

Assessment of Current Status of Physics Laboratory Practical Activities and Factors Affecting Their Implementations: In Colleges of Teacher Education in Western Oromia, Ethiopia

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Abstract

The study assessed: adequacy level of laboratory facilities, utilization of resources, current status of implementations of laboratory practical activities; and investigates main causal factors affecting the implementation of physics laboratory practical activities in Western Oromia (Nekemte, Shambuu, Metu and Dembidollo) College of Teacher Education. The study employed descriptive survey study design and was guided by four basic research questions. Purposive and probability sampling techniques were utilized to select sample representatives. Data collecting tools: questionnaire, interview, observations, and content analyses were employed. Both quantitative and qualitative analysis methods were utilized, i.e. frequency and percentage content analysis. Accordingly, the study found out that-- current status of implementation of laboratory practical activities were unsatisfactory, facilities were not adequate, far below the expectations to perform effective practical activities. Overwhelmingly, the status of physics laboratory practical activities in colleges of teacher education in Western Oromia are not on their stipulated state. The study suggested that stake holders, colleges and concerned bodies need to assist in ensuring adequate facilities and to alleviate factors hindering implementations of physics laboratory practical activities in colleges of teacher education and ensure that their predetermined standards are maintained.

Key Words: Assessment, College, Implementation, Physics Laboratory, Practical Activities, Resource Availability, Status.

1. Introduction

Physics is one of the basic disciplines of science that forms a pillar on to which other natural and applied sciences, medicine and engineering make their foundation. It is basically experimental science that needs active learning that could encourage creativity. Creativity requires students be engaged to develop intrinsic desire to achieve a choice to self-concept, self-esteem, sense of high self-efficacy and confidence to cope with situations/challenges/ that lead to success. To learn physics, students have to practice physics learning tasks, problem solving situations, project works and experiments.

Science laboratory is a place where research and testing are carried out and experiment is a scientific test carried out in order to discover whether the theory is correct or what the results of a particular course of action would be (Encarta online dictionary 2009). Similarly, laboratory is a facility that provides controlled conditions in which scientific or technological research, experiments, and measurement may be performed; and experiment is a scientific procedure undertaken to make a discovery, test a hypothesis, or demonstrate a known fact (<https://en.m.wikipedia.org/wiki/online>). Physics (Science) is an enterprise that constructs

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and organizes a set of knowledge in the form of testable explanation. Gbamanja (1991), defined Science as knowledge acquired through a systematic organization of events and objects in the natural phenomena; it is a systematic process of acquiring knowledge and understanding about the natural phenomena. The chief aim of physics is to discover the laws which governs certain phenomenon or to verify a given law which has been derived from a theory, indicating that physics is a practical science that requires adequate practical class (laboratory) to test for truth about a given phenomena in the physical world. According to McDonnell *et al.* (2007) *Ibid*, practical classes are designed to complement materials dealt with in the lectures and give students' practical experiences which will be invaluable in their future career as scientist.

Emphasizing the importance of physics laboratory practical activity Ausbel (1963) noted that: the emphasis on teaching and learning physics/Science/ is on ensuring that teachers not only teach the process of physics/science/ but also enable sensory learning to learn scientific concepts. By this, the "hands on", 'hearts on' and 'minds on' of learners must be on scientific activities such that learners will be able to learn actively and thereby participate in knowledge construction. Black (1993) asserted that sciences (physics inclusive) are practical subjects hence best learnt through experiments, observations, analysis, and generalization of conclusion. Therefore, laboratory has a direct effect on students' attitude and academic performance. This in turn indicates that hands on, hearts on and minds on of learning brings perfection and proficiencies. Thus, practical activities lead learners to perfection. Hager, (1974) indicated that practice makes one perfect.

Additionally, Simeon Olayinka Olajide (2017) indicated that the teaching of science without laboratory resources is to mask the value of science and make the subject alien to the students, a preventive implication from pursuing it in secondary schools and allied courses in higher institutions. The suggestion clearly portrays that adequacy of laboratory facility has an important implication in supporting practical laboratory activities; and that without resources it becomes a meaningless journey in dark without light. Thus, the importance of laboratory activities in the teaching and learning of physics can't be overemphasized.

Teachers must try to encourage students to discover knowledge by themselves in physics learning process, so that they could develop knowledge, problem solving skill, creative thinking, scientific thinking and ways of thinking that could ensure success in physics. Emphasizing teachers' role, Kaisa Jakarta, (2014) suggested that it is our job, as science teachers, to help the students see the connections between the theory we teach them and the phenomena they see in the experiments. To reach this goal it is important, first to recognize the problems students have in making links between the practical and the theoretical and deduce the reasons behind them. Once this is done, changes can be made in the way we instruct students in practical work. Ausbel (1963) suggested that the emphasis on teaching and learning physics/science/ is on ensuring that teachers not only teach the process of physics/science/ but also enable sensory learning to learn scientific concepts. Thus, teachers need to be highly committed in supporting students on implementation of laboratory practical activities.

Similarly, Hager (1974) indicated that it is generally believed that constant practice leads to proficiency in what the learner learns during class room instruction, hence the dictum 'practice makes one perfect'. It is on these platforms that the society and the nation benefit from science and technology which is achieved with quality education within the institutions and education centers. Hossen and Shad, (2007) advocated student centered approach to promote interest, analytical research, critical thinking and enjoyment among students. Hence, laboratory activities are more effective in improving level of students' creativity through practical

activities. Accordingly, constant students' active participation in laboratory practical work is more powerful in promoting creative thinking through thorough laboratory practices.

The quality of laboratory, depends on the adequacy of laboratory facilities, teachers' effectiveness in the use of laboratory facilities with the aim of facilitating and providing meaningful learning experiences to the learners, committed, qualified and well trained laboratory technicians and dedicated leaders--assessing challenges and resources in science laboratory. Different research findings indicated that learning of science is enhanced, and the understanding level is improved when the students are engaged in science laboratory for practical experiments (Hofstein and Lunetta, 2004). Additionally, N. Mbabuu, F.N. *et.al* (2011) concluded and suggested on the adequacy of facilities and teachers' role. Availability of equipped laboratories has a positive influence on students' attitude towards physics. Physics laboratories should be adequately equipped. Upon equipping of the laboratories, physics teachers should strive to teach physics 'by doing' rather than theoretically. This will improve the students' hands-on abilities and experiences besides triggering an inquisitive and analytical mind. Taiwo Oludare Ogunmade, (2005) elaborated that factors such as the absence of trained laboratory technicians, suitability of equipment, commitments of teachers and education sector administrations distribution, etc., influence the quality of practical activities. Conclusively, these are the factors identified in affecting implementations of lab practical activities.

The laboratories have been given a central and distinct role in physics, as there are many benefits in learning from laboratory activities. Well equipped laboratories are one of the essential characteristic features in physics/science at all levels. It would be rare to find any science course in any institution without substantial components of laboratory practical activities. Hofstein & Mamlok-Naaman (2007) suggested that science/physics is an experimental discipline; laboratory is an essential part in enhancing students' scientific skills. As physics is basically an experimental science it needs active learning that would encourage creativity and would enhance students' scientific skills.

It is no more news that the general status of physics laboratory practical activities and students' performance in the study area has not been impressive in the past few years. Therefore, it is crucial and timely to investigate into the factors that could affect effective implementation of physics laboratory practical activities in Colleges of Teacher Education. It is on the basis of this note that this study aims at Assessment of Current Status of Physics Laboratory Practical Activities and Factors Affecting their Implementations: In Colleges of Teacher Education in Western Oromia; Ethiopia and to suggest possible solutions. To this end the Researcher is intending to raise the following basic research questions:

- To what extent laboratory facilities/resources/ are adequate/sufficient/ in performing physics laboratory practical activities?
- What is the current status of implementation of physics laboratory practical activities?
- How often teachers are committed to assisting students' involvement in physics laboratory practical activities?
- What are the causal factors affecting implementation of physics laboratory practical activities?

The main purpose of this study is to assess physics laboratory facilities, the current status of physics laboratory practical activities, and to investigate factors that could affect effective implementations of physics laboratory

practical activities. Similarly, it aims at suggesting possible solution/s. More specifically the aim of this study is to -

- Assess the availability/adequacy/ level of physics laboratory resources/facilities to perform physics laboratory practical activities.
- To evaluate the current status of laboratory practical activities.
- Investigate level of teachers' commitment to support students in performing laboratory practical activities.
- Identify factors that affect implementations of physics laboratory practical activities in Colleges of Teacher Education in Western Oromia.

The study is significant to indicate causal factors hindering laboratory practical activities, to suggest possible solutions, to encourage students' involvement and instructor's commitment in supporting students work. Also, it will be useful to provide relevant information for researchers who are interested to make further research related to the problem in the future.

2. Methodology

2.1. Research design

This study was designed to assess the current status of physics laboratory practical activities and factors affecting their implementation in Colleges of Teacher Education in Western Oromia. The study employed a descriptive survey research design which involves gathering data that describe events and then organize; analyzing data that allows generalizing the finding of data collected from the selected sample from the population without any influence. According to Glass & Hopking, (1984) cited in (AECT, 2001)—'Descriptive design involves gathering data that describe events and then organizes, tabulates, depicts and describes the data collection. Additionally, Borg & Gall, (1989) suggested that descriptive studies are aimed at finding of "what is" so observation and survey methods are frequently used to collect descriptive data. Also Best, K. and Kahn B., (1999) suggested that descriptive research is primarily concerned with 'what is' the present although it also considers past events and influences as they relate to the current conditions. Therefore, descriptive- survey research design has been employed on the bases of above suggestions. Descriptive research involves describing and interpreting events, conditions, or situation of the present. More specifically, descriptive research is going to affect that are evident or trends that are developing. Descriptive research can use qualitative or quantitative method to describe current events, conditions or situations.

The survey study method was employed in which primary data was collected from DVDS, teachers, and integrated natural science stream students in the College using tools like questionnaires, interview and observation.

Descriptive research design was taken to be appropriate method to describe and assess the implementation of physics laboratory practical activities in the selected Colleges. Both quantitative and qualitative analysis methods were utilized to address the purposes of the study, i.e., utilizing frequency and percentage and content analysis. Furthermore, the method enables the Researcher to examine the present situation of laboratory practical activities, identify some of the major problems and to find possible solution/s for the existing problems.

2.2. Sample and Sampling Technique

The population comprises one hundred one ($n=101$) integrated natural science stream students the case of physics department regular students, nine ($n=9$) physics teachers regular program, four ($n=4$) College dean and three ($n=3$) college academic vice dean; selected through purposive sampling and probability sampling technique. From Colleges in western Oromia (Shambo, Nekemte, Metu, and Dembdolloo Colleges of Teacher Education); were purposively selected to take part in the study, because they were considered as samples that were likely to produce the most valuable data and to get unambiguous generalization. Out of these College students, 79 (78.22 %) male and 22(21.78 % female students from Nekemte and Metu college of teacher education integrated natural science stream were selected purposively to take part in the study for their availability and suitability for observation ; individual students were selected through probability sampling. Physics teachers ($n=9$), College Dean ($n=4$) and College Academic Vice Deans ($n=3$) in the entire sample from Colleges were purposively used because of their discipline and availability.

2.3. Research Instrument

The intended data for this research were obtained through questionnaire, interview, direct observation, and document analyses. Questionnaires' validities were affirmed after pilot test was conducted and research expertise constructive feedback was received that they were valid to measure the intended assess. Questionnaires with rating scales item were included in data collection for all respondents. The items were rated as strongly agree, agree, partially agree, disagree, and strongly disagree. The Researcher preferred close ended questions because it was easier to handle and simpler for respondents to answer and fill within short time. Open ended questions were included because they are suitable to get wide range of information/data from respondents.

✳ Questionnaire for Teachers and College Deans and Academic Vice Deans (DVDS)

This questionnaire contains 20 questions for teachers and 18 questions for DVDS which were open ended and close ended. The questions were related to general information about laboratory facilities, resource availability, supplementary materials, in-service trainings and workshops received, lab technicians, commitment of instructors, sources of financial support, status of lab practical activities and factors affecting their implementations and suggestions for improving the current status. Additionally, questions related to laboratory time schedule, the levels of students' involvement were included in questionnaire for teachers.

✳ Questionnaire for students

This questionnaire contains 17 questions which are open ended and close ended. The questions were related to -- availability of separate laboratory room, level of laboratory facilities, utilization of resources, availability materials; provision of practical time schedule, instructor's commitment, status of practical activities and factors affecting implementations of practical activities.

Similarly interview related to the current status of laboratory practical activities, factors affecting their implementations, supplementary materials, permanent time schedule for lab, sources of financial support, for possible suggestion were used to confirm and collect more information on their reactions in questionnaire

2.4. Method of data analysis and interpretation

The data collected were analyzed utilizing both quantitative and qualitative analysis method to address the purposes of the study, i.e. utilizing frequency, percentage and content analysis. In this research qualitative data analysis method includes describing in details specific situations, phenomena using questionnaire, interview, and observation. It focused mainly on the gathering of verbal data rather than measurements. The data collected through open ended questions from respondents were analyzed quantitatively. To know the answer to the research questions quantitatively, the collected data were analyzed by properly classifying, tabulating, and calculating statistical values used as frequency and percentile analysis for arriving at conclusion.

3. Presentation and Interpretation of Data

3.1. Availability and Utilization of physics lab resources

Table 1		Physics Laboratory Resource Availability and Their Utilization Observation Checklist				
No	Laboratory resources	available	available obsolete	available, not functional	available, not used	not often utilized
1	Voltmeter	9 AC		7AC		5AC
2	Voltmeter	2DC		2DC		
3	Ammeter	10	4			6
4	Electroscope	9		3	6	
5	Galvanometer	9				9
6	Ven de graph generator	4			4	
7	Magnets dft.	22		7	15	
8	Vernier caliper	10		2		8
9	Thermometer	37		2	35	35
10	Calorimeter	4				4
11	Lenses dft.	30		5		25
12	Dft. Mirrors	23	7	16		
13	Pulleys	16			10	
14	Tuning fork	10			10	
15	Resonance box	2		2		

Observation and inventory check-list result depicted that some available equipments in the lab were: rarely used, not often utilized and/or not utilized satisfactorily (Table- 1)

As confirmed through thorough observation and verbal interview responses, no visible experiments were performed related to laboratory practical activities. There were some materials listed on inventory checklist which help to perform simple experiments and demonstrations, but these materials were infrequently used or not used at all even for demonstrations. Likewise, most of the teachers do not make use of the few available materials in physics laboratories of colleges incorporated in the study. Even though there were some materials in most of the Colleges, these materials were either damaged, obsolete, and not accordingly organized on the basis of branches of physics, which was evidence to conclude that organization and utilization of resources was poor .

3.2. Teachers' tendency on utilization of physics laboratory resources

The result of teachers' tendency to the use available laboratory resources in performing laboratory practical activities showed that 66.67% of teachers reported as they use occasionally; while 33.33% teachers indicated that they use most of the time. The finding depicted that those teachers didn't use on hand resources effectively and efficiently in physics lab practical activities, indicating that level of utilization of available resources were not impressive (Figure1).

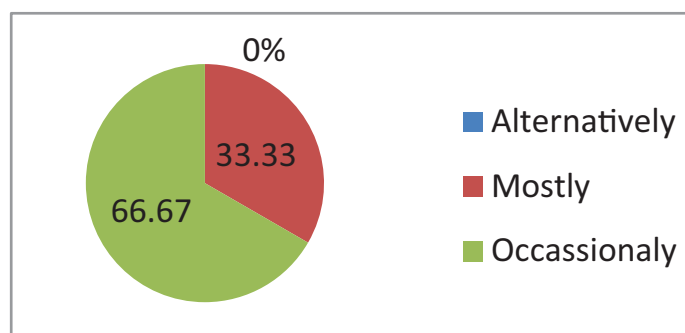


Figure1. Assessment of utilization of resources by teachers

3.3. Laboratory Facilities, Resources Availability and Supplementary Materials

Table 2 Respondents View on Physics Laboratory Facilities and Supplementary Materials					
Ite. No	Description	Alternatives	DVDS. N=7 f(%)	Teachers N=9 f(%)	Students N=101 f(%)
1.	Is there separate room for physics laboratory practical activities?	Yes	-	-	-
		No	7(100)	9(100)	-
2.	Laboratory materials are almost damaged/obsolete once, for use	Yes	5(71.43)	6(66.67)	85(84.16)
		No	2(28.57)	3(33.33)	16(15.84)
		Ns	-	-	-
3.	Are there supplementary materials that give support in performing laboratory practical activities?	Yes	2(28.57)	2(22.22)	9(8.91)
		No	-	1(11.11)	36(35.64)
		Ns	5(71.43)	6(66.67)	56(55.45)

NB: NS-Not satisfactory, RW – relatively well, DVDS –Dean and Vice dean of colleges.

Result in Table- 2 showed 100% DVDS and 100% teachers reported that there was no separate room for physics laboratory according to branches of physics. Likewise, 71.43 % DVDS, 66.67 % teachers and 84.16 % students stated that Laboratory resources were almost damaged/obsolete ones, for use in performing lab activities, while rest of the respondents reacted in contrary. Through this research work, it was found that 57.14% DVDS, 66.67 % teachers and 55.45 % of students reported that supplementary materials were insufficient/scant (Table- 2). The finding is in conformity with a study done by (Solomon Guta and Kadir Osma, 2015) on physics subject, which indicated that inadequate spaces for lab or lab facilities, outmoded and insufficient equipment and supply within laboratory, were the main problems that were encountered in the teaching and learning of science.

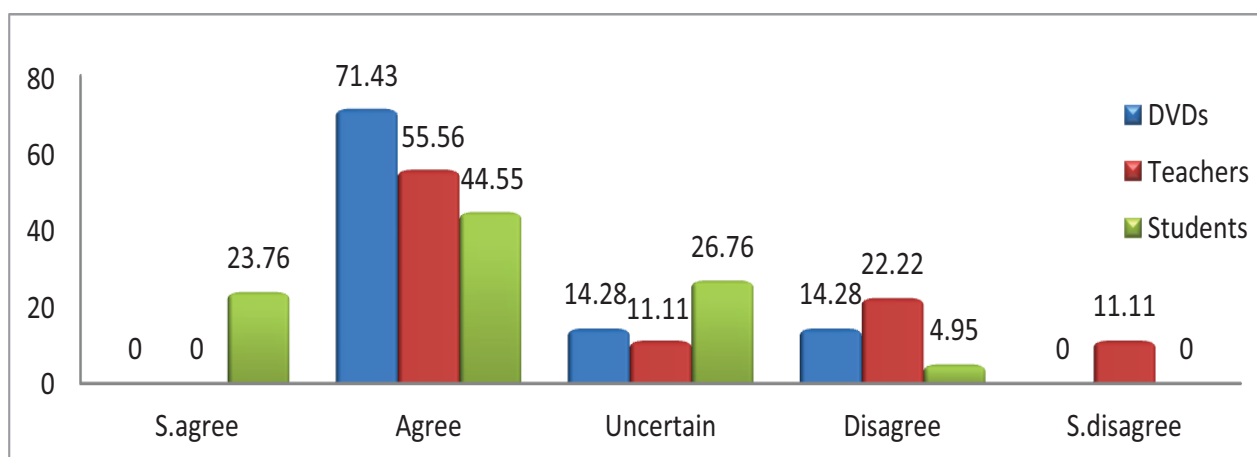


Figure 2. Respondents' views on lab facilities/resources are not adequate to perform lab practical work.

The reactions of respondents on Lab facilities/resources which were not adequate, indicated as about 71.43 % DVDS, 55.56 % teachers and 44.55 % of students agree that laboratory facilities/resources were not adequate, while 23.76 % of students strongly agreed with this idea while 14.28 % DVDS, 11.11 % of teachers and (26.73 %) students were uncertain. On the contrary, 14.28% DVDS, 22.22% teachers and 4.95% students disagreed while 11.11% teachers strongly disagreed to-- that facilities and resources are available and adequate to perform practical activities. This research work clearly portrays that laboratory facilities and resources were far below the predetermined standard (Figure 2).

Verbally, DVDS of the Colleges reported that there were not enough budget grant for labs, and no manual for experimental work. From this finding the Researcher inferred that there were no adequate facilities and non uniform resource distribution, manual and guide line to monitor laboratory practical activities among Colleges of Teacher Education in Western Oromia; inadequate facility has hindering effect on performing practical activities. Similarly, a study done by Solomon Guta and Kadir Osma (2015) on physics subject indicated that inadequate space for lab or lab facilities outmoded, insufficient equipment and supply within laboratory, were the main problems that were being encountered in the teaching and learning of science.

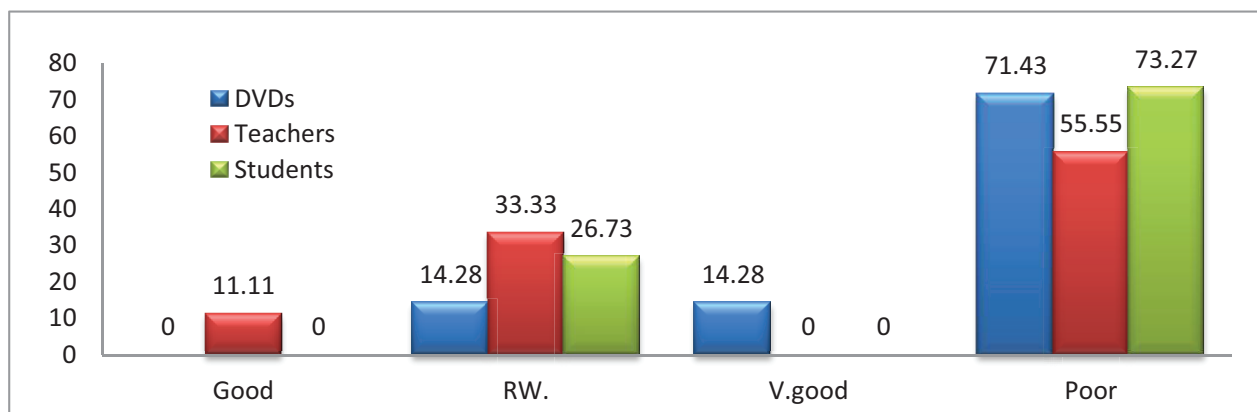


Figure 3. Assessment of current status of lab facilities

Additionally, respondents' reaction on the status of lab facilities revealed that 71.43 % DVDS, 55.56% teachers and 73.27% students reported the current status of physics laboratory facility was poor, while 14.28 % DVDS reported it as very poor, whereas 14.28 % DVDS, 33.33 % teachers and 26.73 % of students responded it to be relatively well. In general, the result indicated that the status of physics laboratory facilities were poor (Figure 3). There was persuasive evidence to conclude that lab facilities and resources in most of Colleges under the study were inadequate and far below the stipulated standards.

3.4. Status of Laboratory Practical Activities

Table 3 Respondents View on the Current Status of Laboratory Practical Activities					
Item No	Description	Alternatives	DVDS. f (%)	Teachers f(%)	Students f (%)
1.	Is there separate manual for physics laboratory practical activities?	Yes	-	-	5(4.62)
		No	-	9(100)	71(70.29)
		Ns	-	-	25(24.75)
2.	Is there permanent laboratory work time table like other courses?	Yes	-	3(33.33)	10(9.25)
		No	-	6(66.67)	98(90.74)
3.	There is regular time schedule like other courses for laboratory activities.	a	-	-	-
		b	-	1(11.11)	11(10.18)
		c	-	-	25(24.75)
		d	-	8(88.89)	36(35.64)
		e	-	-	37(36.63)

Strongly agree, b. Agree, c. partially agree, d. Disagree, e. strongly disagree and NS-not satisfactory.

The result portrays that 100% teacher and 70.29% student respondents indicated; that there was no separate laboratory manual, number of practical activities performed was so small, credit given to students'

performance were 15% -20% marks of major course which was generally different from College to College (Table- 3).

Verbally, most of the teachers and students responded that there was no specific laboratory manual which they followed for conducting experiments and the rest followed a laboratory manual prepared (written on black board) by College laboratory technicians/teacher. This finding is in conformity with finding of Fayera (2014) that to practice lab experiments, there are no well-prepared laboratory manuals.

Furthermore, 90.74% students and 66.67% of teacher responded that there was no permanent lab work time slot just like that of regular scheduled courses' time-table. Similarly, result of the finding revealed that 88.89% of teachers and 35.64% students reported that there was no regular time schedule like that of other courses, 36.63% strongly disagreed that there is regular time- schedule and 24.75% student respondents were not certain about this. Contrarily 11.11% teachers and 10.18% were uncertain (Table- 3).

Verbally, all respondents reported that there was no permanent time- table just like that of regular courses, but either on the opposite shift or as the lab technician arranged according to his/her preference for three or maximum four experiments per semester of the year. Most of the Colleges perform the experiments by way of demonstration. This was attributed to the large number of students per class, while it could also be due to the time required for the experiments. At institution level, an experiment session is scheduled for three hours or more; it is therefore understandable that if the experiments are not provided in the normal teaching timetable it would be unthinkable to expect the teachers to find the three or more hours for effective performance of the experiment/s to allow students to perform such experiments physically.

Lack of instructional materials, like laboratory guidance or manual and short period allocated for practical work was the problem identified for implementations of practical work; and has negative impact on performance of physics laboratory activities. This finding was in harmony with the findings of Makgato's (2007) work which also indicated that lack of practical experiments in sample school contributed to the poor performance of learners in physics subject in schools that did not conduct experiments, and highlighted the lack of resources like laboratory manual in schools.

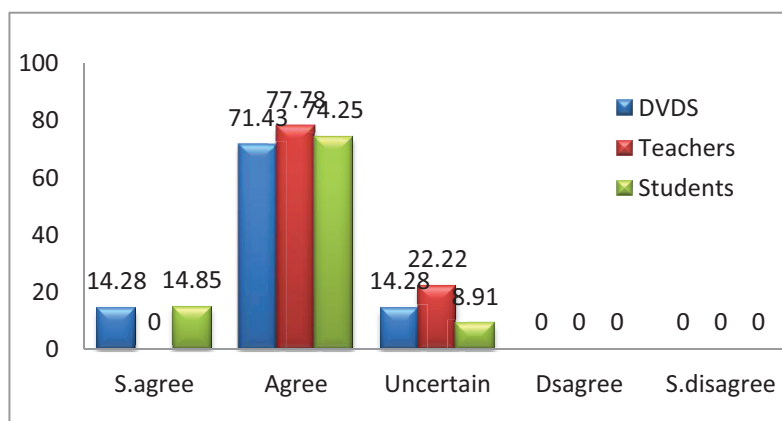


Figure 4. Respondents' judgment on poor status of practical activities

Additionally, 14.28 % DVDs and 14.85 % students strongly agreed, 71.43% DVDs, 77.78 % teachers and 74.25 % students agreed, while 14.28 % DVDs 22.22 % teachers and 8.91 % students were uncertain on status of poor lab, which confirmed that the status of physics lab practical activities were not impressive (Figure 4) .

Furthermore, interview and observation results indicted that only Metu College of Teacher Education had trained laboratory technician. In contrary, in other Colleges 100% teacher and DVDS agreed with that there was no trained laboratory technician for physics laboratory in their College. Instead, they recruit diploma graduates with the same field of study without any orientation or other additional training concerning physics laboratory.

The finding is in conformity with the survey research made in Ilu Ababora as one of hindering factors to practical laboratory experiments, which makes negative impact on students' academic achievement in science education in the absence of laboratory technician for Biology, Physics and Chemistry in the school, who can carefully practice in the laboratory (Fayera, 2014).

Specifically, Dembidollo College of Teacher Education did not have lab technician, the subject teachers take the responsibility. Similarly, this finding is in conformity with the research findings of Abebe. *etal*, (2019) that, secondary schools of Bale zone south of Ethiopia, that most of the teachers (89 %) are not implementing, due to the hindering factors called lack of laboratory technician.

3.5. Teachers' Commitment and Students' Involvement

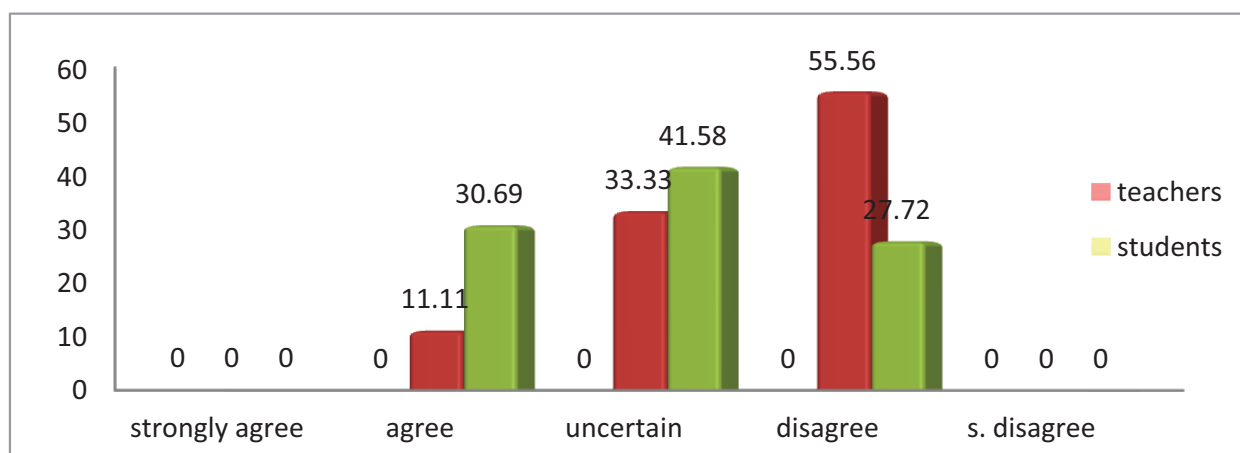


Figure 5. Respondents' outlook on students' involvement on practical activities were low

Respondents' reaction on 'students' involvement was low', clearly portrays 55.56% teachers, 27.72% student respondents reported that they disagreed on students' involvement on the existing physics laboratory practical activity is low and 33.33 % teachers and 41.58% student respondents were partially agreed, while 11.11% teachers and 30.69% of students agreed that students' involvement is low. However, students' involvement on the implementations of existing practical activities was insufficient, most of the students said that they have high interest to perform lab practical activities even though they were not supported.

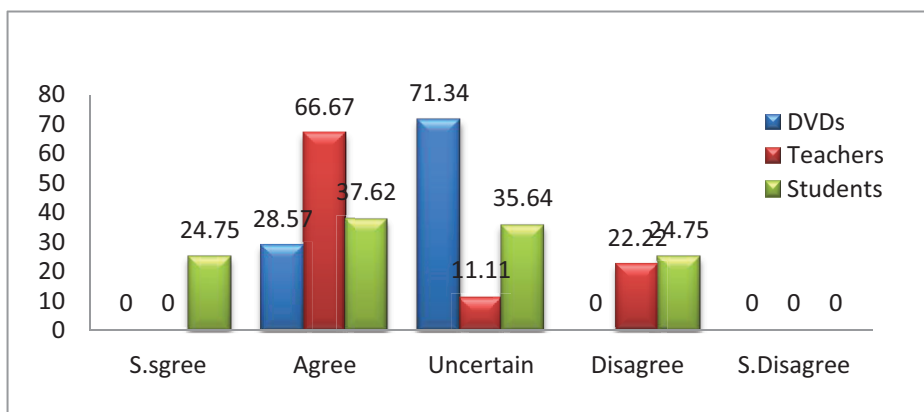


Figure 6. Respondents' view on teachers' commitment in supporting students were low

Similarly, 28.57 % DVDS, 66.67 % teachers and 37.62 % of student respondents agreed with the idea that teachers' commitment on supporting students, assist, explain give feedback on practical activities were low, while 24.75% students strongly agreed. Whereas 71.34% DVDS, 11.11 % teachers and 35.64 % student respondents partially agreed (are not certain) . In contrast, 22.22% teachers and 24.75% students disagreed (Figure 6). Therefore, the result again revealed that teachers' commitment in supporting students on lab practical activities were unsatisfactory or/and lacking. Similarly, study done by Ashebir Gogle, (2016) confirmed that the major factors that affect teachers' performance in practical activities were lack of appropriate laboratory time/schedule, absence of reward, lack of necessary equipments and materials, teachers' lack of training and commitment.

Response on Teachers' Commitment in supporting Students

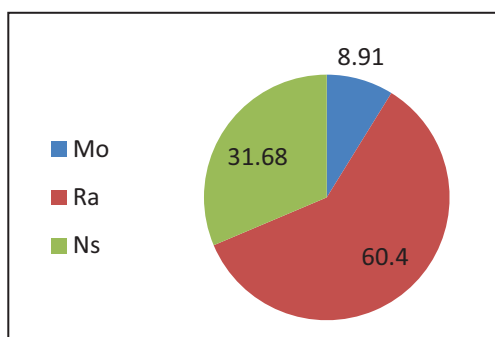


Figure7. Students' opinion of teachers' commitment in supporting students

Additionally, the result revealed that 60.40 % student confirmed teachers rarely support them whereas, 31.68 % students reported teachers' commitment were insufficient only 8.91% of them agreed that teachers support them most of the time, showing that teachers' support was not impressive (Figure 7).

As the finding directed, teachers' commitment in supporting students on practical activities was not satisfactory; and this approach could not encourage students' need of creativity. Therefore, teachers should guide and support their students' academic development through implementing, demonstrating, doing projects and practical activities in physics practical classes.

3.6. Factors Affecting Physics Laboratory Practical Activities.

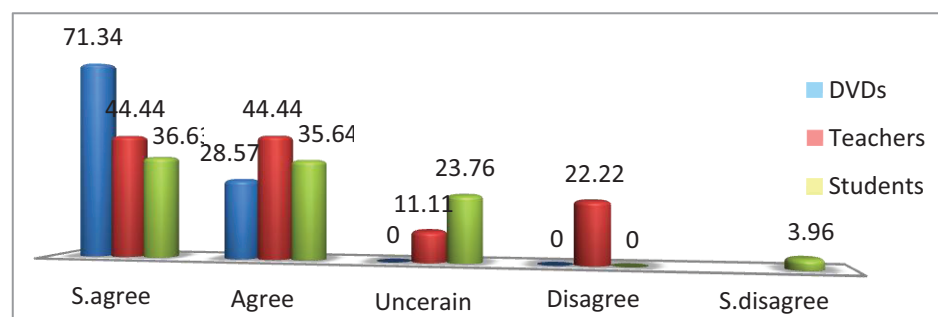


Figure 8. Respondents' views on poor facility has direct hindering effect on practical activities

The study revealed that 71.34% of DVDS, 44.44% of teachers 36.6 % students strongly agreed, 28.57% DVDS, 44.44% teachers 35.64 % of students agreed, whereas 11.11 % teachers and 23.76% students be uncertain while only 22.22% teachers disagreed and 3.96 strongly disagreed on that poor facilities in College has direct hampering/hindering effect on the implementations of laboratory practical activities (Figure 8)

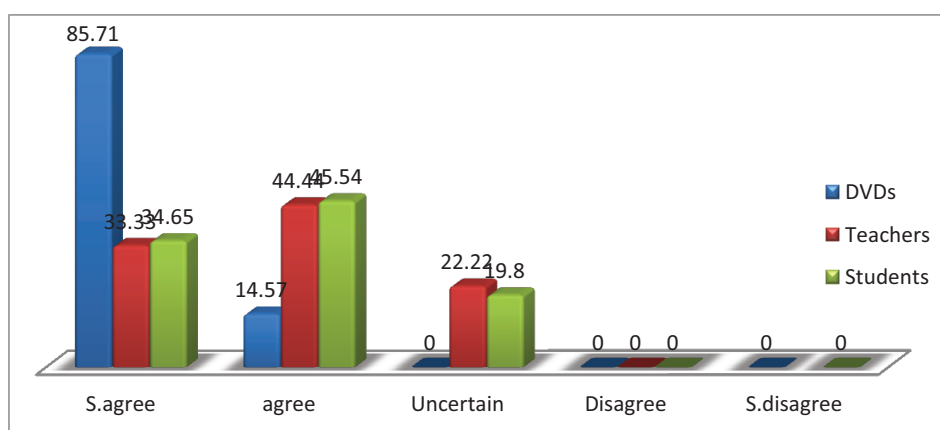


Figure 9. Respondents' opinion on lack of resource has direct hampering effect on lab practical activities

Result on bar- chart revealed that 85.71% of DVDS, 33.33% teachers 34.65% strongly agreed and 14.57 % DVDS, 44.44 % of teachers 45.54 % of student agreed whereas 22.22 % teacher and 19.80 % students were uncertain on that lack of resources in College have direct hampering effect on the implementations of laboratory practical activities (Figure 9)

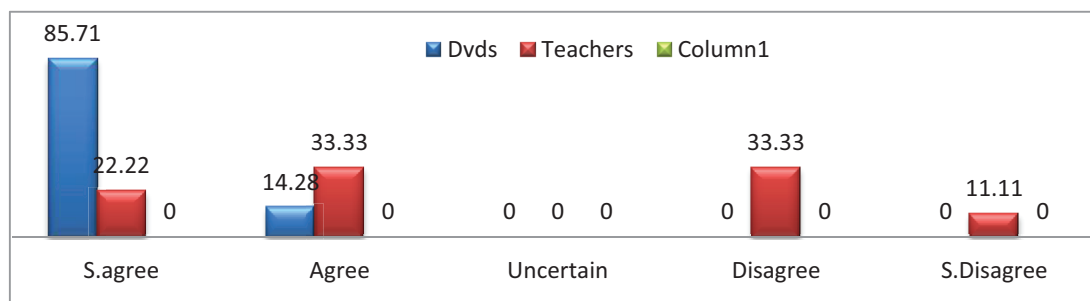


Figure 10. Response on Lack of trained technician has hampering effect on lab activities.

Similarly, the bar chart depicted that 85.71% of DVDS and 22.22% teacher respondents strongly agreed to the lack of trained lab technicians which has hampering effect on lab practical activities. 14.28% DVDS, 33.33% teachers agreed, in contrary 33.33% of teachers disagreed while 11.11 % of teachers strongly disagreed with the idea (Figure 10). In general, the study revealed that lack of trained lab technicians has a direct hampering effect on implementation of laboratory practical activities. The finding is in conformity with findings of Abebe and et al (2019), that in secondary schools of Bale zone, southeast of Ethiopia, most of the teachers are not implementing due to the hindering factor called lack of laboratory technician.

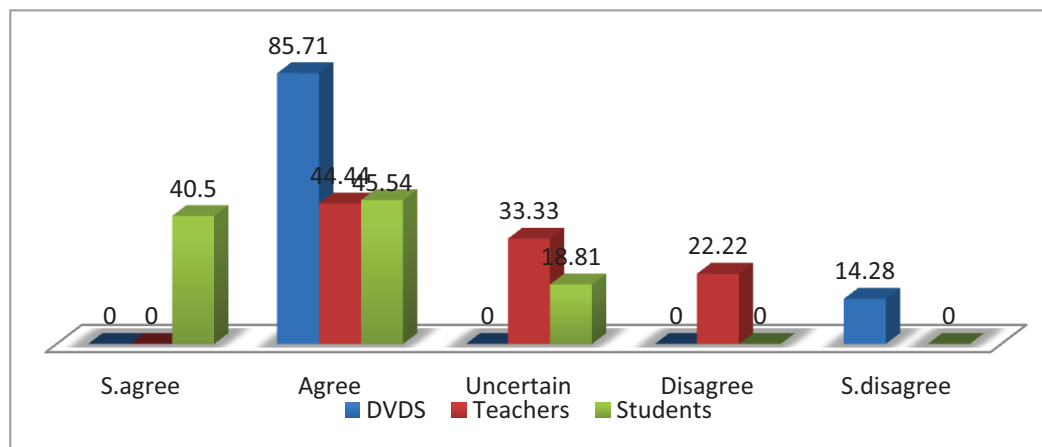


Figure 11. Respondents' judgment on teachers' poor commitment has hampering effect on lab activities

On the other hand, reaction regarding- teachers' poor commitment has hampering effect on lab practical activities, revealed that 40.50% of students strongly agreed 85.71% DVDS, 44.44% teachers and 45.54% students responded- agreed to the effect; 33.33% teachers and 18.81 % students were uncertain while 22.22% of teachers disagreed and 14.28% of DVDS strongly disagreed (Figure 11).

The result purely indicated that teachers' poor commitment has a direct hampering effect on the implementation of laboratory practical activities. The finding is in conformity, in most cases with Asherbir Gogile, (2016) findings that the major factors that affect laboratory activities in secondary schools in Wolaita were absence of reward, lack of appropriate laboratory time schedule, lack of adequate equipment and materials, lack of teachers' commitment and teachers' lack of training. This implies that without teachers' support and commitment teaching experimental science (like physics) is just like a journey in dark without light and that it will affect students engagement in knowledge construction. Similarly, this finding is in line with Taiwo Oludare Ogunmade,(2005) elaboration that factors such as the absence of trained laboratory technicians, suitability of equipment, commitments of teachers and education sector administrations distribution, etc., influence the quality of practical activities.

Interview of teachers, DVDS and observation results, additionally confirmed that:

- There were scarcity of resources, obsolete/damaged lab equipments, poor laboratory facilities indicating inadequacy, even in some Colleges there were no water line, there was no separate laboratory experiment manual (guideline in modules), separate laboratory room accordingly with the branches of physics and no supplementary material.

- No sufficient budget/financial grant from any part of the concerned bodies in order to fulfill resources, equipments, facilities and for maintenance of damaged materials.
- No course credit is given to laboratory practical activities. Instead, marks of 15%-20% from the main courses are given to experiments and there is no regular lab-time schedule.
- The number of students at an average in each group were (8-13); in some cases, two groups will be mixed and take their own data for the existing three or four experiments which is not recommended, was credible evidence that indicated implementations of practical activities were poor, since all students are not actively engaged in performing the practical activities.
- There were no additional short-term training or workshops related to physics laboratory given or incorporated in each College work plan. The finding is in conformity with the survey research made in Ilu Ababora as one of hindering factors to practical laboratory experiments, which makes negative impact on students' academic achievement in science education - was the absence of laboratory technician for Biology, Physics and Chemistry in the school, who can carefully practice in the laboratory (Fayera, 2014)

4. Summary, Conclusion and Recommendations

4.1. Summary

The findings indicated that (71.43% DVDS, 66.67% teacher and 84.16% student) there were scarce resources and dearth of facilities, "if any", they are either obsolete or damaged, materials were not satisfactory, even no water in lab rooms of most of the colleges. All respondents reacted (100%) that there was no separate room according to branches of physics in all colleges in the study area. This was invariably evident that instructional resources are lacking, to perform practical activities effectively. Generally, the finding portrays physics laboratories resources are lacking and facilities are not adequate (as about 71.43% DVDS, 55.56% teachers and 44.55% of students showed), far below the expectations to perform effective practical activities. Utilization of the available resources by teachers has not been impressive.

Contrarily, the findings depicted (as 100% teacher and 70.29% student respondents reported) that there were no physics laboratory manuals or guideline in modules, none of participating colleges has been allotted a separate slot for laboratory activities in their time table, similar to regular courses. Budget grant is lacking or not sufficient which was either actual or in their plan for purpose of laboratory activities. In most of these Colleges there were no trained lab technicians and (no physics lab technician particularly in Dembidollo College), there were no training, workshops, seminars etc. organised for teachers and for lab technicians. The research result portrays (77.78% of teachers 74.25 % of students and 57.14% DVDS) that the status of practical activities are far below their stipulated standards. Additionally, the study depicted that teachers' commitment in supporting students on laboratory practical activities were not satisfactory.

The study revealed inadequate facilities, scarce resources, unplanned lab activities, lack of teachers' commitment, lack of budgeted grants, lack of trained technicians and not arranging trainings, workshops and seminars for teachers and lab technicians etc. were deep-seated and foremost factors identified that hinder effective implementations of physics laboratory practical activities, and has direct hampering effect on the performance of laboratory practical activities.

4.2. Conclusion

On the basis of the findings, it can be concluded that:

- **Facilities and resources:** Physics laboratory facilities are inadequate and far below from the expectations, inadequacy of laboratory resources and facilities have direct hindering effect, no financial support to fulfill resources to alleviate inadequacies of facilities; indicating that there is significant relation between laboratory facilities and practical activities.
- **Status of lab practical activities:** Likewise, factors such as -lack of trained lab technicians, time schedule, separated manual, credited lab, independent room for lab etc., poor utilization or organization of resources are additional hindering factors on implementations of physics laboratory practical activities, which lead the status of implementations of laboratory practical activities in colleges incorporated in this study to be poor and unsatisfactory. Therefore, evidently the status of physics laboratory practical activities in colleges incorporated in this study was not satisfactory, rather far below stipulated standard.
- **Teachers' commitment:** the finding indicated that teachers' commitment is less than the necessary scarification required from them to pay in supporting students/young generation; giving feedback, guiding on lab practices was lacking; lack of continuous trainings, work- shops and seminars etc, for teachers and technicians were some of the constraints that hamper implementation of laboratory practical activities in physics laboratories of colleges in the study area.
- **Fundamental factors that were directly affected lab practical activities:** Contemporary, the findings indicated that inadequate facilities, scarce resources, lack of sufficient budget or fund, lack of trained lab technicians, teachers' underprivileged commitments were primary factors affected effective performance of lab practical activities. The findings purely portrays that there is significant direct relationship between laboratory facilities, resources, teachers' commitment, lab technicians and laboratory practical activities performance.

4.3. Recommendations

On the basis of the research findings the following recommendations were drawn out:

- Oromia Education Bureau, Colleges, stake holders and concerned NGOs need to assist in ensuring adequate facilities, in alleviating factors hindering implementations of physics laboratory practical activities and ensuring that their predetermined standards are maintained,
- Curriculum organizing bodies need to give necessary credit hour for lab experiment.
- Colleges should look beyond funds from the proprietors and universities through sponsorship and partnership with non-governmental organizations, and international donors for assistance in terms of facilities and equipment,
- Colleges and teachers need to find ways in order to organize laboratories in their stipulated standard, arranging separate (time schedule, lab manuals and room) and fixing budget in their actual plan in collaboration with responsible bodies.
- Laboratory technicians in colleges should be trained in physics lab practices in order to enhance laboratory professionalism and effective execution of laboratory demands.

- Teachers' commitment is indispensable in supporting students on lab work as it is professionally obligatory duty, in order to promote inventiveness in students.
- Teachers should attend workshops and seminars to update themselves on current issues in physics, likewise In -service Training for lab technicians should be organized periodically in order to update them on current trends on lab practice.
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