum alignment is the degree of co-ordination among curriculum, instruction, and assessment to assists students learning (Martone and Sireci, 2009). It is the method of educational quality control where the process of teaching and learning is predetermined and pre structured. It makes sure about the alignment of instruction and assessment with curriculum (Fan, 2010). National goals are reflected in the objectives of the curriculum and implemented and achieved through the text books. Curriculum document is considered to be the roadmap to meet the national goals. For this reason, the books are developed in a way that the contents should be aligned with the curricular objectives and instructional strategies. If it's not aligned, then it will be difficult to achieve the national goals that are determined by the curriculum development center. Appropriately aligned curriculum and the textbooks help in effective teaching and learning (Mahmood, 2011). The alignment of textbooks with the curriculum ensures alignment of instruction, assessment and evaluation with the curriculum. However, development of text-books aligned with the curriculum is considered one of the initial aspects for implementing of curriculum. Textbooks prepare learners for examinations, help teachers by reducing their preparation time, help administrators to allocate lessons to teachers, standardize teaching, and provide teaching that would be useful to any learner anywhere at a specified language level. There is less role of textbook to develop professional skills among students (Martone & Sireci, 2009). The curriculum specialists stress on curriculum alignment as the degree of coordination among curriculum, instructions, and assessment to facilitate students' learning (Martone & Sireci, 2009) emphasizing as the method of "educational quality control" where the "process of teaching and learning is predetermined, pre-paced, and pre-structured" (Rubin & Kazanjian, 2011). Therefore, it is very significant to analyze the quality

of textbooks according to the national curriculum. Instead of this, there is the inverse relation between textbook and curriculum alignment. The alignment between objectives of curriculum and textbook is ignored (Saher & Kashif, 2020). It shows that the textbook and curriculum is not aligned and it may avoid achieving the aims and objectives of curriculum. In these contexts, this study has focused to study on level of alignment of Grade 9 science textbook with the curriculum objectives.

Alignment of a textbook with its curriculum ensures coherence and consistency between the learning standards and the content offered in the textbook so that use of instructional materials and pedagogy correctly reflect intended educational goals (UNESCO, 2021; OECD, 2020). It comprises the correspondence between curriculum objectives and textbook content, where lessons, contents, and depth of coverage fit the specified learning outcomes (OECD, 2020). Alignment requires consistency between the sequence and organization of content in the textbook and the structure of the curriculum to support logical development of learning across units and grades (UNESCO, 2021). Alignment also extends to instructional approaches, ensuring that activities, examples, and illustrations promote curriculum-recommended strategies (Darling-Hammond et al., 2020). Furthermore, textbook assessments should correspond with evaluation methods and cognitive level of the students to measure the achievements correctly (OECD, 2020). It also incorporates 21$^{st}$ century skills and ensures inclusivity and contextual relevance in accordance with curriculum expectations (Darling-Hammond et al., 2020; UNESCO, 2021).

Alignment of science textbook with curriculum ensures the quality education and supports both students and teachers in achieving national goals. National Curriculum Framework for School Education (NCF, 2076) emphasizes that the textbooks and instructional materials should be developed in accordance with national curriculum. Moreover, several empirical studies have examined curriculum-textbook alignment and assessment practice using Bloom's taxonomy. Researchers have applied diverse methods to evaluate textbooks and question papers (Saeed & Rashid, 2014) and also highlighted the need for adequate training for the curriculum and textbook developers to ensure alignment between national curriculum and textbooks. However, such studies remain limited particularly in the context of Nepal. In these contexts, the present study examines the extent of alignment between the Grade 9 science and technology curriculum and textbook in terms of objectives, content and pedagogy.

The findings of this study may help the textbook developer to align textbook with curriculum objectives, help the curriculum designer and implementer to improve the fault present in textbook and essential for the achievement of educational objectives and aims. The study was delimited as a case study under qualitative research and includes only the document analysis of the two documents: a) Science and Technology curriculum of grade nine and b) Text book of the same subject. Both of them were developed by the CDC. This study was delimited to the study of alignment of text book with the objectives, content and pedagogy of only the biology lessons of Science and Technology for grade nine.

## Methodology

The study is qualitative in nature focusing on analyzing the curriculum and textbook of Science and Technology of Grade nine of secondary level of Nepal. The study was done through document analysis. Document analysis is a process for reviewing and evaluating a document. Like any other analysis method, this procedure is also required in depth study of the content for generating underlying meanings and to develop empirical knowledge (Rapley, 2007). The following documents were analyzed: 1) National curriculum for Science and Technology for Grade nine and 2) Science Textbook for same grade. The data were sourced from comparing the Science and Technology textbook of grade nine with the respective curriculum. For the alignment of national curriculum and textbook, required number of tables are developed comparing the objectives, content and methodology respectively as prescribed by the curriculum and incorporated in the text book. The instruments contained chapter-wise objectives, content and methodologies. The content given in the text book was analyzed based on the objectives and instructional pedagogies given in the curriculum. The document analysis was further verified and discussed with the curriculum developers and subject experts.

The data collection and analysis procedure were based on qualitative approach. General themes were developed after coding of the information. The finding is written in the thematic way and discussed on the basis of researcher's personal opinion and also compared with the secondary literatures. The validity of the used interview guideline was established by its approval from the subject experts. Prior informed consent, taking permission from the concerned agencies, respect to participants, anonymity, minimizing the harm, maintaining the objectivity, transparency in data accessing and reporting, justice and respect for persons are some ethical considerations considered during the research. All the information were taken under informant's consent.

## Findings

### Development of Science in Secondary Level

In the context of Nepal, the government had started to teach science in Tri-Chandra college in 1977 B.S. (1920 AD) and Science subject as an extra subject in school leaving certificate (SLC) had been provisioned since 1996 B.S. (1939 AD). Furthermore, Nepal National Educational Planning Commission (NNEPC, 1956), recommended three-year science course (first two years as the basic science and the last one year as advance science) for secondary level (class eight to ten) education as defined by the commission (Sharma, 2071 BS). Similarly, National Education System Plan (NESP, 1971-1975) had recommended Science as a compulsory subject in all three types of secondary schools (general, Sanskrit and vocational) from eight to ten. At lower secondary level (from four to seven) (Sharma, 2071 BS). It had recommended Science subject as compulsory subject. Furthermore, this plan had recommended Physics, Chemistry, and Biology as separate optional subject along with some other lingual and vocational subjects. It had given more emphasis on the construction of education teaching materials in the local level. It had focused on development of science laboratory compulsorily in every secondary school.

National Education Commission (NEC, 1992) had recommended Science and Environment Education as a compulsory subject in secondary level (grade nine and ten). However, High Level National Education Commission (HLNEC, 1998) after six years in 2055 B.S. recommended Science, Health, Population and Environment Education as a compulsory subject and another Science subject as optional subject in in grade nine and ten (Sharma, 2071). National Curriculum framework for School Education in Nepal (CDC, 2007) has incorporated Science as one the five learning areas (in secondary level- 9 to 12) as identified by CDC (2076) and Education of this level is categorized into two streams: general and vocation/technical. Science subject is taken as compulsory subject in grade nine and ten and elective subjects (specific subjects like, Biology, Physics, Chemistry etc.) in grade eleven and twelve (CDC, 2007). This structure is now in implementation in Nepalese school education. This Science education in grade nine and ten consists of the components of Physics, Biology and Chemistry. Biology simply is a life science which deals with the study of living beings. It consists of mainly two branches: botany and zoology. Morphology, taxonomy, embryology, anatomy and physiology etc. are the fundamental sub- sciences of biology. But in secondary level, Biology is mainly composed by two parts i.e.: Botany and Zoology.

**Objectives and Content Alignment**

The Science and Technology subject is a five-credit subject with annual working hour 160. The evaluation includes 75 marks as external examination (summative) and 25 marks as internal evaluation (formative) out of its 100 full marks. The curriculum has included nineteen units under the major five areas. Among them, scientific studies (7 working hours) hold 4.37% weightage, Information and Communication Technology (14 periods) holds 8.75% weightage, Chemistry (43 working hours) holds 26.87% of the total weightage, Biology content holds about 24.37% (39 working hours) of the total course, and more content emphasis is given to the physics (six units, 57 working hours), 35.62% weightage. Classification of living beings (6 working hours), life cycle (5 working hours), evolution (6 working hours), body structure and life process (16 working hours), and nature and environment (6 working hours) are the five units incorporated under biology content.

The content and objectives given in the curriculum were studied and analyzed with the content of the text book and given inferences (table 1). In some content given in the textbook, there are some errors and the figures are also not clear. In the unit '2. Classification of Living Beings (teaching hour: 6)', the objectives and content given in the curriculum match respectively with the addition of the title 'introduction to classification' 'genus and species' as separate heading. But the content heading in the textbook differs but reflects and incorporated all the objectives of the curriculum. Genus and species are included under binomial system of nomenclature. Characteristics and examples of the monera, protista and fungi included under 'bases of five kingdom method of classification'. The unit '3. Life Cycle' (teaching hour: 5) contains the 'mushroom'. The objectives are incorporated in the content but the sequence of the objectives and sequence of the content in the curriculum is different. The heading 'use of mushroom for human health' is kept as separate heading with priority, is one heading out of four heading in the curriculum but in the text book it is embedded under the 'use of mushroom'. Structure of mushroom not included in the objective 3.3 'use of mushroom' and 3.5 'storage

and use of mushroom' overlapping in the heading. The content in the text book also contains some errors. For example: the figure 3.4 (page 28) life cycle of mushroom does not contain sufficient labelling and the concept of life cycle can't be clear.

The unit '4. Evolution (teaching hour: 6)' gives the specified objectives and content but some inconsistencies have been observed. For example: in the content 'Hugo de Vries theory of mutation' is included under the topic theory of evolution but in the textbook, it is corrected and described under the topic mutation. The topic as heading 'significance of mutation and variation' is missing in the content of the both book and curriculum. Similarly, the objective "to describe the concept of evolution based on evidences" could not clarify the types of evidences but it is clearly stated in the content of the curriculum and given in the text book. The unit 5. Body Structure and life process (teaching hour: 16) possess relatively higher teaching hours. It means the content load is different for the units. The curricular objectives and contents are seen aligned and also aligned with the content of the textbook too. Similarly, the unit '6. Nature and Environment (teaching hour: 6)'also shows the alignment in curricular objectives with the content of the curriculum as well as the content of the text book. The detail of the unit wise objectives, content and content in the curriculum with inference is given in the table 1.

The alignment of the content given in the text book is compared with the objectives and content given in the curriculum as developed by CDC. The study has included only the biology units. The units 'evolution' and 'body structure and life process' hold highest number of objectives but only the unit body structure and life process' has highest teaching hours (16 hours) which is followed by classification of living beings, evolution and nature and environment (all of 6 hours). The unit: Body structure and life process seems to be vague with vague objectives as compared to other units. In this unit three different exercises are developed and such trend is not seen in other units. The content given in all units are seen sufficient and all of the objectives are achievable.

**Table 1**

*Unit wise objective and content analysis.*

| Units | Objectives | Content in curriculum | Content in text book | Inference |
|---|---|---|---|---|
| 2. Classification of Living Beings (teaching hour: 6) | 2.1. To introduce binomial system of nomenclature and write the scientific names of organisms.<br>2.2. To define genus and species.<br>2.3. To clarify the concept of classification of organisms according to the five-kingdom system.<br>2.4. To explain the characteristics of Monera, Protista and fungi. | • Introduction to classification<br>• Binomial system of nomenclature<br>• Genus and Species<br>• Five Kingdom system<br>• Characteristics and examples of Monera, Protista and fungi | 2.1. Importance of classification<br>2.2.Binomial system of nomenclature<br>2.3. Five Kingdom system of classification<br>2.4. Bases of Five kingdom method of classification | • Not given the subheading for introduction.<br>• Genus and species are included under binomial system of nomenclature.<br>• Characteristics and examples of the monera, protista and fungi included under ‘bases of five kingdom method of classification’. |

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|---|---|---|---|---|
| 3. Life Cycle (teaching hour: 5) | 3.1. To explain the life cycle and importance of mushroom.<br>3.2. To identify the edible and poisonous mushroom.<br>3.3. To inquire about mushroom cultivation technique. | • Importance of mushroom<br>• Economic income (mushroom cultivation, production through biotechnology like sukuti pickles)<br>• Use of mushroom for human health<br>• Identification of edible and poisonous mushroom<br>• Life cycle of mushroom | 3.1. Structure of Mushroom<br>3.2. Lifecycle of mushroom<br>3.3. Use of mushroom<br>3.4. Mushroom farming<br>3.5 Storage and use of Mushroom<br>3.6. Edible and Poisonous mushroom | • Structure of mushroom not included in the objective<br>• 3.3 ‘use of mushroom’ and 3.5 ‘storage and use of mushroom’ overlapping in the heading.<br>• ‘Use of mushroom for human health’ described under the heading 3.3. use of mushroom.<br>• The sequence of the objectives, content and lessons do not fit accordingly. |

| | | | | |
|---|---|---|---|---|
| 4.Evolution (teaching hour: 6) | 4.1.To describe the concept of evolution based on evidences.<br>4.2.To clarify the concept of Lamarckism.<br>4.3.To clarify the concept of Darwinism.<br>4.4.To explain the Hugo De Vries theory of mutation.<br>4.5.To inquire about the significance of mutation and variation. | • Evolution: concept<br>• Evidences of evolution (fossil, embryological, connecting link, homologous and analogous organs)<br>• Theories of Evolution Lamarckism, Darwinism<br>Hugo de Vries theory of mutation<br>• Variation and Mutation | 4.1. Introduction to evolution<br>4.2. Evidence of Organic evolution<br>4.3. Theory of evolution (Lamarckism, Darwin's theory)<br>4.4. Variation and Mutation (Hugo De Vries theory of mutation) | • In the content 'Hugo de Vries theory of mutation' is included under the topic theory of evolution but in the textbook it is corrected and described under the topic mutation.<br>• 'significance of mutation and variation' is missing in the content of the both book and curriculum |
| 5.Body Structure and life process (teaching hour: 16) | 5.1.To describe the types and function of plant and animal tissues with their introduction, types, parts found and function.<br>5.2.To explain the structure and function of the parts of the human nervous system. | • Tissues: introduction. Function and types of plant and animal tissues<br>• Nervous system: introduction, types and function | 5.1 Tissue<br>5.2 Human Nervous system<br>5.3. Human Glandular System<br>5.4. Plant hormones | • The contents have reflected the objectives |

| | | | | |
|---|---|---|---|---|
| | 5.3. To introduce and compare exocrine and endocrine glands.<br>5.4. To describe the function and effect of human hormones with introduction.<br>5.5. To describe the function and uses of growth hormone introducing plant hormones. | • Gland system: introduction, types<br>• Human hormone: introduction function and effect<br>• Plant hormones: introduction and uses | | |
| 6. Nature and Environment (teaching hour: 6) | 6.1. To explain the interrelationship of biotic and abiotic components in aquatic and terrestrial ecosystem.<br>6.2. To introduce food chain and food web in ecosystem to show the interrelationship of organism.<br>6.3. To describe the types of interaction between organisms in an ecosystem. | • Ecosystem<br>• Components of terrestrial and aquatic ecosystem<br>• Food chain Food web<br>• Interactions among organisms | 6.1. Ecosystem<br>6.2. Interaction between living beings | • The topics have included the content and objectives respectively. |

**Pedagogical Alignment**

The curriculum has given "Life Cycle" in the Unit III but in the text book, the title "Mushroom" is given which has included storage, cultivation and edible and poisonous mushroom along with structure and life cycle of the mushroom. The book has not included the collage of mushroom in the activities or project work.

In Unit IV: Evolution, the content is sufficiently provided and aligned with the objectives, content and pedagogy. Moreover, more project works are also given. For example: project work on mutation, project work on phylogenetic characters in the family and project work on mutation from internet search. Similarly, in unit V: Body Structure and Life process, the content in the text book is seen sufficient on the basis of objectives and content provided in the curriculum and pedagogically also fitted with the curriculum. But the text book incorporated concerned concept and more project works. For example: Field visit: agricultural farm and prepare the report on use of plant hormones in the field.

In unit VI: Nature and Environment, the text book has included the necessary text and exercises as per the objectives and content prescribed by the curriculum, but the book does not include the project work on the preparation of model of aquatic and terrestrial ecosystem though sufficient project work rather included in the curriculum are given there (for details table 2).

The curriculum has focused on ICT enhanced student-centered approach of teaching learning activities. It focuses on student centered methods of teaching like: field trip, experimental methods, demonstration methods, discussion methods, and problem-solving methods. In Unit II: Classification of Living Beings, the book has tried to incorporate the methods prescribed in the curriculum but some project works described in the curriculum are not included in the text book content. For example: Project work on model of prokaryotic cell and microscopic observation of *Amoeba, Plasmodium*, Diatoms and their characterization etc. are missing in the text but some extra project works are included like: project work on study of the fungus.

The activities or project work which are given in the curriculum are missing (mushroom collage, project work on the preparation of model of aquatic and terrestrial ecosystem) in the textbooks. But the text book incorporated concerned concept and more project works in some other lessons. For example: Field visit: agricultural farm and prepare the report on use of plant hormones in the field. Pedagogy is focused on project work from internet search. This reflects the focus in student-centered approach of learning.

**Table 2**

*Unit wise pedagogy as given in the curriculum.*

| Units | Pedagogy prescribed | Missing in the text book | Extra given in the text book |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Classification of Living Beings | • Field observation<br>• Demonstration: figures, photos, charts, pie charts<br>• Discussion: Group (pen in the middle)<br>• Lecturer | • Project work: model of prokaryotic cell<br>• Microscopic observation of *Amoeba, Plasmodium*, Diatoms and their characterization | • Project work in study of Fungus |
| Life Cycle | • Field observation<br>• Report writing and presentation<br>• Demonstration: Charts, Videos<br>• Project method: mushroom cultivation<br>• Laboratory method: mushroom cultivation<br>• Group discussion<br>• Collage preparation: life cycle of the mushroom | • Collage preparation: life cycle of the mushroom | • The text book has given the storage technique. |
| Evolution | • Group discussion<br>• Lecture<br>• Demonstration: videos<br>• Peer reading and peer summarizing | | • Project work on mutation<br>• Project work on phylogenetic characters in the family<br>• Project work on mutation from internet search |
| Body Structure and life process | • Question answer method | | • Field visit: agricultural farm |

| | | | |
|---|---|---|---|
| | • Experiment method: slide preparation<br>• Discussion<br>• Observation: microscopic<br>• Lecture method<br>• Demonstration: exhibition<br>• Demonstration: videos<br>• Listing: disorders due to hypo or hyper secretion of hormones | | and prepare the report on use of plant hormones in the field. |
| Nature and Environment | • Interaction<br>• Field visit<br>• Demonstration<br>• Discussion<br>• Project: Model preparation aquatic and terrestrial ecosystem | • Model Preparation of aquatic and terrestrial ecosystem | • More project works on interaction and ecosystem |

## Discussion

Science education is the field concerned with sharing science content and process with individuals not traditionally considered part of the scientific community. Science education in particular has played a major role to in the development of critical and informed citizens in a rapidly changing technological society (Watters & Ginns, 2000). The task is to make science education meaningful and useful for children of today. Science education develops the understandings and habits of mind they need to become compassionate human beings able to think for themselves and to face life head on. It should equip them also to participate thoughtfully with fellow citizens in building and protecting a society that is open, decent and vital (Watters & Ginns, 2000). The learners of science education may be children, college students, or adults within the general public and private schools; the field of science education includes work in science content, science process (the scientific method), some social science, and some teaching pedagogy. The standards for science education provide expectations for the development of understanding for students through the entire course of their formal education and beyond.

The document analysis and the interview reflection prove that the CDC is not following the definite theory for the development of the curriculum and hence understand that CDC is following the conventional methods of curriculum development. But it has tried to update the curriculum and tried to be more student centered in its content and pedagogy. In foreign countries, several curriculum development theories are adopted by the concerned agencies (Saher & Kashif, 2020). There are three models of curriculum design: subject-centered, learner-centered, and problem-centered design (blog.teachmint.com). Subject-centered curriculum design revolves around a particular subject matter or discipline, such as mathematics, literature or biology. This model of curriculum design tends to focus on the subject, rather than the student. It is the most common model of standardized curriculum that can be found in K-12 public schools. Instructors compile lists of subjects and specific examples of how they should be studied.

Learner-centered curriculum design revolves around student needs, interests and goals. It acknowledges that students are not uniform and they are different in their potentialities. Therefore, they are subject to a standardized curriculum. This approach intentions to empower learners to shape their education through choices. This form of curriculum design engages and motivate students. The downside to this form of curriculum design is that it can generate pressure to form content around the learning desires and preferences of students. Harmonizing individual student interests with the course's required outcomes could prove to be a daunting task.

Problem-centered curriculum design imparts students how to look at a problem and formulate a solution. A problem-centered curriculum model helps students involve and engage in authentic learning because they're wide-open to real-life issues and skills, which are convertible to the real world. It increases the relevance of the curriculum and encourages creativity, innovation and collaboration in the classroom. The drawback to this model is that the individual needs and interests of students aren't always accounted for. The different models of curriculum design should be considered before the planning and concerned agencies or the instructor can choose the model that is best suited to both their students and their course.

The findings of this study conclude that the textbook content is generally aligned with the curriculum objectives, as all specified objectives appear achievable through the provided content. This warrants that the textbook achieves the fundamental requirement of curriculum alignment in terms of content coverage. However, alignment also comprises coherence among objectives, instructional hours, pedagogy, and assessment (OECD, 2020; UNESCO, 2021). Therefore, while the basic alignment is evident, deeper analysis is needed to explore several inconsistencies. One of the major issues identified is the disproportion between the number of objectives and the division of teaching hours across units. Although the units "evolution" and "body structure and life process" comprise the highest number of objectives, only the latter is allocated the highest teaching hours. This disproportion designates a mismatch between curriculum expectations and instructional emphasis. Such disparity may lead teachers to prioritize units with more instructional time rather than those with greater conceptual weights, hence affecting the equitable attainment of learning outcomes (OECD,

2020). Another significant finding is that the unit "body structure and life process" covers relatively vague objectives compared to other units. Clearly defined and specific objectives are important for effective curriculum implementation, as they guide both teaching and assessment practices. The vague objectives may be interpreted differently, leading to inconsistencies in classroom performs and student learning experiences (UNESCO, 2021). This deficiency of clarity fails the strength of alignment, even if the content coverage seems sufficient.

The study also recognized inconsistency in the distribution of exercises, as the unit "body structure and life process" contains three different exercises, whereas such variation is not observed in other units. Alignment needs consistency not only in content but also in instructional and assessment design. Unequal distribution and unequal weightage of exercises may result difficulties in practice and evaluation, possibly affecting students' mastery of concepts across units (Zhang et al., 2023). Despite these concerns, the objectives achievable through the textbook content is a positive indication of alignment. It recommends that the textbook adequately supports the intended curriculum. However, effective curriculum alignment involves a balanced integration of all components, including clarity of objectives, proportional allocation of teaching time, and consistency in instructional and assessment practices (OECD, 2020; UNESCO, 2021).

The findings on pedagogical alignment indicate a partial misalignment between the curriculum and textbook in terms of prescribed activities, as specific tasks such as mushroom collage and ecosystem model preparation are missing. This missing recommends a gap in the adoption of intended curriculum into implemented materials (book), which may limit the realization of hands-on and experiential learning outcomes (UNESCO, 2021). But in contrary to this, the inclusion of alternative project-based activities, like field visits and report preparation on plant hormone use, shows an adaptive alignment where textbook developers incorporate contextually relevant and inquiry-based tasks. Such performs are consistent with contemporary emphasis on student-centered learning, which enhance active engagement, critical thinking, and real-world application of knowledge (OECD, 2020). Furthermore, the integration of internet-based project work directs a shift towards digital and self-directed learning approaches, aligning with 21st-century pedagogical trends (Voogt et al., 2021). Thus, although direct alignment is seen inadequate, the pedagogical orientation remains progressive and learner-centered.

This study has focused on providing feedback to curriculum developers and textbook writers to consider alignment (given unit wise analysis of the objectives, content and pedagogy) between curriculum objectives and textbook content are the intent of the curriculum. Such type of alignment is the major intent of the curriculum (Mahmood, 2006; Saher & Kashif, 2020). In this study, deficiencies have been reported with respect to objectives, content and pedagogy in the textbooks. Elimination of such deficiencies will bring the text revision and also supports in the students' achievement (Squires, 2012). Saher and Kashif (2020) reported that there are some deficiencies seen in textbooks, approved by Curriculum Wing and also in textbooks. There are many factors to account for deficiencies in the textbook selection procedures being used, two appear prominent: a) appropriate criteria

against which to judge textbook characteristics; and b) the factors through which to identify the textbook characteristics to be judge against the curriculum criteria. By overcoming these deficiencies, the quality of textbooks could be improved (Mahmood, 2011).

## Conclusion

The document analysis has shown that there is alignment of Science and Technology text book of grade nine with its curriculum developed by CDC, except some minor mismatching and non-sequential arrangement of the objectives and the content. Both contents from curriculum and textbook are based on the objectives of the curriculum. The pedagogy also reflects its alignment with the objectives. But in some units, the project works are mismatched. Regular revision of curriculum is essential for the updated curriculum and reducing the errors. Consulting with the subject specific experts, need analysis, textbook proof reading are some of the keys of the improved textbook and curriculum. The course orientation trainings are essential to adopt new trends in the curriculum. The teachers must be properly trained for the adoption of new curriculum. The CDC or the government should focus on the alignment of the curriculum and text book by formulating the rules and development of the policy. Similarly, the analysis of alignment of privately published text book by different publication is urgent for the quality control.

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