ASSESSMENT OF CURRENT CHEMISTRY LABORATORY STATUS AND PRACTICES OF SECONDARY SCHOOLS IN FINOTE SELAM TOWN

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ABSTRACT

This research paper aimed to assess the practice, facilities, and effectiveness of practical work in Damot secondary school. The research was designed to narrate laboratory facilities (equipment and chemicals) and laboratory practice of Damot secondary schools and effectiveness of laboratory activities incorporated in grade twelve chemistry textbooks. Qualitative research method with thematic narration design were used to assess laboratory equipment availability and laboratory practice in Damot secondary schools and effectiveness of laboratory tasks incorporated in grade twelve chemistry textbook. In this study qualitative research approach was used to collect the relevant data. Qualitative data was collected through deep interpretive analysis of observed data, data from document analysis and data from the focus group discussion and data from the check list also used to examine meanings, themes and patterns of the laboratory task incorporated in the textbook during content analysis. Damot secondary school was moderately equipped in physical facilities, chemicals, equipment and other inputs. But the teachers who taught there have poor performance in implementing experimental works in laboratory. The assessment method, absence of specified laboratory technician, time allotment etc. make teachers, students, and administrators to highly focused in the theoretical aspect of the subject not on the practical aspect of the subject. Due to time allotment, class size and absence of laboratory technician teachers were forced to show laboratory activities in the form of demonstration instead of students practice on the task. Teachers lack commitment/interest and even skill to conduct laboratory activities in the laboratory. In addition, school administrator never supervises, organizes, and facilitates teachers and students to conduct experimental works there. *[African Journal of Chemical Education—AJCE 13(1), January 2023]*

INTRODUCTION

Background of the Study

Science education is frequently perceived to be of great importance because of its links to technology and industry, hence at national perspective may be areas with high priority for development. Consequently, science is included as a core element in elementary and secondary levels despite conceptual complexity and high cost of implementation. Another justification for the inclusion of science in school curricula is that all citizens need to achieve a degree of "scientific literacy" to enable them to participate effectively as citizens in modern societies. Chemistry, as an upper-secondary school subject, should aim to supply students with chemical literacy and chemical culture, to cultivate higher-order cognitive skills (critical thinking, problem solving, evaluative thinking and decision making) [1], and to be a useful, interesting, and enjoyable subject. As [2], chemical literacy may be practical or functional literacy which refers to the ability of a person to function normally in his/her daily life as a consumer of chemical and technological products, such as food, health, and shelter. Civic literacy refers to the ability of a person to participate wisely in a social debate concerning chemical and technologically related issues. Finally, cultural or ideal literacy refers to appreciation of the chemical endeavor, and the perception of science as a major intellectual activity.

Studying chemistry provides students not only with specific concepts and theories in chemistry, but also with tools, confidence and attitudes for constructing their future prosperous

society. Besides learning to think effectively and efficiently, students come to understand how chemistry deals with daily and routine lives of theirs and theirs and people at large. Students are also expected to realize the changing power of chemistry and its significance nationally as well as internationally.

Practical work has been defined as an experiment performed by the teacher and students for demonstrations, or series of experiments and observational exercises carried out by the students to relate theoretical knowledge with practical activities done in the laboratory, classroom, field or elsewhere [3].

The use of laboratory method of teaching science has become a dogma among science educators and teachers. On the one hand, they extolled the importance of the use of the laboratory method in science teaching while on the other hand, they only pay "lip service" to its use in practice. Science teachers do not usually find it convenient to make laboratory work as the center of their instruction. They usually complain on lack of availability of facilities like laboratory room, equipment, apparatus, and chemicals available to conduct experiments. they also complain on the time allotment, large class size, weekly working load, and curriculum design to carry out practical work. At the same time, it is possible that some of these materials and equipment may be locked up in the school laboratory store without teachers being aware of their existence. The conditions under which many teachers' functions do not engender any enthusiasm to use the laboratory method of teaching science even where they know that these materials and equipment are available.

As [4] described most of secondary as well as preparatory schools in Ethiopia and other countries in the world faced different problems that can hinder performing experiments and any practical activities as practical works in chemistry in particular and in science in general. Preparatory Science laboratory need to fulfill supplies, equipment and reagents. These facilities for science laboratory are paramount important for continuous and enormous range of experimentation, adjustment of apparatus, demonstration and laboratory equipment and supplies for on-going projects. It also requires enough space for storage and supplies as well as adequate electrical & water services, library resources like laboratory manuals, suitable demonstration desks, good ventilation and arrangement of the room.

As [5] described "laboratory conducted by students has long been considered the hallmark, the unique feature of science education. Science students should be taught for at least part of the time in the laboratory classes, students laboratory work is the method of choice for teaching technical skills and increasing understanding of the apparatus involved. Students' laboratory work can also be effective in teaching application of scientific knowledge and principles."

As most scholars in the field explained that the efficiency of practical work in science teaching is impaired not only by a critical shortage of well-trained science teachers but also by a variety of other factors such as: Insufficient laboratory facilities, lack of skilled laboratory technicians, the over loaded laboratory time tables, lack of time in some schools, too large class size for practical work.

As [4] revealed practical work can't be taken place without having the necessary equipment, apparatus and reagents in the school laboratory. Because of this student will have few or no exposure to practical activities and that is why they become confused, how to conduct practical activities and operating equipment as a college and university student when they completed preparatory or secondary school and have joined universities and colleges. Therefore, lack of materials and other facilities highly restrict students to perform practical works in the laboratory and demonstrations and other practical activities in the classroom or in the field.

As [6] declared that when the curriculum is designed depending on the education policy of the country, especially for science subjects, practical works like experiments, investigations, and demonstrations are included in the syllabus of each subject and grade level in order to achieve the desired goals of the subjects. MOE proposed that the expense of providing laboratories and equipment is a fundamental constraint on effective science teaching and the emphasis on the new science teaching programs on practical work for students has manifested this challenge for the developing countries.

As [4] explained, it is assumed that number of students per class should be limited and manageable by the teacher in order to follow and check up every activity that the teacher teaches and disseminates to the students. This becomes more essential for science teaching and to carry out practical activities as planned by the teacher when the number of students per class is manageable. So, to make effective demonstration in the class and carrying out experiments in the laboratory the

students must be grouped in small number and the chance of each student to involve in the practical activity will be high and the students will gain more exposure and experience sharing. On the other hand, as the number of students increases the opportunity of each student to participate in the group becomes low.

As [4] described

> *"the assessment strategies practiced in the school play a great role in enhancing the practical work performed in science courses. Practical examinations are one of the main factors influencing, the importance to which experimentation is put in science teaching. Technique, attention and accuracy, lay out of results, estimation of error and above all, 'getting the right answer' were the factors commonly rated in the making of candidates' work of practical examinations. Without an examination a serious neglect of practical work can occur."*

Statement of the Problem

Regarding the importance of laboratory work in natural science, [2] has compared as "a fish can't survive without water and likewise teaching science that does not support with practical activities is incomplete and science students are not fully trained." So, learning by doing can be achieved only by conducting experiments.

Higher institutions in Nigeria charged with the responsibility of training science teachers at all levels, are increasingly turning out teachers without requisite laboratory experience. A common reason usually given is shortage of laboratory facilities. Such trained science teachers usually lack the necessary confidence to conduct practical classes with their students. It is only accreditation exercises that are improving this situation in Colleges of Education and Universities at present

Practical activities are essential in all levels of science education and in particular it is highly significant in senior secondary schools to help students in internalizing and understanding the theoretical knowledge of science fields such as Chemistry, Biology and Physics. The natural science core subject at the secondary level (grades 9-10) becomes distinctly differentiated as Biology, Chemistry and Physics.

According to [7] the cause of mass failure of students in secondary school chemistry examination includes teacher's methodology, structuring of the curriculum, the concentration of examination questions on few topics and the inability of the students to perform enough practical before their examination. Practical work is an inquiry and hands on activity which makes it possible to transfer knowledge on higher order cognitive levels and create curiosity in students' mind. But in reality, in different schools due to different reasons teachers are teach chemistry, simply using usual presentations method as a chemistry teaching method.

According to [8] foundation "if students are given a chance and ample time, they can design and modify their own experiment, meeting challenges as well as fruitful results, try things out with

a careful eye and ready mind as any professional scientists do. They need this personal experience for that they need time and encouragement, but not too much detailed orders and instructions or precautions, since they need to feel that it is their own experiment and to learn by their mistakes as well as their success."

There should be a regular and effective implementation of practical work in senior secondary schools to bring science teaching at a standard level with better understanding and greater achievement of students. However, degree of implementation of practical activities and availability of laboratory equipment, availability of physical facilities, availability chemicals etc are differed from school to school.

As one of the authors was at Finote Selam teacher's college before, the author got an opportunity to deal with chemistry subject teachers and with school principals, on how can conduct a chemistry laboratory activity as the level or standard expected and one of the author observed and assess the real situation of chemistry laboratory practice in Damot secondary school. And even though laboratory has been given a central and distinctive role in science education, there is no study conducted on the assessment chemistry laboratory status and practices of secondary schools in Finote selam Town. These serous issues initiate the author to conduct this research.

Research Questions

This research has been guided by the following research questions.

1. Are there sufficient facilities for carrying out chemistry practical works in Damot secondary school?
2. Is there sufficient laboratory practice in Damot secondary school?
3. Are laboratory tasks incorporated in grade twelve chemistry textbook are relevance?
4. What is the effectiveness of laboratory activities incorporated in grade twelve chemistry textbook?

Objective of the Study

The specific objectives of the research were:

1. To assess the status of laboratory facilities in Damot secondary school
2. To assess status of laboratory practice in Damot secondary school
3. To assess the relevancy of laboratory tasks incorporated in grade twelve chemistry textbook
4. To assess the effectiveness of laboratory tasks incorporated in to grade twelve chemistry textbook.

Significance of the Research

This research is significant in:

- Providing insight for policy makers, developers, and school administrators about the status of their school basic laboratory facilities.
- Providing insight for policy makers, developers, school administrators and teachers about the status of implementation of practical activities.
- Inspiring teachers, policy makers, developers & students to aware the relevance of laboratory tasks.
- Providing insight for policy makers, developers, teachers and students about the effectiveness of grade twelve laboratory tasks.

METHODOLOGY OF THE RESEARCH

This study aimed at assessing laboratory facilities (equipment and chemicals) and laboratory practice of Damot secondary schools, relevancy and effectiveness of laboratory activities incorporated in grade twelve chemistry textbooks. With this in mind, this section encompasses the methodological aspects such as research design, the research method, sample and sampling procedure, data gathering instruments, data collection and data analysis technique of the study.

Research Design

The research was designed to narrate laboratory facilities (equipment and chemicals) and laboratory practice of Damot secondary schools, relevancy and effectiveness of laboratory activities incorporated in grade twelve chemistry textbooks. Qualitative research method with thematic narration design were used to assess laboratory equipment availability and laboratory practice in Damot secondary schools and relevancy and effectiveness of laboratory tasks incorporated in grade twelve chemistry textbook.

Research Method

In this study qualitative research approach (method) was used to collect the relevant data. qualitative data was collected through deep interpretive analysis of observed data, data from document analysis and data from the focus group discussion and data from the check list also used to examine meanings, themes and patterns of the laboratory task incorporated in the textbook during content analysis.

Sampling Techniques

The population of the study was all-natural science students, all chemistry teachers and all demonstrative staffs. in those selected schools.

To assess the current laboratory practice & laboratory status of secondary schools (9-12), Past discussion opportunity about the issue while I was at college and thinking as grade twelve is the last preparatory level for higher education entrance, make me to select Damot secondary schools in general and grade twelve chemistry in particular purposefully.

Among 8 chemistry teachers, as one teacher was a zone animator and since he was responsible to the laboratory, to get relevant data he was selected as a data source using purposive sampling method. besides, all three administrative leaders were selected using comprehensive sampling method and three students were selected randomly. A total of four sample were used as a data source.

Data Collection Instruments

To assess the practice and laboratory status in Damot secondary school and to answer the intended research questions; observation, focus group discussions and document analysis were used as data collecting instruments. And to assess relevancy and effectiveness of laboratory tasks incorporated in grade twelve chemistry textbook and to answer the basic research questions; data find from incorporated laboratory tasks using content analysis was used. Further to assess the effectiveness of laboratory tasks incorporated in grade twelve chemistry textbook, all fourteen laboratory tasks were assessed and checked through a chick list. The standard chick list that used to assess the effectiveness of grade twelve chemistry lab tasks were adopted from [9]

Data Analysis Technique

As the research follows a qualitative research approach, qualitative data analysis techniques were employed. To assess the practice and laboratory status in Damot secondary school and to answer the intended research questions, data collected through observation, focus group discussions and document analysis data collecting instruments, and to assess relevancy and effectiveness of laboratory tasks incorporated in grade twelve chemistry textbook and to answer the basic research questions collected qualitative data were analyzed using thematic narrative analysis technique.

ANALYSIS AND INTERPRETATION OF RESULTS

The data obtained from observation, focus group discussion and document analysis was used to answer the research question through the following briefed listed questions.

To assess the availability of facilities in Damot secondary school, the following points (physical facilities; availability of chemicals & reagents; laboratory apparatus and instruments) were considered; from observation and focus group discussion, the following findings were formulated.

Physical Facilities: laboratory room, electric system in laboratory room, water system in laboratory room, is isolated bench to each student during laboratory activities, black a white board etc. at Damot secondary school, there is a chemistry laboratory room which function for around 2000 (33 section) students. In each section there is about 60 students, and it is too much crowded to conduct

laboratory in the laboratory room. Besides the floor and windows are old enough, broken and scratched. Chemicals and reagents, apparatus, benches, and all in the laboratory rooms are exposed to dust and even for rain. As we know a laboratory room should be partitioned at least in to three room (chemical and apparatus store, preparation room and demonstration room) in line with this, the laboratory room in Damot secondary school was partitioned in to three parts-stores, demonstration room and chemical preparatory/pre demonstration rooms. Even if it is on and off there is a water and electric installation in the laboratory room. The problem here was, both water and electrical installation were not grounded, and it is not comfortable to the student during laboratory work even it is risk.

Another physical facility that the researchers interested was the presence of isolated bench in the laboratory. There are around 50 isolated new and standard benches around the laboratory table in the laboratory room, which is easy to move and manageable size. There is also white and blackboards in the laboratory room.

Availability of chemicals and reagents: There are some chemicals in the store, most of them are outdated. As the focal chemistry laboratory teacher most of laboratory activities were failed during the experiment but they are positive when they used chemicals from Finote Selam teachers' college. This is true even for chemicals that they get recently, and they feel un thrust on the distributer and the respected education sectors. The problem here is most teachers were refused and unable to

prepare solution with different concentration through dilution and other method. Chemicals in the laboratory room was tried to logically arrange using their properties. But the arrangements of chemicals were not that much fruitful due to the absence of responsible laboratory technician; teacher return chemicals after their experiments to improper position and due to insufficient shelf and partitioned class chemicals can be misplaced.

Laboratory apparatus and instruments: From the observation, and according to the focal person, most of instruments like thermometers, electronics beam balances, triple beam balance are not functioned. There are different sized and shaped test tube, beakers, measuring cylinders, long glassed tubes. Generally, laboratory apparatus in Damot secondary schools was sufficient but the problems here were a lot of test tubes, beakers, flasks etc were permanently contaminated with previous laboratory chemicals. Most teachers lack skill to prepare different sized and shaped glass tube. Most of long sized delivery tubes were finding as it were packed for a long period of time.

According to the school director and laboratory focal person, there is sacristy of chemicals and apparatus in the laboratory and most teachers lacked laboratory skill and they fright chemicals even. So, they advised higher institutions in general and chemistry departments in particular to

- Train students to perform laboratory activities, to arrange chemicals in logical order, to prepare chemicals from existing stock, and to prepare apparatus independently.

- Train teachers (short or long term) to perform laboratory activities, to arrange chemicals in logical order, to prepare chemicals from existing stock, and to prepare apparatus independently.
- To visit their laboratory activity and their laboratory room.

The types of laboratory experimentation commonly carried out in Damot secondary school as the laboratory focal person and from the researchers' observation were categorized under demonstration type. Most of the time after introducing the objective and theoretical aspect the daily laboratory activity, teacher showed laboratory activities for students practically. Sometimes the demonstration may be done by active students or group leaders. Even if there were procedure in the textbook, teachers tell and guide demonstrator students or group leaders to follow him and students in the group (8-10 students) observe what the group leader do. This is due to the crowdedness of laboratory room, unavailability of chemical, shortage of time (40 min and net less than 30').

In Damot secondary school, for each grade level, chemistry teachers prepared manual standing from students' textbook and regional animator chemistry manual. The existing manual was prepared by considering the existing school laboratory situation. Some laboratory activities were left from the textbook due to unavailability chemicals and apparatus in their laboratory and some other laboratory activities are added as a laboratory activity which are not yet designed in the textbook. The developed laboratory manuals incorporate more detailed and well-organized tasks. the beginning of the manual contains marking system (5% attendance, 15% laboratory report=20%),

submission date (submission date is always when student came to the next laboratory). As the animator and from researcher observation, even if most students (7-8 students) were not actively involved in the experiment few students were actively participated in the laboratory activity. They effectively follow the procedure on their manual, they weigh, they measure, they register their data and observation etc. and those students frequently call their teacher when they fell ambiguity.

Most of the chemicals and apparatus they used during their laboratory work are pre-determined and collected to the table by their teacher before students entered to their laboratory. Throughout their laboratory work teachers assist and guide students and, in some occasion, teacher allow active group students to demonstrate their laboratory works for other groups. As from students' laboratory report, some teachers marked student's laboratory reports and wrote constructive comments on their report.

As the animator, due to time scarcity and class size teachers have not got chance to assess or marke students higher thinking order cognitive, affective and psychomotor domains. The only assessment method that held by the teacher were assessing and marking of students group laboratory report. So, laboratory report was the only chance of the teacher to assesses his/her students. This laboratory report assessment mostly classified under lower cognitive assessment, besides the problem here was laboratory reports are only done by group leaders or even worst by other body.

Mostly laboratory tasks that need higher order cognitive (applications, analysis and evaluation), affective and psychomotor, like setup construction, preparation of solution, preparation of apparatus

are not allowed to the students to perform during their laboratory activities. Students' performance of the above types was not assessed by the teacher due to large size of students in a group and in the class and the time given to assess made those assessment to sub pressed. Even if teachers sometimes try to observe how students follow the procedure that they follow, teachers have no time to assess them.

According to the laboratory focal person, among nine chemistry teachers only three of them are interested in conducting laboratory with their students frequently but others six of them were not well in helping their students through conducting laboratory activities. And he concludes that as there was no separate time allotment for laboratory session, they have no extra time to conduct laboratory activities but most of them are good at theoretical teaching in their class.

In grade twelve old chemistry curriculums, there are 14 laboratory activities and chemistry teachers added other relevant chemistry laboratory activities standing on the manual developed by Amhara regional chemistry animators' group. But the total laboratory activities planned by Amhara regional laboratory animator for preparatory and secondary school were 21 laboratory activities. Those laboratory manuals are also in hand of each group representatives. From old grade twelve chemistry text, all the procedure and instructions were written for the students. But since most of grade twelve students or high school students are not skilled enough in in processing practical laboratories and to avoid risks in some cases teachers should be share some tasks specially at procedure which leads risk. As one of the researchers assessed, there is no phrase which allow

teachers to help their students. Even if the procedure lacks teacher involvement and teacher role, the procedure and instructions are written in a clear and concise forms.

From the observation and information given by the laboratory focal person there are some experiments which are proposed in grade twelve chemistry curriculum but no chemicals in Damot preparatory and secondary school to conduct the experiments. For instance, under experiment 1.2, investigating properties of some mixture, gentian violet and real bile, experiment 2.1, the buffer action of solution, PH meter as apparatus, experiment 6.1, synthesis of nylon, hexamethyl diamine and adipoyl chloride chemicals are not available in Damot preparatory and secondary school. Teachers were forced to ignore those experiment.

The relevance of listed laboratory activities was assessed by relating them to the topic that they are intended to. As our assessment, under experiment 1.5, preparation of solution of known concentration, students are asked to weigh 11.7 g of NaCl and mix it with 50 g of water, here there is no more clarity or checkup mechanism weather it is the intended concentration or not. This is not relevant to the topic instead it is relevant to skill of measuring masses. In experiment 1.6, preparation of solution of lower concentration from stock solution, students are allowed to carefully add 10ml of stock sulfuric acid to 50 ml of distilled water and asked them to calculate the new concentration and to justify weather there is a change in number of moles of the original and final solution. Here from the experiment, students have no chance to understand about the number of moles of the two

solutions without calculation. So, this experiment is not relevant, it is better to use animation or simulation to justify about number of moles of the two solutions.

As all know there in no separate time allotment for chemistry laboratory activities. As Ethiopian educational curriculum there are four period allotment per week with forty min duration. To your surprise these durations are totally addressed to the theoretical learning objectives. Then there is no time allotment for the laboratory sections and most teachers used one period for their laboratory task and some other teachers used their free time in opposite shift. The problem here is the laboratory room also busy at opposite shift. Then teachers are forced to use their period for laboratory activity. As most of chemistry teachers and focal person students wastes at least ten min to come and go to the laboratory room and they left only thirty min in the laboratory. This thirty min is not enough even for demonstration. And teachers are complaining to have a consecutive (80 min) in a week. Under experiment 1.2, investigating properties of some mixture, the procedure order students to wait the mixture for 30 min and under experiment 6.1, synthesis of nylon, students are allowed to follow six procedures and each procedure are asked them to measure chemicals. Those two experiments are long enough and cannot completed in a period.

According to [9] effectiveness of laboratory work can be assessed by considering the match between what students are intended to do in the task and what they actually do; and between what students are intended to learn from the task and what they actually learn. By determining the effectiveness of a lab task, it is also important to determine which aspects of the task design leads to

its effectiveness or non-effectiveness. To evaluate the effectiveness of grade twelve chemistry laboratory tasks, all fourteen laboratory tasks were assessed and checked through a chick list. The standard chick list that used to analyze the effectiveness of grade twelve chemistry lab tasks was adopted from [9].

The checklist describes the following aspects of the laboratory task:

A: The intended learning outcomes (learning objectives);

B: Key elements of the task design, including:

B1: the cognitive structure of the task

B2: the level and nature of student involvement

B3: the practical context of the task.

Some of those aspects of laboratory tasks can be sub categorized in to specific type of aspects that can be addressed to a specific laboratory task.

Learning objectives may be factual, or they may be higher order process type, and both of them were assessed.

Table 1: Aspect A: Intended learning objectives

To help students to…	**Tick one or more boxes**	
Content		
	Identify objectives & became familiar with them	
	Learn a fact	x
	Learn a concept	
	Learn a relationship	x
	Learn a theory	x
Process	Learn how to use a standard lab. Apparatus/instruments	x
	Learn how to carry out a standard procedure	x
	Learn how to plan an investigation to address a specific problem	x
	Learn how to process data	x
	Learn how to use data to support conclusion	x
	Learn how to communicate the result of lab work.	x

All laboratory tasks incorporated in each grade level secondary school chemistry curriculums were intended the students perform laboratory activities using the procedure designed in the textbook. And students are intended to answer the questions and to observe phenomena while they perform their lab, to record their observation and data, and to write reports using their data.

Table 2: Aspect B1: The cognitive structure of the task

B1. 1: What students are intended to do with objectives and observables? Tick one or more boxes		
Use	An observation or measuring instrument	**x**
	A laboratory device or arrangements	**x**
	A laboratory procedure	**x**
Present or display	An object	
Make	An object	
	A material	**x**
	An event occurs	**x**
Observe	An object	**x**
	A material	**x**
	An event	**x**
	A physical quantity	**x**
B1.2: what students are intended to do with ideas		**tick one or more boxes**
Report observations		**x**
Identify a pattern		**x**
Explore r/b	Objectives	**x**
	Physical quantities	**x**

	Objects & physical quantities	**x**
Discover a new concept (a physical quantity)		
Determine the value of a physical quantity (not measured directly)		**x**
Test a prediction	From a guess	
	From a law	**x**
	From a theory	**x**
Accounts for observation	in terms of a given law	**x**
	By proposing a law	
	By proposing a theory	
Choose b/n two or more given explanations		
B1.3: objectives-or ideas-driven?		**Tick one box**
What the students are intended to do with ideas a rise from what they are intended to do with objectives		**x**
What the students are intended to do with objectives arises from what they are intended to do with ideas		
There is no clear r/s b/n what the students are intended to do with objectives and with ideas		

Grade twelve students are intended to use objects and observables in observation or measuring instrument as

- ✓ A laboratory device or arrangements
- ✓ A laboratory procedure
- ✓ Present or display an object like setup to make a material (chemicals) and events like indicators.
- ✓ Students intended to observe and make object, materials and events also they intended to observe physical quantities and to determine it which is not measured directly.
- ✓ But the text suppressed invention and discovery of concepts.

Table 3: Aspect B2: level and nature of student involvement

For B2.1: 1, =specified by teachers, 2=decided by discussion 3=chosen by students

B2.1: Degree of openness/closure write 1, 2, and 3	
Question to be addressed	1
Equipment to be used	1
Procedure to be followed	1
Method of handling data collected	1
Interpretation of results	3
B2.2: Nature of student involvement	**tick one box**
Demonstrated by teacher; students observe	
Demonstrated by teacher; students observe and assist as directed	
Carried out by students in small group	x
Carried out by individual students	

As assessed, grade twelve chemistry textbook laboratory tasks incorporated in the text strict allowed students in the activity. But question to be addressed, equipment to be used, procedure to be followed were selected by teachers, and only interpretation of data was done by students and the laboratory activities were more intended to be done by small group. This type of laboratory activities was categorized under guided type enquiry.

Table 4: Aspect B3: The Practical Context

B.1: Duration of task	**Tick one box**
Very short (Less than 20 min)	
Short (say, up to 80 min)	x
Medium (2-3 science lessons)	
Long (2 weeks or more)	
B3.2: people with whom the student interacts	**tick one or more boxes**
Other students carrying out the same lab work	x
Other students who have already completed the task	x
Teacher	x
More advanced students (demonstrators, etc)	x
Others (technician, glassblower, etc)	
B3. 3: information sources available to the student	**tick one or more boxes**
Guiding worksheet	
Textbook	x
Handbook (data book)	x
Computerized database	
Other	
B3.4: types of apparatus involved	**tick one box**
Standard lab equipment	x
Standard lab equipment + inference to computer	
Every day equipment	
B3.5: source of data	**tick one box**
Real world: inside lab	x
Real world: outside lab	
Simulation on computer	
Video recording	
Text	
B3.6: tool available for processing data	**tick one or more boxes**
Manual calculation	x
computer	

Under practical context in high school chemistry curriculum students were allowed to perform lab activity in 40 min. in small group at maximum, but in reality, students have no chance to use even 30 min., this is because during curriculum development time of laboratory activities were not considered. The laboratory procedure also clearly designed but the subject of each task was not defined. Due to the absence of a lab technician in high school teachers and active/model students can demonstrate some laboratory demonstrations. during their lab textbooks and handbooks are their information sources and standard/purchased lab equipment are used their lab activity. Phenomena inside lab were students' data source and those data are allowed to process using manual calculations.

CONCLUSIONS

Based on major findings, the following conclusions were drawn:

- Damot secondary school was moderately equipped in physical facilities, chemicals, equipment, and other inputs. But the teachers who taught there have poor performance in implementing experimental works in laboratory.
- The assessment method, absence of specified laboratory technician, time allotment etc. make teachers, students, and administrators to highly focused in the theoretical aspect of the subject, not on the practical aspect of the subject

- The schoolteachers were not interested to use their knowledge, experiences, and good opportunities to work many practical works and brings teaching chemistry more tangible, attractive, and easy for their students.
- Due to time allotment, class size and absence of laboratory technician teachers were forced to show laboratory activities in the form of demonstration instead of students practice on the task.
- Teachers lack commitment/interest and even skill to conduct laboratory activities in the laboratory.
- In addition, school administrator never supervises, organizes and facilitates teachers and students to conduct experimental works there.

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