PRACTICES AND CHALLENGES OF ACTIVITIES FOR SUCCESSFUL PRACTICAL LAB WORK IN CHEMISTRY AT DEBRE MARKOS PREPARATORY SCHOOL, EAST GOJJAM, ETHIOPIA

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ABSTRACT

Chemistry is a field of study in which a lot of experimentation is involving. An experiment is a test carried out under controlled conditions to demonstrate a known truth, to examine validity of a hypothesis and to determine the efficacy of something new. Laboratory experience also gives students an opportunity to observe chemical systems and to gather data useful for the development of principles subsequently discussed in the textbook and in class. However, experimental work is a fundamental part of any science course and this is especially true for chemistry courses. It is vital to know that any one in chemistry should be able to conduct practical work effectively. This paper seeks to offer an overview of the current situation in higher education, and explores what might be the aims for today. It also argues that laboratory work in higher education cannot be seen in isolation. For most students it follows school laboratory experiences which are rapidly changing, and has to relate to material taught in lectures and tutorials. But, learning chemistry by doing practical work at Debre Markos higher education preparatory secondary school is not organized in such away. So, the researcher needs to conduct this study to explore all things that are happened there. The study employed in both qualitative and quantitative research approaches. The researcher used descriptive research strategy and data were collected by using questionnaire, interview, document analysis, FGD and observation. The sample size of this study is 221; 212 students and 8 teachers, the school administrator and the delegated lab technician were also considered. It was analyzed by percentage, mean value, t-test and one-way ANOVA by SPSS program version 20. The main challenges of DMHEPSS practical works were lack of teachers' interest and carelessness, lack of wise school administrator, lack of professional lab technician, lack of conducive lab environment were the main challenges that the researcher was discovered. Therefore; motivating and encouraging teachers, training teachers, creating awareness of students on practical works, employing professional lab technician and improving the attitudes of school administrator were solutions to be taken there. *[African Journal of Chemical Education—AJCE 11(1), January 2021]*

INRODUCTION

Background of the study

Chemistry is a field of study in which a lot of experimentation is involving. An experiment is a test carried out under controlled conditions to demonstrate a known truth, to examine validity of a hypothesis and to determine the efficacy of something new. A laboratory work can give rich learning experiences to students and acts as a bridge from the conceptual to the actual and from the molecular scale to the macro scale. Literatures show that the problem in lab work is that students do not academically prepare themselves for the laboratory work and presence of lab risks. The other problem is due to bulk number of students in lab, some individuals are restricted to be engaged in reviewing the literature, in deciding a suitable reading or observation by his/her interest[1]. In some cases they are not even aware with the objectives of the experiment[2].

However, experimental work is a fundamental part of any science course and this is especially true for chemistry courses[3]. For effective practical work, there are different activities to be carried out. The first activity for effective laboratory work is knowing the objective and principles before the actual lab is started[4]. Second use different guides containing different activities to be carried out in lab such as to organize learning resources [5]. The original reasons for its development lay in the need to produce skilled technicians for industry and highly competent workers for research laboratories [6]. This paper seeks to offer an overview of the current situation in higher education, and explores what might be the aims for today. It also argues that laboratory work in higher education cannot be seen in isolation. For most students it follows school laboratory experiences which are rapidly changing, and has to relate to material taught in lectures and tutorials. Together, these may enrich and enhance the whole laboratory experience, and enable it to contribute more effectively to the overall learning of students in chemistry.

But, learning chemistry by doing practical work at DebreMarkos higher education preparatory secondary school is not organized in such away. So, the researcher needs to conduct this study to explore all things that are happened there.

Statement of the problem

Science education is the developing of technologically literate citizens who understand how science, technology, and society influence one another and who are able to use this knowledge in their everyday activities. Several different types of laboratory-based teaching exist. By far the most common among these is the expository or 'recipe-style' laboratory class. Practical work has had a central and distinct role in chemistry education (from school to university) for more than a century. One of the features of chemistry as a subject in school or university is that it involves practical work in the laboratory. On the other hand, at secondary school or elsewhere practical works were not conducted in such a way. Especially at Debre markos higher education preparatory school practical laboratory works are in problem. That is why the researcher tries to conduct this research. Some of the issues that will be considered are:

- To assess each practices and challenges of laboratory works.
- To suggest how experimental activities were efficient and effective.
- To provide equivalent solutions how to organize the lab.
- To inform the management body and other stake holders about the status of chemistry laboratory.

In order to have detail, clear and comprehensive information, it would have been good if the study takes place at most throughout Ethiopia or in Amhara region and at least in East Gojjam zone higher education preparatory secondary school; however, to make the study manageable and to

complete the study within the time limit, it was restricted to Debre Markos higher education preparatory secondary school at East Gojjam zone.

RESEARCH METHODOLOGY

Research Design and setting samples

The main aims of the study was: to assess each practices and challenges of laboratory work, to suggest how experimental activities were efficient and effective, to provide equivalent solutions how to organize the lab; in chemicals, apparatuses and professional lab technician and to inform the management body and other stake holders how to support teachers in conducting experimental works.

The research uses descriptive way of study and qualitative and quantitative data analysis. Debre markos higher education preparatory secondary school was selected purposefully. This was because; the researcher has been working in the school since 2001E.C, the school was grand and there were many experience teachers in it. At the study area, there were 968 natural science students with 16 sections. Of these 16 sections 8 sections were grade 11 & the remaining 8 were grade 12. A total of 4 grades, 2 from each grade level were selected by random sampling selecting method. So, 212 of them were participated in the study. And all chemistry teachers (8) and the school administrator were included by using target group sampling method.

Data collecting instruments and analysis

To assess the practice and challenges in teaching chemistry at Debre Markos higher education preparatory secondary school and to answer the basic research questions the researcher used: Questionnaire, observation, document analysis and FGD as data collecting instruments.

The data were analyzed using both qualitative and quantitative method. Accordingly, percent, mean, t-test and ANOVA were used for analyzing data collected by questionnaire. Moreover, the responses on observation, document analysis, open-ended items and FGD were organized and analyzed on the basis of common themes in each category of items. The use of qualitative analysis was in supplementing the quantitative data.

RESULTS AND DISCUSSION

Demographic Characteristics of the Respondents

This section represents the main characteristics of the study's population- sex, age, educational status and experiences.

Table 1: Demographic characteristics of teachers

		frequency	Percentage
Sex	M	5	62.5
	F	3	37.5
	T	8	100
Educational level	First degree	3	37.5
	Sec degree	5	62.5
	Total	8	100
Experience	5-10yrs	-	-
	11-15yrs	-	-
	16-20yrs	2	25
	>20yrs	6	75
	Total	8	100
Training			
	None	2	25
	Once	4	50
	Twice	1	12.5
	Three times	1	12.5
	Total	8	100

The study includes 5 males and 3 females, a total of 8 chemistry teachers. 3(37.5%) were first degree holders and 5(62.5%) were second degree holders. This was achieved 62.5% of the standard of MOE (2001). In addition, 6(75%) were highly experienced and 2(25%) were not trained.

From Table 1, one can understand that training concerning practical work was not given to teachers adequately. This concept was strongly supported by the researcher's observation and teachers' interviewing.

Table: 2 Teachers' representativeness (to be lab technician)

		frequency	Percentage
Being lab representative	Yes	2	37.5
	No	6	62.5
	Total	8	100
Why you do not to be lab representative?	I am not interested	6	75
	No good condition to be	-	-
	I am not invited to be	2	25
	Once someone is delegated, he/she stayed for long period of time.	-	-
	Total	8	100

This implies that teachers were not interested to be lab representative and did practical work. Those teachers who are motivated to do practical work will always find ways to do so even if they are in poorly resourced schools but those who are not motivated will not do practical work even when they have access to the best of resources

Background information about school laboratory

Table 3: school information and lab conditions

		frequency	Percentage
Lab status	Not equipped	1	12.5
	Moderately equipped	6	75
	Well equipped	1	12.5
	Total	8	100
School administrator's helps	Nothing	5	62.5
	Accordingly	3	37.5
	Properly	-	-
	Total	8	100

From Table 3, the school was 6(75%) moderately equipped, 1(12.5%) well equipped and1 (12.5%) not equipped. From this information, it can be concluded that the school was, 87.5% convenient to do experiment. And the school administrator could not assist and helps the school laboratory. This was almost 100%.

From the observation: the school administrator, the assigned lab technician and teachers were not cooperatively worked. For instance, there was no regular time table which governs all stakeholders to do their activities properly.

When the teacher's time is over, another teacher has to come in which in most cases forces teachers to stop without attaining required results or learners understanding the topic.

From the open ended questions of both teachers and students and FGD of students the above idea were strongly supported.

Table 5: Activities to be done before experimental works (Teachers)

No	Item	Response										mean	Standard deviation
		Never		Rarely		Some times		Frequently		always			
		F	%	F	%	F	%	f	%	F	%		
1	How often you read different experimental activities before practical work?	1	12.5	2	25.0	2	25.0	-	-	3	37.5	1.375	1.58
2	How often you read lab manuals before practical work?	2	25.0	2	25.0	2	25.0	1	12.5	1	12.5	2.63	1.41
3	How often you prepare flow charts for practical works?	4	50.0	3	37.5	-	-	1	12.5	-	-	1.75	1.04
4	How often you test the experiments before your work with students?	2	25.0	-	-	1	12.5	3	37.5	2	25.0	3.375	1.60
5	How often you discuss on the activities with other teachers and laboratory technician?	2	25.5	-	-	2	25.0	2	25.0	2	25.0	3.25	1.58
6	How often you check and balance all necessary chemicals and apparatuses for the intended activity?	2	25.0	-	-	2	25.0	1	12.5	3	37.5	3.38	1.67
7	How often you check the neatness arrangement and functionality of the laboratory?	1	12.5	3	37.5	2	25.0	2	25.0	-	-	2.75	1.06

8	How often you give laboratory manuals to student before practical work? 2.302	7	87.5	1	12.5	-	-	-	-	-	-	1.13	0.35
9	How often students use (ask) manuals to read before real work?	6	75.0	1	12.5	1	12.5	-	-	-	-	1.38	0.74
10	How often you group and arrange students before they are coming to laboratory room?	4	50	2	25	-	-	2	25	-	-	2.00	1.31

From Table 5, generally teachers didn't overcome all their responsibilities that were done before the real experimental works. In addition, the researcher discovered the following events through deep rooted observations. These were:

- Teachers didn't give any attention to activities which were conducted before the real activities.
- Teachers had not any time table which shows their pre experimental activities there.

Table 6: shows activities to be done during experimental work (teachers)

No	Item	Response										mean	Standard deviation
		Never		Rarely		Some times		Frequently		always			
		F	%	F	%	F	%	f	%	F	%		
1	How often you set up apparatus and arrange chemicals for activities?	-	-	2	25.0	1	12.5	2	25.0	3	37.5	3.75	1.31
2	How often your students ask questions during they perform activities?	-	-	2	25.0	2	25.0	2	25.0	2	25.0	3.5	1.28
3	How often you follow and supervise students when the perform activities?	-	-	-	-	3	37.5	2	25.0	3	37.5	3.50	1.20
4	How often you prepare extra samples for unsuccessful works?	2	25.0	3	37.5	3	37.5	-	-	-	-	4.00	0.93
5	How often you remind the accidents (risks) to your students in each activity.	-	-	2	25.0	3	37.5	-	-	3	37.5	2.12	0.83
6	How often you work with the lab technician during performing activity?	3	37.5	-	-	5	62.5	-	-	-	-	2.25	1.31
7	How often you check and supervise the functionality of networks like light, water lines, gas pipe?	1	12.5	1	12.5	2	25.0	3	37.5	1	12.5	3.25	1.04

8	How often the laboratory technician helps and assists students on their activity?	1	12.5	2	25.0	3	37.5	2	25.0	-	-	3.25	1.28
9	How often you promote and encourage students to take notes on each event?	-	-	-	-	3	37.5	4	50.0	1	12.5	2.75	1.04

From Table 6, generally, teachers didn't do their work effectively and efficiently when they come to the real experimental work in the lab room. In addition, they were not work cooperatively with the assigned lab technician and had no regular time table.

From the researcher's observations:

- The lab room was not well arranged and apparatuses were not well assembled. Because of unassembled apparatuses and un accessed chemicals, the invited students got back to their class.
- Throughout the whole activities, only students & their class teacher were participated in the experimental work. Means the lab technician not there yet.
- Almost students were not participated on the activities conducted there. Means the teacher demonstrates them simply.
- Most of the time, the teacher waits only 40 minutes for the lab activity whether it needs long or short period of time.
- The class lesson and the lab activities were not match and many activities were conducted within 40 minutes.
- Generally, the class size, classroom management, the lab technician responsibilities and the school administrator support during experimental work were not good.

Table 7: Teachers' activities to be done after experimental work

No	Item	Response										mean	Standard deviation
		Never		Rarely		Some times		Frequently		Always			
		F	%	F	%	F	%	f	%	F	%		
1	How often you check appropriate accomplishment of your students' work?	-	-	3	37.5	1	12.5	2	25.0	2	25.0	3.78	1.30
2	How often you evaluate your students' work in accordance with the theoretical facts?	-	-	1	12.5	4	50.0	1	12.5	2	25.0	3.50	1.07
3	How often you check your students' interpretation, conclusion and recommendations?	2	25.0	1	12.5	2	25.0	2	25.0	1	12.5	2.87	1.45
4	How often you check your students' report consisting all formats allowed scientifically?	-	-	2	25.0	2	25.0	3	37.5	1	12.5	3.37	1.06
5	How often you give feedbacks to all your students work?	3	37.5	-	-	4	50.0	1	12.5	-	-	2.37	1.19
6	How often check whether the lab report is individual work or group?	2	250	1	12.5	4	50.0	-	-	1	12.5	2.63	1.30
7	How often you took any corresponding measures if students are not work properly?	3	37.5	1	12.5	3	37.5	1	12.5	-	-	2.25	1.16

From Table 7, the same performances were observed after experimental works. So, teachers have lots of problems in performing practical works.

From the researcher observations:

- Almost all students work (reports) didn't get back to them.
- Feedbacks, comments and activities which were failed were not given again.
- Teachers were not discussing their findings together.

From the interviewing of the assigned lab technician;

- Teachers were not interested to do experimental activities.
- Even though they come to the lab class, they did experiments very carelessly.
- They were always reasonable for not doing experiments.

From FGD of students:

Students discussed deeply on the issues forwarded to them about teachers' general performances on doing experimental works and the researcher summarizes their ideas as follows.

- Students were in doubt on teachers' attitude, skill and responsibilities on practical works.
- Students thought that teachers were superior to the school administrator and that is why they did things only if they need.
- In addition, students claimed on teachers' approach to their students, which was not fatherly and motherly.
- Even they come once per semester or per year, they did more activities without considering their students' degree of understanding.
- Generally, teachers were boredom (dislike) to work there.

From document analysis: It is well known that every activity that can be done by somebody should be recorded and documented. So, teachers' activities should also document and recorded. But, their works of the three consecutive years summarized as follows.

Table 8: Document analysis of grade 11 teachers performance

Year	Teacher	No of planned activities	Performance (in day)
	A	23	3
	B	23	-
2010	C	23	-
	D	23	-
2011	E	23	4
	F	23	4
	G	23	4
2012	G	23	2
	X	23	2
	B	23	2

Table 9: Document analysis of grade 12 teachers' performance

Year	Teacher	No of activities per yr	Performed per yr
	E	22	6
	F	22	4
2010	D	22	4
	H	22	2
2011	A	22	4
	G	22	6
	B	22	4
	C	22	4
2012	E	22	3
	A	22	2
	F	22	2

The above document analysis shows that there were more than twenty activities planned per each grade levels. On the other hand, teachers' performance on average was less than half which was too poor performance.

From open ended questions, teachers were suggested the following information on the delegated lab technician:

The lab was moderately equipped; therefore, there were enough chemicals, apparatuses, and materials. These were not arranged based on their function, properties, and their use of life time.

This is because:

- No well-trained, professional and full time worker lab technician.
- The lab room is only one and it serves as both store of chemicals and apparatuses and demonstration.
- Most of the time, the delegated lab technician was not available at school.
- The delegated lab technician only brings chemicals and apparatuses. But, he/she hasn't help and assists teachers yet.

- The lab technician has no his/her own time table.

The above results of questioners, observation, document analysis, interviews and FGD were supported by another ways of data analysis called T-test &ANOVA as follows.

Table 10: T-test analysis of teachers

Items		N	Mean	Sta.dev.	T	Df	P
Sex	Male	5	72.6	24.93	-0.236	6	0.682
	Female	3	76.7	20.79			
Education level	First degree	3	61.66	28.98	-1.302	6	0.211
	Second degree	5	81.60	15.46			

Independent sample t-test was used to examine the difference between male and female teachers on their implementation of practical works and it was found that there was no significant statistical differences between male and female teachers this was because ($p>0.05$) and there was also no statistical significant difference between first degree and second degree teachers on their implementation of practical works. This was because ($p>0.05$) as shown in Table 11.

Without change in the above conclusion teachers' performance before, during and after real experiment was displayed below.

Table 11: T-test for teachers' performance before, during and after real experiment (education level)

Ed.level		N	Mean	St dev	T	Df	P
Before	First degree	3	23.00	14.42	-0.398	6	0.201
	Second degree	5	26.00	7.4			
During	First degree	3	24.00	7.54	-2.15	6	0.136
	Second degree	5	31.8	2.86			
After	First degree	3	14.66	7.23	-0.062	6	0.490
	Second degree	5	23.80	5.54			

Table11, the researcher was concluded that whatever the teachers have got different educational levels there was no significant impact on practicing practical works there at DebreMarkos higher education preparatory secondary school before, during and after the real experimental works. This was because; from the observation of the researcher, teachers have no consistent interests to do so. In addition, the T-test results of sex, lab representative had similar findings.

Table 12: T-test for teachers' performance before, during and after real experiment (sex)

	Sex	N	Mean	St dev	T	Df	P
Before	M	5	24.4	12.11	-0.166	6	0.08
	F	3	25.66	5.77			
During	M	5	28.4	6.87	-0.265	6	0.924
	F	3	29.66	5.58			
After	M	5	19.8	7.19	-0.264	6	0.682
	F	3	21.33	9.29			

Table 13: One-way ANOVA value of experience & training of teachers

Items		N	Mean	Sta.dev.	Df	Mean square	F	P
Experience	5-10	-	-	-	2	11.39	0.576	0.596
	11 -15	1	6.7500	2.06				
	16-20	3	10.125	3.09				
	>20	4	13.500	4.12				
Training	None	2	2.125	1.03	3	4.51	1.262	0.400
	Once	4	4.250	2.06				
	Twice	1	6.375	3.09				
	Three times	1	8.500	4.12				

Table 13, implementing practical work based on experience, the value of significant level is greater than 0.05($p>0.05$). It shows that there was no significant difference among chemistry teachers in their experience. And implementation of practical work based on training also has no significant difference ($p>0.05$). But, it was logically accepted that experience and training have their own impacts on practical works at any level of education.

What makes different my findings than other researchers is that: most of them used only questionnaire or interviews to collect their data and analyze descriptively. But, I used interview, document analysis, and FGD instruments for data collecting method and my study was quantitatively supported by using SPSS analysis.

Table 14: ANOVA analysis of teachers' training effect before, during & after experimental work

Training experience		N	Mean	St dev	T	df	P
Before	Once	4	2	1.23		2	0.39
	Twice	2					
	Three & above	2					
During	Once	4	2	1.02		2	0.62
	Twice	2					
	Three &above	2					
After	Once	4	2	0.85		2	0.61
	Twice	2					
	Three & above	2					

Table 14, shows that all the discussed results were correctly explained in each case. Means the value of $p>0.05$ which shows whatever the teachers got different trainings about lab works; they didn't show significant difference before, during and after real experimental works. But, as it was discussed above experience, training and educational level must bring change. So, the researcher concludes that teachers had attitude, skill and knowledge problems.

In both ANOVA analysis, general and specific the results were the same.

NB: the same result was observed on teachers' experience before, during and after experimental works.

Table 15: students' background information

	Item	Frequency	Percentage
Sex	Male	122	57.5
	Female	90	42.5
	Total	212	100
Grade level	11	93	43.9
	12	119	56.1
	Total	212	100

From Table 15, by default the sex composition of males was greater than those of the females. In addition, from the expected respondents (212); about (119, 56.1%) were grade twelfth and the remaining (93, 43.9%) were grade eleventh students. So, the researcher observed that a better feedback was given from grade twelfth students. This was because; they have better experience and information than grade eleventh students.

Table 16: students' activities before experimental works

No	Items	Responses										Mean	Std dev
		Never		Rarely		Some times		Frequently		Always			
		F	%	F	%	F	%	F	%	F	%		
1	Have you laboratory manuals in hand?	77	38.3	39	18.4	67	31.5	20	9.4	9	4.2	2.27	1.17
2	How often you read any manuals, written documents before laboratory class?	37	17.5	64	30.2	62	29.2	35	16.5	14	6.6	2.65	1.14
3	How often your teacher encourages you to read more on activities to be performed in the future?	44	20.8	28	13.2	68	32.1	45	21.2	27	12.7	2.92	1.3
4	How often you discuss with your friends on the activities you will perform?	43	20.3	61	28.8	57	26.9	27	12.7	24	11.3	2.66	1.25
5	How often your teacher gives information how you will perform activities in the laboratory?	11	5.2	27	12.7	45	21.2	66	31.1	63	29.3	3.67	1.18
6	How often your teacher gives flow chart to perform the activities easily?	75	35.4	56	26.4	34	16	26	12.3	21	9.9	2.35	1.34

From Table 16, the researcher summarized as; almost students were doing nothing before they come to the real lab class. This had a negative impact on practical works of students.

Table 17: students' activities during experimental works

No	Items	Responses										Mean	Std dev
		Never		Rarely		Some times		Frequently		Always			
		F	%	F	%	F	%	F	%	F	%		
1	How often you are interested to perform activities?	24	11.3	22	10.1	37	17.5	36	17	93	43.9	3.72	1.41
2	How often you are working in convenient laboratory room?	75	35.7	54	25.5	45	21.2	20	9.4	18	8.5	2.3	1.27
3	How often your friends work with you at all time of the activity cooperatively?	19	9	33	15.6	57	26.9	52	24.5	51	24.1	3.39	1.26
4	How often your teacher works with you at all time of the activity?	22	10.4	31	14.6	48	22.6	64	30.2	47	22.2	3.39	1.26
5	How often you took short notes on your activities what are observed and happened?	16	7.5	32	15.1	56	26.4	51	24.1	57	26.6	3.48	1.24
6	How often you work again if your	70	33	49	23.1	33	15.6	42	19.8	18	8.5	2.48	1.35

	experiment is failed?												
7	How often you check your results, to be consistent with the theoretical facts or not?	36	17	49	23.1	43	20.3	33	15.6	51	24	3.07	1.43
8	How often you wear safety goggles, eye goggles, gowns and other safety equipment in doing so?	141	66.5	14	6.6	17	8	19	9	21	9.9	1.9	1.41

From Table 17, it indicates that students did experiments in fragmented ways. Here a little bit some activities were conducted in a better way than they did activities before the real experiment.

Table 18: students' performances after experimental works

No	Items	Responses											
		Never		Rarely		Some times		Frequently		Always		Mean	Std dev
		F	%	F	%	F	%	F	%	F	%		
1	How often you discuss the results with your friends?	52	24.5	48	22.6	69	32.5	21	9.9	22	10.4	2.59	1.25
2	How often you prepare laboratory reports on the experiments you did?	29	13.7	47	22.2	48	22.2	53	25	36	17	3.09	1.3
3	How often you get feedbacks on your laboratory reports and the activities you did?	35	16.5	40	18.9	57	26.9	43	20.3	37	17.5	3.03	1.33
4	How often your report consists all components of the laboratory report formats?	23	10.8	45	21.2	71	33.5	52	24.5	21	9.9	3.01	1.14

5	How often you discuss on the given feedbacks with your friends or groups?	49	23.1	52	24.5	48	22.6	40	18.9	23	10.8	2.7	1.31
6	How often you did re-work on activities which were failed?	58	27.4	41	19.3	42	19.8	44	20.8	27	12.7	2.72	1.39

From Table 18, in the same way, students didn't work their activities properly after experimental work. And their performances were too poor.

From teachers' open ended questions, students' interest & attitude towards practical work was less. In addition, from the researcher's observation the students' participation and ethics were reduced during practical works.

This was because:

- Teachers' interest was decreased.
- No hope for their future.

From FGD; students' interest and attitude were decreased approximately with the same reason as discussed above.

Generally, students' performance before, during and after the real experiment was very weak. From the descriptive analysis of the data, the mean values of students' performance were 2.6, 2.9 and 2.8 before, during and after experimental work respectively.

The above discussions were supported by T-test analysis as follows.

Table 19: T-test analysis of students (sex)

Items		N	Mean	Sta.dev.	T	df	P
Sex	Male	122	56.95	11.38	-0.665	210	0.423
	Female	90	57.96	10.44			
Grade level	11	93	2.79	10.42	-1.38	210	0.716
	12	119	2.88	11.35			

Independent sample t-test was used to examine the difference between male and female students on their implementation of practical works and it was found that there were no significant statistical differences between male and female students this was because ($p>0.05$) and there was also no statistical significant difference between grade 11 and 12 students on their implementation of practical works. This was because ($p>0.05$) as shown in Table 10 above.

On the other hand, students' practical performance was described before, during and after the real experimental work as follows.

Table 20: students' performance before, during and after real work (T-test on sex)

	Sex	N	Mean	St dev	T	Df	P
Before	M	122	16.54	3.85	0.096	210	0.86
	F	90	16.48	3.96			
During	M	122	23.48	5.72	-0.708	210	0.42
	F	90	24.02	5.11			
After	M	122	16.92	4.73	-0.841	210	0.300
	F	90	17.45	4.23			

The researcher didn't found different results than the general output of T-test conducted on Table 20.

Table 21: students' performance before, during and after real work (T-test on grade level)

	Grade	N	Mean	St dev	T	Df	P
Before	11	93	15.65	5.3	-2.90	210	0.17
	12	119	17.19	4			
During	11	93	23.41	5.4	-0.68	210	0.90
	12	119	23.94	5.5			
After	11	93	17.12	4.7	-0.06	210	0.31
	12	119	17.16	4.3			

Table 21, also shows no significant difference was observed when T-test of students' grade before, during and after the real experiment.

Generally, students' less performing of all activities was directly and indirectly related to their teachers' performances. This is because; they were the role model of their students. Students may in lack of skills, knowledge and attitude. Poor understanding and grasp of practical concepts by learners: this was attributed to stem from student's entry behavior. As such due to poor grasp and under-standing of practical concepts by learners these goals are hardly achieved.

CONCLUSIONS

Based on major findings, the following conclusions were drawn:

- Debre Markos higher education preparatory secondary school was moderately and well equipped in chemicals, apparatuses and other imputes. And the teachers who taught there are well experienced and well educated. But, their performance in implementing experimental works there was too poor.

- The teachers as well as the students defined that the lab technician had no any assistance and support on the experimental activities conducted there.
- The school teachers were not combined and use their knowledge, experiences and good opportunities to work many practical works and brings teaching chemistry more tangible, attractive and easy for their students.
- The lab technician had also lost lots of his/her responsibilities in managing, directing, coordinating and controlling teachers and their students to achieve the intended goals of the country and to increase students' performance and quality of education.
- In addition, school administrator never supervises, organizes and facilitates teachers and students to conduct experimental works there.

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