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Analysis of the Infusion of Science Process Skill Contents into the Ethiopian Grade Nine Biology Textbook: A Content Analysis

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Abstract

This study aims to assess the status of science process skill contents in the Ethiopian grade nine biology textbooks. It evaluates the inclusion of basic and integrated science process skills (SPS) involved in scientific inquiry using the eleven Science Process Skills indicators. After having accessed the Ethiopian grade nine biology textbook from the net, the researchers read it once and again while doing this research. The content analysis research design was used in this research. The result confirmed that basic science process skills cover an excessive percent compared to the integrated science process skills. The skills included in the textbook were inferring, observing, and classifying (from the basic SPS), experimenting, and modeling (from the integrated SPS). The textbook is additionally not often made out of scientific communication skills and data collection and interpretation SPSs. However, the textbook no longer consisted of the prediction (from the basic SPS) and hypothesizing and controlling variables (from the integrated SPS). Generally, the research findings confirmed unequal integration of SPS in the textbook. On the premise of the findings of this study, the researchers forwarded that textbook writers and professionals at the Ministry of Education needs to prepare a preferred and harmonized biology textbook with a reasonable balance of all the integrated skills that could increase students' use of the integrated scientific skills.

Keywords: *Biology, Content analysis, Grade nine, Science process skills (SPS), Textbook*

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1. Introduction

1.1 Background of the study

Science education is the fundamental factor and contributor to prosperity, welfare, and safety of a nation. In this sense, science education is necessary to function as the foundation of technological improvement, and it is a significant component in financial growth (Watson & Crawford, 2000).

Increasing the contribution of science education needs to be supported through a well-prepared science textbook. As it is expressed in Lee et al., (2020), textbooks play a substantial role in primary and secondary school education across the different regions of the world. Scholars tried to show the importance of a textbook as a source of knowledge in the classroom (Vera, 2018), influence the strategies employed by teachers when teaching, and the arrangement in which teaching and learning occur (Hansen 2018; Lee & Catling 2017).

With this background in mind, evaluation of educational applications of textbooks becomes the famous areas of study in some countries. Textbooks play an essential role in commanding biology education in Ethiopia and beyond. They are also sources of data related to the notions of evolution and ecology together with fundamental organic ideas, clinical study techniques, and experimental activities (Haury, 2000). It is well familiar to apply textbooks in coaching biology (Kuechl, 1995). If a textbook is the principal supply of facts and order of content material throughout biology lessons, it needs to be attractive to 'teachers and students' desires (Kuechl, 1995). Teachers consider logical to assess and thereby improve the status of textbooks so as to better support

students learning at schools (Kuechle, 1995). However, it is expressed that students' realities or learning styles had been no longer associated with the ideas included in the textbooks. In addition, students' historical past information is not associated with the brand new ideas that those textbooks do now no longer inspire the scholars to do studies inside the vicinity of technological know-how schooling (Leonard & Chandler, 2003).

Studies regarding the problems confronted in the biology textbooks are determined both in the national and international literature. By analyzing seventeen biology textbooks, Jablon (1992), for example, indicated that those textbooks are explicitly alike. Jablon further disclosed that though those textbooks could have basic techniques and correct claims subjects like Science-Technology-Society and collaborative mastering, they now no longer combine the strategies as the experimental activities look like prepared dinner, it no longer permits lively participation of the scholars in doing studies. On the other perspective, Gottfried and Kyle (1992) indicated that textbook-oriented instructors are very dependent on the content material of the textbooks. As a result, they no longer cognizance of subjects like Science-Technology-Society, non-public desires, and professional sensitivity. Then they do now no longer spend time on any of those subjects. Therefore, the imperative position that the textbooks declare inside the instructional technique prevents the powerful technological know-how of schooling from accomplishing the goals we commonly demand. Lumpe and Scharmann (1991) showed experimental activities regularly occurring in the biology textbooks offer the students such possibilities as manipulating the devices and growing observational abilities. The close-ended and rigidly based activities constrain students' improvement of better-order scientific questioning competencies along with discussion, putting speculation, and forming their very own inquiry. Guritno, Masykuri, and Ashadi as cited in Antrakusuma et al. (2017) emphasized that the result of different studies explains that there has been an impact of active learning on the improvement of scientific knowledge competencies.

Biology is carefully associated with activities in locating out and understanding nature scientifically. Due to this, mastering; now no longer easier calls for information inside the shape of facts and concepts. However, it calls for a systematic technique (National Education Department, 2001). That is, Biology requires Science Process Skills. Science process skills (SPS) are skills engaged by scientists when they conduct scientific research (Feyzioğlu et al., 2012; Kruit et al., 2018b; Maranan, 2017; Özgelen, 2012). The skills promote addressing a scientific problem and providing solutions to natural world phenomena. However, according to Kruit et al., (2018b), the development of SPS is not only considered essential to scientists but also to students for them to achieve a better understanding of science content. In carrying out scientific activities of a course, Science process skill competencies are much needed. The SPS is one of the essential competencies possessed by students in engaging in scientific activities. SPS should mirror the proper conduct of scientists while fixing the troubles and planning experiments. SPS is, therefore, one essence of questioning and research in science. According to Handayani, Adisyahputra, Indrayanti (2018), scientific works and the biology mastering techniques are related to one another due to the fact that biology learning cannot be separated from the scientific skills such as observing, experimenting, and analyzing activities. SPS is believed to enhance scientific literacy and further assist students to comprehend biology ideas without any problems correctly. During the teaching-learning process, students require to be energetic in discovering the main concepts of biology materials through observation, experimentation, drawing pictures, graphs, tables, and communicating the results to others (Agustina & dan Saputra, 2016).

Individuals who no longer have proper SPS will celebrate problems in each day's activities as those competencies are not the simplest used throughout schooling. Based on this, it could be visible how essential SPS competencies are in each day's orders, particularly while mastering scientific activities. According to Deriloi (2019), there are basic science process skills and integrated science process skills. The basic skills are beneficial in scientific and nonscientific conditions but, the integrated process skills are the running conduct of the scientists and technologists. Thus, each fundamental and incorporated scientific skill is applicable and suitable for all science subjects. So, it is necessary to check the presence of these skills in a science textbook.

1.2 Statement of the problem

As Mohanty (cited in Negassa, 2014) showed, in this modern world, science occupies an ever-expanding place in our everyday life as it is the basis for development. Additionally, it is essential for increasing science literacy and cultivating a generation of scientists. In modern society, for the formation of citizens with their complete realization as humans and the competitive global economy, education in general, science education, in particular, is not only a dominant factor, but it is also emerging as a strategic means with significant importance. So, like other developing countries, Ethiopia also considers science education as a strategic means to resolve obstacles of development in science and technology through its education and training policy and needs rapid improvement of science education. Due to this, the policy provides a 70:30 admission ratio in tertiary institutions for all science and technology (MoE, 2008). Even though this change becomes implemented, the implementation process of science education is limited in Ethiopian schools. So as; Samuel & Welford, (2000) found, students in Ethiopia generally perform poorly in science subjects. Factors that contribute to this poor performance of students in science are; problems associated with attitude, methods, teachers' capacity, and resources qualities like textbooks contents. In biology lessons, teachers and students have frequently used textbooks and convey a great deal of information based on the curriculum (Dokme, 2004; Karamustafaoğlu & Ustun, 2004). There was research in the related literature about textbooks due to their importance as teaching materials in developed countries. For instance, a study by Watson (2000) in the UK has confirmed the direct relationship between expenditure on textbooks and learners' achievement. Also, in developed countries, some studies focused on the inclusion and implementation of process skills included in the student science textbook (Chiappetta, & Fillman, 2007). In finding solutions for many problems in society proficient scientific knowledge and science process skills is significant. So, in preparing students for the challenges

in the immediate environment, biology as a practical subject in the secondary school curriculum plays a role. However, in Ethiopia, no studies discovered the inclusion of SPS in biology textbooks and their practicality in the class. Due to this, it is high time to examine the inclusion of SPS in the Ethiopian textbooks. So, the purpose of the present study does direct towards solving the existing problems specifically by addressing the following research questions:

- Which science process skills are included blatantly in the grade nine Biology textbook?
- How far do science process skills integrate with grade nine Biology textbooks?

1.3 Research Objectives

The main objective of this study is to reveal the extent of the presentation of science process skills in the grade nine Biology textbook. The present study does design to achieve the following specific objectives:

- Discover the level of inclusion of basic and integrated science process skills in the Ethiopians grade nine Biology textbook.
- Check the extent of integration of science process skills in grade nine Biology textbooks.

1.4 Significance of the study

The study was conducted to examine the inclusion of science process skills in the biology textbook. The result of this research hopes to benefit the following stakeholders:

Students: This study may encourage students to master basic and integrated science process skills and improve their performance in science.

Teachers: They may appreciate the importance of students' mastery of basic and integrated science process skills by using appropriate ways of teaching the subject.

The curriculum Planners: help to realign the curriculum with further emphasis on the addition and integration of basic and integrated science process skills in science.

Future Researchers: This may serve as a base for future related studies at a more advanced position in the current area of exploration emphasis.

1.5 Scope of the study

The research delimited examining the Ethiopian grade nine Biology students' textbook published by the Minister of Education. The study is also delineated to analyze all the chapters of grade nine students' Biology textbook with a specific reference to elven Science Process Skills. These are, in the part of basic SPS (observation, classification, inferring, measuring, predicting, and scientific communicating), and the integrated science process skills (defining and controlling variables, making a hypothesis, experimenting and designing experiments, gathering and interpreting data, and making models).

2. Research Methodology

2.1 Research Approach and Design

The mixed (mainly qualitative) research approach guided this research. According to Plano Clark & Ivankova (2016) (cited in Dawadi, S. et al., 2021), a mixed research approach helps to obtain more demanding conclusions by engaging two methods in such a way that the strengths of one technique can compensate for the weakness of the other. For instance, the qualitative methods offset the drawbacks of the other (quantitative methods) and vice versa, implying that one technique can be better in some areas where the other is weak and vice versa. Quantitative design can be good in those areas where a qualitative is feeble and vice versa. The mixing of the two methods offers the possibility of combining two sets of strengths while compensating at the same time for the weaknesses of each. The combination of quantitative and qualitative methods is often appreciated because a researcher can utilize the respective strengths, escape the drawbacks of the two approaches and produce a more accurate conclusion. The qualitative part of this research is to reveal to what extent science process skills are included in the Ethiopian grade 9 biology textbook. The research questions were: What is the noticeable science process skills included in the grade nine biology textbook? How far were science processes skills integrating into the grade nine biology textbook? To answer these research questions: Firstly, constructed SPS indicators from the literature for content analysis. Secondly, carefully analyzed the grade nine biology textbook. The research employed a content analysis research design. There were various ways to define content analysis over the years. For example, content analysis is described as the analysis of written contents of a communication (Fraenkel & Wallen, 2006). In the current study, to investigate to what extent the grade nine biology textbook presents science process skills, content analysis was used to observe and analyze.

2.2 Data Sources and Sampling

In the present content analysis, there was one data source for both research questions as part of the whole study. The sample was the grade nine biology textbook. Discussion on the two research questions of this study was with a content analysis of a grade nine biology textbook published in 2004. A chosen sample was the one widely used at secondary schools in Ethiopia. It had six chapters these are; (1) Biology and technology, (2) Cell biology, (3) Human biology and health, (4) Micro-organisms and disease, (5) Classification, and (6) Environment. An analysis of all chapters was by concerning the eleven SPS indicators.

2.3 Instrument of Data Collection

Data can be collected by using various data collection tools. From these, observation, life histories, document reviewing, narratives, and interviews in qualitative research can be mentioned (Marshall & Rossman, 1995). For the present content analysis, the data were already ready in the grade nine biology textbook for the first and second research questions. So the researcher used content analysis as a data collection tool.

2.4 Data Analysis Techniques

The specific nature of the research question in this study needed the selection of eleven SPS indicators from the literature that most scholars differentiated as basic and integrated SPS. Therefore, researchers selected the eleven SPS indicators to recognize science process skills in the textbook. This section presented the eleven SPS indicators that serve as the only instrument for data analysis in this study. The second and third subsections clarified processes of recognizing the SPS and Unit of analysis.

2.4.1 The process of recognizing the science process skills presentation

Primarily, reviewing textbooks related to teaching and assessing science process skills (Bell, 2008; Rezba et al., 2007) in detail. Based on this, the eleven science process skills were divided into two; basic science process skills and integrated science process skills. These were the fundamental indicators in this content analysis. Basic science process skills include observing, measuring, inferring, classifying, predicting, and communicating scientifically. The second group; integrated science process skills are hypothesizing, defining, and controlling the variables, experimenting, collecting and interpreting data, and modeling. The investigation of the SPS included in that textbook required the following things. The first thing was to consider descriptions of each SPS, and the next was to carefully analyze the keywords that can indicate the presence of these SPS. Table 1 below shows the description of each SPS and indicator keywords of each SPS used in the present content analysis.

Table 1: A summary of the category of science process skills with their definitions and key words

Category	Skills	Description	Key words
Basic SPS	Observing	Using the senses to collect evidence about things and events	Observe, examine, watch, define display, view, smell, touch, taste, look, see, note, listen, notice, describe.
	Measuring	Measuring Quantifying properties of objects by using proper units and proper measuring instruments	Determine, measure, calculate, quantify, compute, estimate Inferring
	Inferring	Construction of statements about an opinion that provide a practical explanation	Conclude, make clear, reason, suppose, infer, deduce, clarify, describe, explain
	Classifying	Classifying Arranging or ordering objects or concepts into sets or categories based on their properties.	Sort, put in order, classify, show similarities and differences, categorize, class, organize, catalog, group, compare, contrast, class, type
	Predicting	Predicting Estimating what the outcome of an event will be based on interpretations and, commonly, earlier knowledge of similar occasions	Supposing, Guess, expect, imagine, foretell, predict, see coming, suppose, tell
	Scientific Communicating	Scientific Communicating Spread information educated from science experiments, vocally ask questions about, discuss, illuminate or report any stage of scientific method.	Report, explain, tell, graph, describe, picture, diagram, make a table of, ask, present, discuss, chat, argue, claim, reason, say, write
Integrated SPS	Defining & Controlling Variables	Declaring the variable features that can affect an experiment, find and defining the free and dependent variables, outlining the relations among variables in an experiment, governing influenced variables in an investigation.	Express variables, govern the variables, show how to operate variables, handle the variables
	Making a Hypothesis	Declaring a difficulty to be solved as a question/propose a testable solutions or estimated outcomes for experiments	Assume, hypothesize, offer, theorize, conceive, imagine, propose, suggest
	Experimenting and Designing Experiment	Testing hypotheses through the operation and control of independent variables and seeing the influence on the dependent variable: inferring and presenting results in the form of information that can be followed by others to experiment.	Perform, follow, achieve, make, do, design the experiment, test the hypotheses
	Gathering and Interpreting Data	Collecting data through effective and consistent instrument in order to test hypothesis, forming or using tables, graphs, or diagrams to establish and describe information.	Show documents in a meaningful pattern, diagrams, make table of data, collect, put together, gather interpret data, organize data, and explain data by using graphs.
	Making Models.	Making an illustrative, printed or physical demonstration to explain an event, idea, or object.	Model about the idea, picture, graph, diagram, phenomena, objects.

2.4.2. Coding units of analysis

According to Krippendorff (2004), coding units are units that are distinguished for separate description, transcription, and recording or coding. Units are entities that experts identify and treat as autonomous elements. For a meaningful outcome, the objects that counted must be dissimilar. For example, it makes it logical to count words or sentences but not the manuscript. When it is possible to make a variation between meanings and ensure that one does not depend on another, they are also countable. Units are aspects of a text that convey messages to the reader consisting of complete paragraphs, questions, figures with captions, tables with captions, and each complete step of an activity. Each of these text parts served as a unit of analysis (Chiappetta, Fillman, & Sethna, 2004). In the preparation of the coding unit, it was necessary to consider each text conveyed a message addressing science process skills. The units of the content analysis in the present grade nine textbook included complete paragraphs, each complete step of an activity, tables with captions, figures with captions, and a box that says "Did you know"?. Before the analysis began, the researchers read the textbook many times to get familiar with the material. In addition to familiarization with the content of each chapter, the researcher made a tally for the appropriate behavior category of SPS indicators in each chapter according to the developed coding units (for example, AC, PA, FG.). Then, sum up these tallies in each chapter and a coding unit of the textbook. The total number of tallies is then divided by the total number of SPS in the textbook and expressed as a percentage in interpreting the results.

2.5 Data Analysis

Data analysis is the process of systematically searching and arranging all data collected for the study in a meaningful way Bogdan & Biklen, (1998). In this study, the analysis of the inclusion of science process skills was on the grade nine biology textbook published by the Ministry of Education. The results were presented with percentages to show the frequency of each skill in the textbook. This categorical quantitative analysis was necessary to calculate and compare the frequencies of skills, grouped into meaningful categories (basic and integrated).

2.5.1 Obtaining the document

The soft copy of the grade nine Ethiopian Biology textbook was downloaded from the internet and then read chapter by chapter.

3. Results and Discussion

This section is composed of three parts following the research problems. The first part presented the presentation of SPS in the different coding units of the textbook. The second part presented the findings related to the first research question-which basic and integrated science process skills are included in the Ethiopian grade nine biology textbook?. The third part responded to research question two- to what extent are basic and integrated science process skills integrated into the grade nine biology textbook? The grade nine biology textbook contains six chapters. The textbook consists of many parts in each unit which shows the inclusion of SPS in the text. Table 2 showed some of these parts with the explanations translated from the textbook.

Table 2: Parts of the biology textbook that shows the presence of SPS

Name of Parts/coding units/	Explanations in Textbook
Activity	Students are involved in discovering the intended information by themselves, utilizing supplied tools and devices
Did You Know This?	It supplies principles and necessary information about learned subjects.
Table	Students are given data in table form to intended information by themselves based on it.
figure	Generalized ideas are given to the students to get the concepts.
Paragraph	Some sentences express the main idea of the text.

3.1 Distribution of Science Process Skills in the parts/coding units/ of grade nine biology textbook

In content analysis attempts of the textbook, to determine which part of the textbook includes SPS, some parts of the book considered to determine which part of the textbook consists of SPS. Table 3 shows the distribution of SPS among the sections of the book. In the table, the first main row show textbook parts; the second main row represents the distribution of skills in each part, and the third main row shows the total number of SPS in each section with the respective percentages. As Table 3 shows, most of the science process skills are included in the figures part (36.68%) and the activity (29%) parts of the textbook. However, in Ethiopia, the practice of this type of inclusion of SPS in the activity parts of the biology textbook seems dangerous. Because, as the researcher's working experience as a biology teacher confirmed, most of the biology laboratories in Ethiopia have a shortage of laboratory facilities-like laboratory chemicals, and apparatuses to do all the experimental activities included in the textbook. So, the SPS included in the activity parts of the Ethiopian grade nine biology textbooks cannot be addressed to the students as intended. As a result, the Ethiopian school students may not practice the included skills.

Generally, the percentage of each SPS from the total 169 SPS is shown below in figure 1.

3.1 The level of inclusion of basic and integrated Science Process Skills

3.1.1 The level of inclusion of basic Science Process Skills

Table 4 presents the frequency distribution of basic SPS in each chapter of the 9th-grade biology textbook published by the Minister of education. The names of chapters are in the first main row with their abbreviations. The frequency distributions of SPS per chapter are given in the second main row. The total number of each basic SPS is in the last column, and its percentage from the total of 127 basic SPS presented under the bottom line and the final main row of the table shows the total percentage of basic SPS from the total of 169 SPS in the textbook.

Table 3: Distribution of SPS in the parts/ coding units/ of the 9th grade biology textbook

		AC	DK	TB	FG	PA	Total	percentage % (n=169)
SPS name	Observ.	22	0	0	2	1	25	14.79%
	Inferi	6	5	7	41	0	59	34.91%
	Measu	4	11	1	1	0	17	10.05%
	Classi.	5	0	5	4	2	16	9.46%
	Sc. Com.	8	0	0	0	2	10	5.91%
	Predi.	0	0	0	0	0	0	0%
	Hypote.	0	0	0	0	0	0	0%
	Experi.	0	5	11	3	0	19	11.24%
	Model	4	1	0	9	3	17	10.05%
	Col.Int. Da	0	1	3	2	0	6	3.55%
	Dfi.Con.Va	0	0	0	0	0	0	0%
Total%(n =169)		49 (29%)	23 (13.6%)	27 (15.9%)	62 (36.68%)	8 (4.73%)	169 (100%)	100%

(Sc. Com.: Scientific Communicating, Inferi.: Inferring, Dfi.Con.Va.: Defining-Controlling Variables, Experi..: Experimenting, Observ.: Observing, Hypote.: Hypothesizing, Model.: Modeling, Measu.: Measuring, Classi.: Classifying, Predi.: Predicting, Col. Int. Da.: Collecting Interpreting Data. AC: Activity, PA: Paragraph, FG: Figure, TB: Table, DK: Did You Know?).

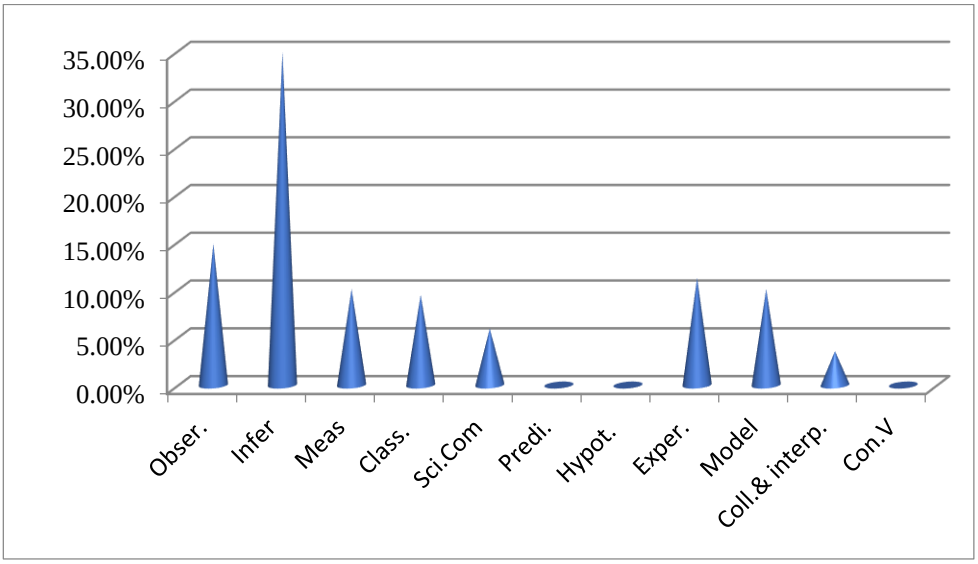


Figure 1: Percentage of each SPS from the total 169 SPS in the textbook

Table 4: Frequency distribution of basic SPS in the grade nine biology textbook

SPS type		Chapters BaT	CB	HbaH	MoaD	CLA	ENV	Total	% (n=127)
Basic SPS	Observ.	6	0	3	2	14	0	25	19.68%
	Infer.	2	9	21	15	3	9	59	46.45%
	Measu.	1	0	8	1	0	7	17	13.38%
	Classi.	1	0	5	0	10	0	16	12.59%
	Sc. Com.	4	0	0	5	0	1	10	7.87%
	Predi.	0	0	0	0	0	0	0	0%
Total % (n=169)								127(75.4%)	

(Classi.: Classifying, Observ.: Observing, Inferi.: Inferring, Sc. Com.: Scientific Communicating, Predi.: Predicting and Measu: Measuring, BaT: Biology and technology, CB: Cell biology, HbaH: Human biology and health, MoaD: Micro-organisms and disease, CLA: Classification and ENV: Environment).

As shown in Table 3, there were 169 SPS in all parts /coding units of the textbook. From this total number, basic science process skills are highly emphasized competencies (127 (75.4%)) as shown in Table 4. From the total of 127(100%) basic SPS in the text, (46.45%) of this skill was inferring, the highly included basic SPS, next to it, observation (19.68%) is the second basic skill. In addition, the book included measuring (13.38%), classification (12.59%), and Scientific Communicating (7.87%). However, there was no chapter in the textbook which shows the inclusion of the prediction SPS indicator. Inferring SPS is frequently involved in Human biology and health (HbaH) chapter. For example, it has been in the information observed in the figure below. The figure discloses an idea about -what scientists do to know the compatibility of the blood group of someone by doing experiments before blood donation action decision. So by looking at this figure, students can conclude that, before blood reception and donating action, blood groups of the individual must checked whether or not it is compatible by doing tests in the laboratories, otherwise blood coagulation will result as shown in the given figure (figure 3.57, (p.114)).

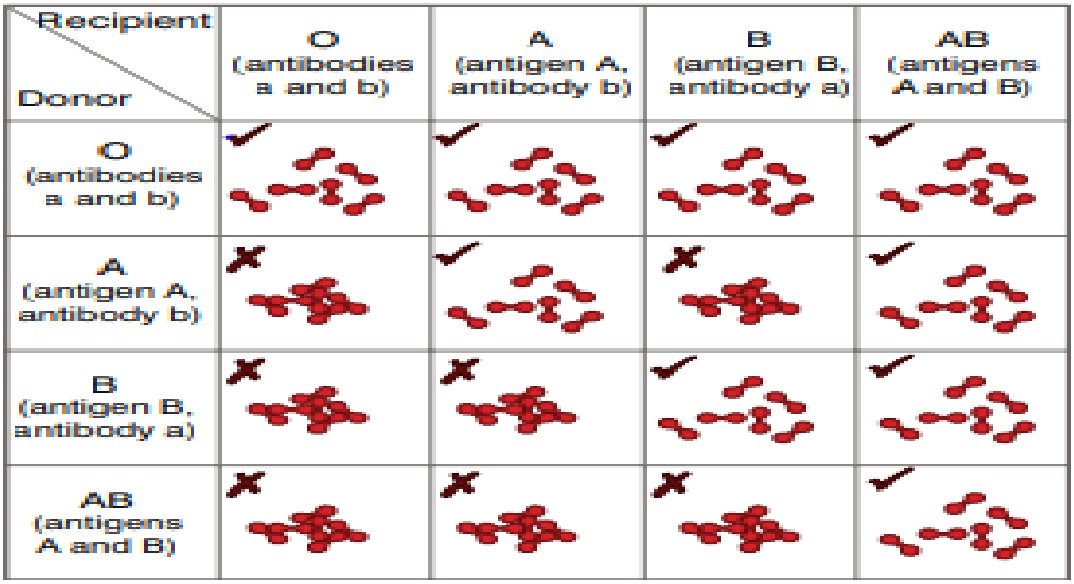
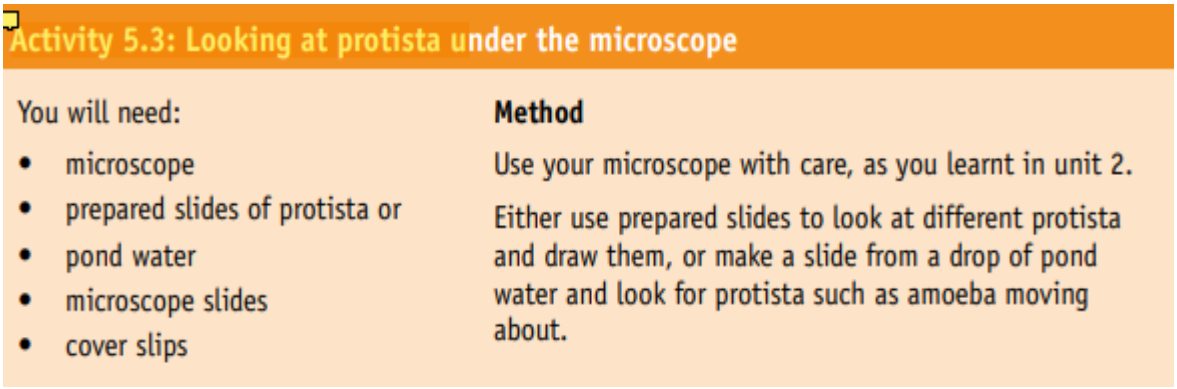


Figure 3.57: The compatibility of the different blood groups (Source: The grade nine biology textbook)

Observing is the second skill highly covered in the textbook. According to Table 4, observing skill covers (19.68%) of the total basic SPS in the text. This skill is mostly included in the 5th chapter (Classification chapter) (CLA), it is mentioned in this chapter in the coding units mostly in activities. For example, the activity given for students (page 177, activity 5.3), asks students to observe the different groups of protista like amoeba and their movement. The presence of this type of activities enables students to use their sense organs in ordered to get scientific evidence about the nature of different organisms and other things in their surroundings.

Generally, as Table 4 shows, inferring, observing, measuring, and classifying skills are the included basic skills. However, predicting basic science process skills did not found in the textbook.



Activity 5.3: Looking at protista under the microscope

You will need:

- microscope
- prepared slides of protista or
- pond water
- microscope slides
- cover slips

Method

Use your microscope with care, as you learnt in unit 2.

Either use prepared slides to look at different protista and draw them, or make a slide from a drop of pond water and look for protista such as amoeba moving about.

3.1.2 The level of inclusion of integrated Science Process Skills

Table 5 presents the frequency distribution of integrated SPS in the chapters of the grade nine Biology textbook published by the Minister of education. In the first main row, the names of the chapters place with their abbreviations. The frequency distributions of integrated SPS per the respective chapters were in the second main row. The total number of each integrated SPS and its percentage from the total, 42 integrated SPS were also presented under the last two columns

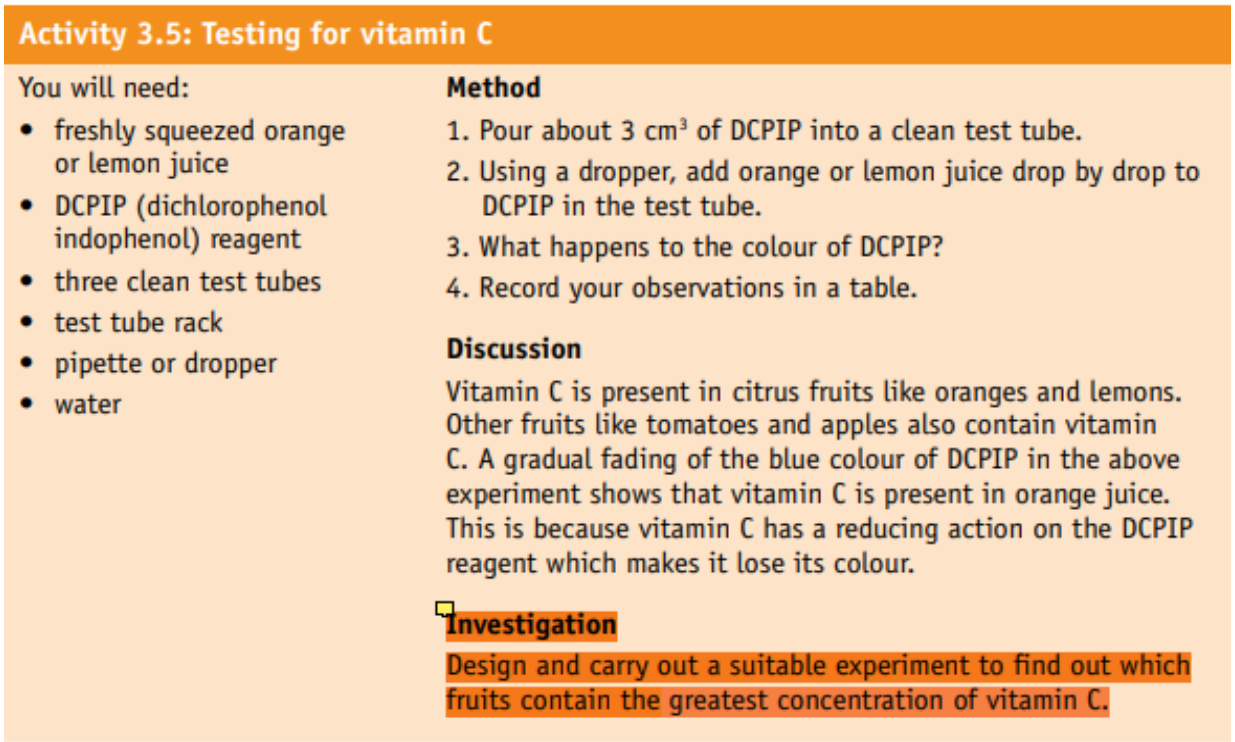
respectively. The final main row of the table shows the total number of integrated SPS from the total of 169 SPS in the text.

Table 5: Frequency distribution of the integrated SPS in the grade nine biology textbook chapters

	Name	BaT	CB	HbaH	MoaD	CLA	ENV	Total	%(n=42)
Integrated SPS	Hypot.	0	0	0	0	0	0	0	0%
	Exper.	0	6	9	1	0	1	19	45.23%
	Model	0	6	9	1	0	1	17	40.47%
	Col.Int.D	0	1	3	2	0	0	6	14.28%
	Dfn.Cnt.V	0	0	0	0	0	0	0	0%
Total								42	
%(n=169)								(24.86%)	

(BaT: Biology and technology, CB: Cell biology, HbaH: Human biology and health, MoaD: "Micro-organisms and disease, CLA: "Classification" ENV: Environment, Col. Int. D.: Collecting-Interpreting Data, Hypot: Hypothesizing, Model: Modelling. Exper: Experimenting).

In the inclusions of integrated SPS in grade nine biology textbooks, as Table 5 shows, there were 42 integrated SPS in the text. From the total of 42 integrated SPS, experimenting skill 19 (45.23%) was highly included integrated skill in the coding unit of activities, next to this -modeling 17(40.47%) was also included frequently in chapter 3, especially in different figures, and the third integrated SPS included in this textbook was collecting and interpreting data 6 (14.23%). However, hypothesizing and defining and controlling variables were not found in this textbook. Experimenting is a synthesis of all other SPS involved in some activities. However, there is a difference between following the steps of an experiment and designing an experiment. This activity shown below coded as experimenting gives the steps and expects students to conduct the experiment step by step. Here is the example of activity (Activity 3.5) that shows the inclusion of the experimenting skill in the textbook.



Activity 3.5: Testing for vitamin C

You will need:

- freshly squeezed orange or lemon juice
- DCPIP (dichlorophenol indophenol) reagent
- three clean test tubes
- test tube rack
- pipette or dropper
- water

Method

1. Pour about 3 cm^3 of DCPIP into a clean test tube.
2. Using a dropper, add orange or lemon juice drop by drop to DCPIP in the test tube.
3. What happens to the colour of DCPIP?
4. Record your observations in a table.

Discussion

Vitamin C is present in citrus fruits like oranges and lemons. Other fruits like tomatoes and apples also contain vitamin C. A gradual fading of the blue colour of DCPIP in the above experiment shows that vitamin C is present in orange juice. This is because vitamin C has a reducing action on the DCPIP reagent which makes it lose its colour.

Investigation

Design and carry out a suitable experiment to find out which fruits contain the greatest concentration of vitamin C.

Source: Ethiopian Grade Nine Biology Textbook, (p.63).

In addition, the inclusion of modeling SPS in the textbook can be clearly observed in the next figure, which is taken from Ethiopian grade nine biology textbook (p.37).

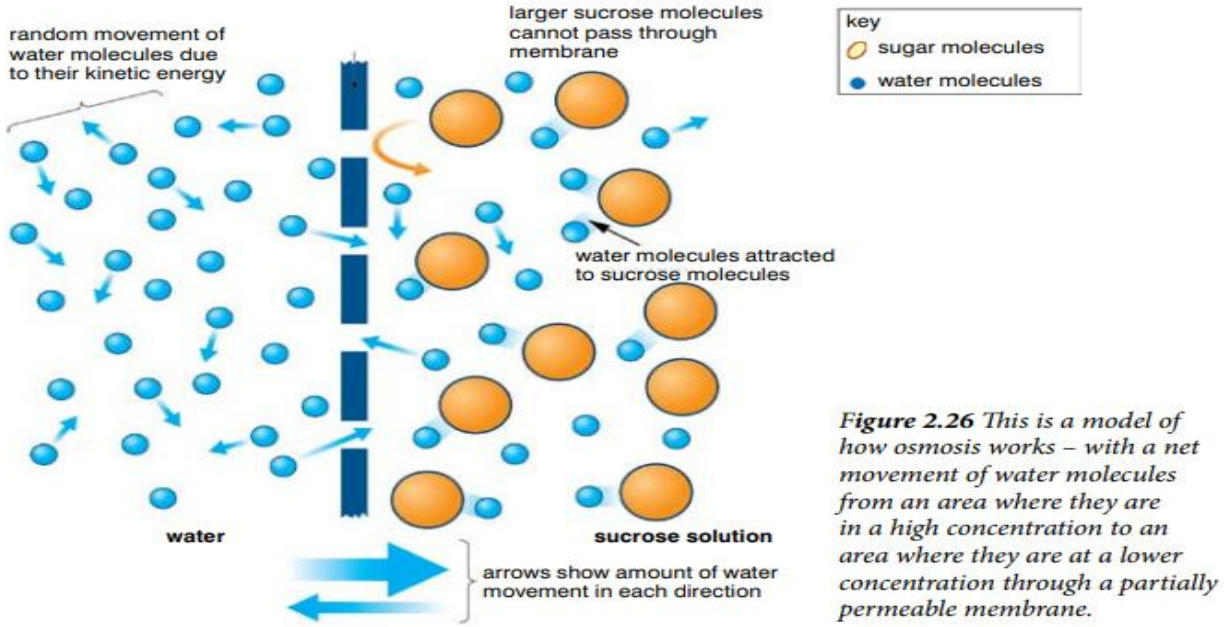


Figure 2.26 *This is a model of how osmosis works – with a net movement of water molecules from an area where they are in a high concentration to an area where they are at a lower concentration through a partially permeable membrane.*

Source: Ethiopian Grade Nine Biology Textbook, (p.37)

To sum up, the result of this analysis indicated that grade nine biology textbook highly includes more basic SPS (127 (75.14%)) than the integrated (42 (24.86%)) SPS. This finding is in line with the results of early researchers in the area. Samar and Zeina (2015), for example, found out 375 skills in the grade nine biology textbook (from these, 324 were basic skills and 51 integrated, and the rest 12 out (not clear to group them under basic or integrated SPS categories).

Generally, Figure 2 below represents the level of inclusion of basic and integrated skills in the Ethiopian grade nine biology textbook.

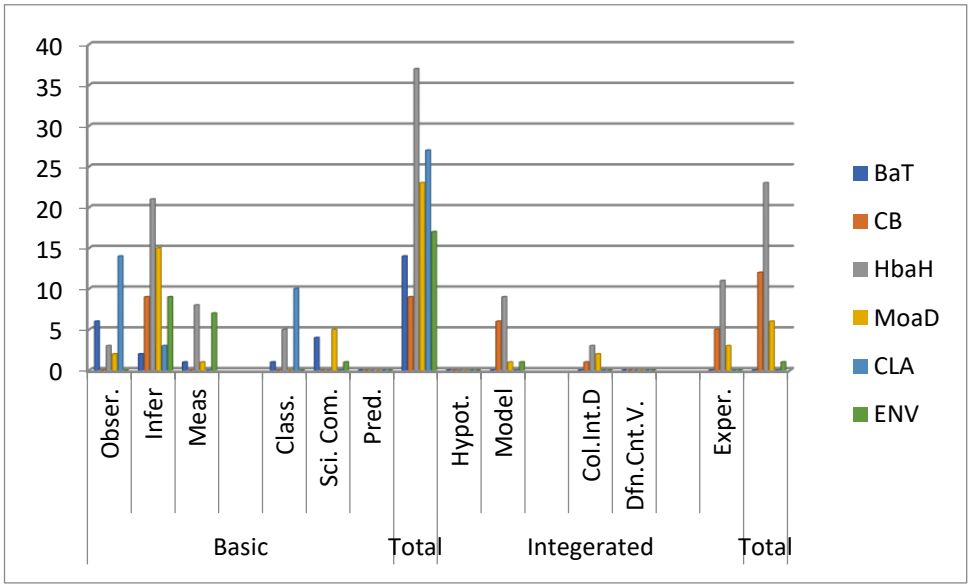


Figure 3.2: The level of inclusion of basic and integrated skills

3.2 Integration of basic and integrated SPS

The result of this content analysis indicated that the grade 9 biology textbook includes both basic and integrated SPS. However, they have a different proportion; the book highly includes basic science process skills 127 (75.14%) than the integrated 42 (24.86%) SPSs. In addition, this analysis showed that the textbook did not integrate the expected SPS like prediction, hypothesizing, and controlling variables in the activity parts of the different units that need these skills. It shows that the textbook did not include most integrated SPS indicators like identifying and controlling variables and hypothesizing skills. For example, activities in the textbook did not make students hypothesize or pose testable questions even though they are the starting points of science education.

Generating hypotheses is very important for students in developing science process skills; it is the first step in experimenting (Kwon, Jeong & Park, 2006). Scholars also stated that students develop a deeper understanding of concepts and skills when making their hypotheses. But, the activities in the present textbook seldom provided opportunities for students to observe, measure, infer and write a report for the given procedural activity. However, the activities could include making hypotheses as a step in the activities, similar to making predictions before observing and measuring steps in activities. The results of this study indicated that the grade nine biology textbook is highly structured; in that: it provided step-wise detailed instructions in the activities. The following three components made up the activities: equipment, procedure, and conclusion. The beginning part of the textbook gave the equipment required for the activity in detail; then asked students to follow well-defined steps to attain the goals of activities in the procedure part. In the conclusion part of the activities, there were questions asking students to make inferences or interpretations according to observations, measurements, or calculations. Therefore, most of the activities reviewed asked students to follow the steps and use the given equipment to attain a conclusion. Generally, it asked students to manipulate materials, make observations and measurements, record results, make qualitative and quantitative relationships, draw conclusions, make inferences and generalizations, interpret the results, and share what they found in the activities. The present result, having a highly structured textbook, is consistent with the literature in science education (e.g., Germann, Hasking, & Auls, 1996; Soyibo, 1998; Tamir & Lunetta; as cited in Hanauer, Hatfull, Jacob-Sera, 2009). Investigated that; activities including step-by-step procedures whose result is already known and, therefore, do not truly develop the students' SPS (Solomon, 2014). So, it is possible to conclude that: the activities in the grade 9th Biology textbook did not much designed to develop SPS. To the poor representation of SPS in the activities, it is possible to propose modifying the step-by-step procedure of activities to promote the SPS of the students. In this regard, according to Soyibo (1998), it is suggested that the activities in the textbook should enhance open-ended investigation to facilitate the development of SPS. The more involvement the students in observing, measuring, designing experiments, hypothesizing, and so on, the higher the level of process skills included. The lower level of process skills is characterized by: activities with directions like step-by-step procedures. The activities in this textbook provided explanations, detailed steps, and crude exercise that gave little space for the students' higher-order thinking. Wang (1998), for example, explained this situation as it is almost a dumb-down strategy that merely betrays the fear that students will not get it, but the result is that it leaves no space for the students to grow. The students' abilities of imagination and creativity can mute by the hand-feeding fashion of presentation of learning materials (p.143). Moreover, the activities in the textbook are mostly hands-on. However, being so structured is an obstacle to developing the learners' skills. Instead of completing exercises from a chapter in the textbook, students need to solve daily life problems by themselves. The present finding was near to Jablon's (1992), finding which stated that the textbooks do not allow the students to do active research because they do not completely integrate those techniques; so, the experimental activities appear to be like a cook-book. According to scholars like Akgün, Özden, Çinici, Aslan, and Berber (2014), we shall follow the gradual approach of SPS provision, i.e., the type and nature of SPS may depend on grade level. It is also true for the present biology textbook organization. Because primary school biology students' textbooks should include basic process skills, middle and upper secondary school students intended to attain integrated process skills (Akgün et al., 2014). So, the present result showed that this textbook did not integrate some of the required integrated science process skills like making a hypothesis and collecting and interpreting data, and one of the basic SPS (i.e., Predicting).

4. Conclusion and Recommendations

4.1 Conclusion

The present analysis revealed that a high emphasis in the textbook was on some skills mostly, for the basic ones like inferring, observing, measuring, and classifying (basic SPS). Also, it included some integrated SPS like experimenting, modeling, and collecting and interpreting data skills in different parts of the textbook. However, the text did not include predicting (basic SPS) and hypothesizing and controlling variables (integrated SPS) skills. So the integeration of basic and integrated skills was not proportional in this textbook. In addition, this grade nine biology textbook was highly structured; it included SPS in step-by-step activity procedures. However, step-by-step procedures in activities are weak to develop SPS. In addition to this, figures and activities of the textbook included most of the SPS in this textbook. In the Ethiopian school's context, most of the time, the activities included in the biology textbook cannot be experimented with due to different reasons. One of which is the lack of laboratory facilities. Therefore, addressing the SPS included in the activity part of the textbook becomes difficult.

4.2 Recommendation

From the concluding remarks made above,

- It seems necessary that textbook writers include basic and integrated skills in different parts of the textbook-like in paragraphs, tables, and figures of the textbook in addition to the activities parts. They are also required to provide ill-structured activities to enhance students' SPS.
- As science educators have recommended, the fact that: types of SPS provision may depend on grade levels; for example, middle and upper secondary school students intended to attain integrated process skills. Due to this, the curriculum designers should pay more attention to the inclusion and the diversification of the science process skills enabling students to be prone to creativity, problem-solving, and reflective thinking. To this end, more emphasis should be placed on skills such as prediction, designing experiments, formulating hypotheses, interpreting data, and controlling variables.
- Regarding curricula and textbooks, the new national science curricula and the way the skills represented in the text should consider science process skills as the building blocks to construct science tasks.

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