

# PROVISION OF ENABLING CONDITIONS IN BIOLOGY PRACTICALS AMONG PUBLIC SECONDARY SCHOOLS IN LUGARI, KAKAMEGA COUNTY, KENYA

JOYCE NEKESA NGAKHALA

PhD Candidate, University of Eldoret, Elodert, Kenya.

---

**Abstract:** Biology practical activity is at the heart of mastery of biology education and it is believed that if there is no practice either individually or in a group, all what have been learnt become inert knowledge. Therefore assessing provision of enabling conditions in biology practicals among public secondary schools is important to identify root cause and forward the way for the improvement. This study investigated provision of enabling conditions in biology practicals among public secondary schools in Lugari, Kakamega County, Kenya. A descriptive survey research design was used to assess students' participation, compare their participation at the implementation stage and to determine factors affecting participation at the implementation stage of biology practicals. The respondents were also categorized per class level. A random sample of 10 public schools was selected from which 300 students were proportionally selected. Questionnaires and observation schedules were used to collect data. Data were analyzed using descriptive and inferential statistics. The study revealed that most of the sampled schools performed biology practicals less than five times with majority of them not using notebooks for practicals. Sample schools sometimes discussed practicals of the results. As such it is recommended that they need to take advantage of the positive attitudes students have towards biology practical work to involve them in as many activities as possible in order to enhance the acquisition of the various biological scientific skills. The study also recommends that all public secondary schools should have laboratories with adequate supplies of equipment and reagents for practical work where biology process skills can be practiced and tested.

**Keywords:** Biology, Enabling Conditions, Kakamega County, Practical, Public Secondary school.

---

## 1. INTRODUCTION

The teaching of science is incomplete without practical activities (work) (Faize and Dahar, 2011). This is why almost all science curricula around the globe encourage science teachers to involve learners in practical activities. Biology education programme should be built on the skills, knowledge and experiences, developed by the students, through participation in practical; Biology practical work assist students in utilizing their knowledge and skills acquired in real field outside the classroom. Opol, Ezech and Ezemagu (2008) reported that much stress has been placed upon practical work for there is no substitute for it, for practical experiment must be the basis of knowledge in biology.

Biology practical are defined as the learning experiences in which students interact with materials or with secondary source of data to observe and understand the natural world (Ahadzi, 2017). Practical biology is viewed as any science teaching and learning activity which involves students, working individually or in small groups, manipulating and observing real objects and materials, as opposed to the virtual world (Hofstein, 2017).

Biology practical teachings are important in order to understand biology concepts. If science education aims to enhance the understanding of the natural world by students and how it functions, then the students have to experience and observe the relevant of science phenomena. Recent studies advocate for a change in teaching methods so that students participate fully and understand different science concepts (Miller, 2010). Students should understand processes and structure; develop skills in manipulation, processing of science information and conducting scientific investigations. Hence, the teaching methods such as learners design, reciprocal, inclusion, divergent and self-check could enhance the teaching of Biology practical lessons (Capel, Least & Turner 2019).

Practical activities in biology provide opportunities for students to actually do science as opposed to learning about science. Nzewi (2010) asserted that practical activities can be regarded as a strategy that could be adopted to make the task of a teacher (teaching) more real to the students as opposed to abstract or theoretical presentation of facts, principles and concepts of subject matters. Nzewi maintained that practical activities should engage the students in hands-on, mind-on activities, using varieties of instructional materials/equipment to drive the lesson home. Nwagbo (2010) stated that the use of practical (approach) to the teaching of biological concepts should therefore be a rule rather than an option to biology teachers, if we hope to produce students that would be able to acquire the necessary knowledge, skills and competence needed to meet the scientific and technological demands of the nation.

Globally, practical work has become a well-established part of secondary school science (Poppe and Markis, 2011). In fact, since 1988, the National Curriculum of England placed emphasis on practical's (Wellington, 2002) and current science teaching involves students carrying out practical work as an entity of biology, chemistry and physics lessons. Since the 19th century practicals have been part of the science classes in the United States of America and European secondary schools. Practical are of great significance in curriculum of any practical science such as Biology (Singer et al., 2005). Students claim to find practical work as an enjoyable and effective way of learning science (Hodson, 1993) and this has also been reported in many other studies (Osborne and Collins, 2001; Jenkins and Nelson, 2005). In Israel, practical work has been reintroduced in form of inquiry-based learning (SCORE, 2008). That is so because observation and experiment help learners to understand science concepts (Dambra'veanu, 2007). In Turkey, Dikmenli (2009), found that all biology student teachers agreed that practical work (experiment) is important in the teaching and learning of science.

In developing countries many teachers indicate that lack of resources is a major contributing factor for not using practical work in science. For example, in Nigeria lack of equipment is attributed to insufficient funds (Asokhia, 2009). Also, it has been reported that: "teachers have a myth that science teaching should take place in a laboratory as cooking belongs to the kitchen and gardening to the garden" (Fraser and Onwu, 2006: 70). Thus, teachers view lack of laboratories as a license not to engage learners in practical activities. Research indicates that teachers in South Africa also do not involve learners in practical activities, irrespective of whether they have laboratory equipment or not (Rogan, 2004, 2007: Muwanga-Zake, 2001). A study by Bhukuvhani, et al (2012) in Zimbabwe likewise points out practical work as an important and integral component of science teaching and learning. The implementation process of practices in science education is limited in Ethiopian schools and students in Ethiopia generally perform poorly in science subjects at secondary schools. Academically less prepared students of secondary schools prefer humanities and social sciences than science and technology in higher education. The majority of students in schools of the study area join social science.

In Kenya, since 1963, the Biology curriculum has gone through various revisions with each revision maintaining the emphasis on practical skills at both class and examination levels. In the School Science Project (SSP) syllabus, Biology was taught through heuristic approach consequently the students' text books were more of work-books with brief explanations of concepts (Namuddu, 1989). The various Biology curriculums inclusive of Biological Sciences syllabus implemented between 1987 and 2000 in Kenya despite it being deemed suitable for schools which had limited science resources tested scientific investigations replicated in practical work in the laboratory. More emphasis and competence in practical skills consequently may result in higher achievement in KCSE. This observation suggests that practical skills are a crucial aspect of learning that determines performance.

Woolnough et al. (1995) alleged exercises, experiences and investigations aid discussion about practical work. It was observed that new teachers are accosted with challenges of understanding instructions, content and methods of subject delivery (Davis et al., 2006). The student's text books recommended by KICD give the outline of the recommended

practicals, the procedure, execution, and student reports the observation and makes conclusions. The complementary teacher's guide's outlines the materials and conditions under which the experiment ought to be carried and account of the findings that student who is competent ought to come up with. The Biology student's text books and teacher's guide after evaluation by KICD subject specialists are listed in the Orange Book (OB) which teachers refer to when sourcing teaching/learning materials. The Quality Assurance and Standards Office (QASO) supervise subject objectives actualization. Kenya National Examinations Council (KNEC) examines the curriculum and consequent performance (KCSE) evaluates the achievement of the objectives.

### Statement of the problem

Practical work is important in learning science, and yet research has shown that many teachers in rural schools in South Africa ignore practical work (Muwanga-Zake, 2001; Rogan, 2004; Stoffels, 2005). The lack of practical work in schools could be one of the reasons why learners do not perform well in matric science examinations. Learners easily lose interest when they are taught using traditional approach and this may lead to students leaving science courses in preference of other subjects. The steady decline in the performance in KCSE biology practicals raises eyebrows. While the Government of Kenya has made attempts to improve the situation by in-servicing teachers to help learners acquire skills in practical work, and in the provision of teaching materials, this has not yielded positive results. It is not known immediately what could be responsible for this observation. It may be due to lack of students' participation in practicals during the learning process or due to the teachers' approaches in the teaching of biology or any other reasons. It's against this background that this study was conducted in order to investigate provision of enabling conditions for biology practicals in secondary schools.

## 2. LITERATURE REVIEW

According to Kungania (2015) poor performance was registered in practical papers of Biology due to teachers' absenteeism and students' attitudes. According to Yung (2006), teachers' perceptions on practical work differ according to their opinion of "fairness" within education. The findings showed that "teachers holding perceptions of fairness in the context of providing students with an all-round education and/or providing students with the chance to learn the subject matter" were inclined to view practical work as a means of "developing students' affective / cognitive/ motor skills". Yet, teachers appear drawn between two perceptions of practical work- motivating students and providing the skills for continuation in science and meeting the needs of the practical examinations. Although the key to better practical work, in meeting the effective and affective claims, does not come solely from "doing more practical work, but of doing better practical work" (Millar & Abrahams, 2009).

Muleta and Seid (2016) aimed at assessing factors affecting implementation of practical activities in biology education in some selected secondary and preparatory schools of Afar Region. Teachers do not use practical activities in teaching biology. Absence of separate and well equipped laboratory for each science, absence of efforts made by science teacher to use local material for practice of basic activities and less attention of local government and school administrative to existing problem results in less student motivation to practical activity which have influence on student's preference to science education in the study area. Therefore, attention should be given by all concerned bodies and stakeholders to solve the problem and encourage students to science practical activities to join science classes of future science and technology graduate.

Owan, Basse and Agurokpon (2020) sought to identify the institutional factors affecting quality and effective practical work in senior secondary school biology in Ebonyi state of Nigeria. The findings of the study revealed that items presented are institutional factors affecting quality and effective practical work in senior secondary physics in Ebonyi state of Nigeria. It was recommended that government and none governmental organizations should assist in the provision of the required facilities. Bello (2015) focused on the effects of some teacher factors on the conduct of effective biology practical lesson. The findings revealed that teacher qualification and experience affect his or her ability to use laboratory equipment in biology practical work. It is recommended that government and school proprietors should provide adequate laboratory equipment to their schools and also employ more qualified biology teachers.

Kamar (2007) revealed that 90% of teacher in his study had a minimum of first degree in science or science education. He added that lack of experience with equipment or with the procedure of conducting experiment were not constraining

factors in the conduct of laboratory practical work to 43% and 50% of teachers respectively. Idoko (2008) revealed that unprofessional and inexperienced Agricultural science teachers using inappropriate teaching method in conveying practical skills to students are responsible for lack of interest and poor performance of students in Agricultural science practical. This indicates teacher qualification and inadequate skills in conveying practical skills are among factors affecting performance of students in sciences. Use of laboratory equipment during laboratory practical require experience and qualified teacher, adetayo (2008) observed that teachers' use of available instructional or laboratory equipment depend significantly on their qualifications.

Gacheri and Ndege (2014) analysis biology KCSE practical examinations showed that drawing and measurement skills are not adequately tested. Students are also rarely given practical tests. There are not enough facilities in the laboratories for use during practical test. Kihumbas (2009) investigated availability and use of school laboratory facilities and their influence on students' achievement in sciences in secondary schools in Trans- Nzoia district. Lack of apparatus, chemicals, and laboratory furniture among others were some of the factors that hinder students from handling/manipulating the apparatus on their own. This implies that the students are deprived of the necessary skills that can make them be able to carry out an experiment on their own hence hindering them from performing well in sciences.

Jote (2019) examined the impact of the main factors, which affect the experiments of biology in Nekemte College of teacher education. The results from the study showed that, factors that affect the experiments of chemistry in Nekemte college of teacher education were absence of well-trained lab-technician, unavailability of chemicals, equipment's and apparatus, lack of external and internal facilities, inappropriateness and irrelevance of manual, large number of students, shortage of instructional materials, inconvenient learning environment and etc. These problems undermine the quality of the experimentation in science education.

Ngozi and Halima (2015) sought to find out the availability and utilization of laboratory facilities and their implication in the performance of students in Biology in Senior Secondary Certificate Examination (SSCE) in Zaria metropolis of Kaduna state. From the findings, the teachers do not conduct practical lessons with the students and those that are involved, do not utilize the facilities effectively which impart negatively on students as they are not exposed to or allowed to handle the equipment.

In order to understand factors hindering teachers from conducting practical work, a case study was carried out in Sekhukhune district in Limpopo Province by Asaph and Kibirige (2015). Results show that most teachers do not understand the purpose of practical work, which may be a possible explanation for learners' poor performance. Also, many teachers misinterpreted the departmental policies, the former National Curriculum Statement (NCS) and the current Curriculum and Assessment Policy Statement (CAPS), where two practical tasks to be recorded in the mark schedule for Continuous Assessment (CASS) were construed to be the only ones to be conducted.

### 3. METHODOLOGY

A descriptive survey design was used to study the extent of student participation in biology practicals by class level and school type. The study was undertaken in Lugari District, western province, Kenya. Lugari district is one of the districts where poor performance in biology has been reported over the past five years in K.C.S.E. (KNEC Report 2009: Pg 54.). The study population was made up of students taking Biology in forms one to three. Thirty percent (n=10) of the schools were sampled (Kombo and Tromp, 2006). Simple random sampling was employed to select 20% (n=2) boy schools, 30% (n=3) girl schools and 50% (n=5) mixed schools. The students were interviewed using one main questionnaire and one observation schedule. They had both structured (closed-ended) and unstructured (open ended) items in simple language. The reliability of this research instruments was established by pilot testing. The questionnaire was administered to three schools outside the study area. The research instrument was reliable and valid to collect the data which helped to achieve the objectives of the study and confirm the hypotheses (Cronbach's  $\alpha = 0.88$ ) To test the validity of the instruments further, a pilot study was carried out using 22 respondents from neighbouring Bungoma East District public secondary schools that were not used in the final study but have the same learning environment as Lugari District. All research questions were analyzed using quantitative techniques provided by Statistical Package for Social Sciences (SPSS) version 12.0.

#### 4. FINDINGS AND DISCUSSIONS

To participate fully in biology practical activities, certain enabling conditions are necessary. The respondents were therefore asked to say the extent to which these conditions were provided by the biology teachers, without which they would not fully realize the objectives of practical activities. These enabling conditions included:

- a) Frequency of involvement in biology practicals
- b) Adequate time for practical work
- c) Participation in group work
- d) Discussion of practical results with the teacher
- e) Use of biology practical notebooks. The results were as outlined below in table 1.

**Table 1: Enabling Conditions for Biology Practical**

Item	Student Participation	Class level		
		Form 1	Form 2	Form 3
Frequency of practicals	More than 10	5	4	1
	More than 5	59	33	22
	Less than 5	36	63	77
Adequate time to complete practicals	Yes	68	67	7
	No	32	34	74
Involvement in group work during practicals	Yes	63	61	65
	Not always	31	35	27
	No	6	4	6
Use of notebooks for practicals	Yes	15	12	8
	No	85	88	92
Discussion of practical results	Always	58	50	30
	Sometimes	40	47	60
	Never	2	3	10

#### Frequency of Involvement in Biology Practical

The frequency with which learners perform practicals not only improves their confidence in performing practicals but also improves their skills through experience and also familiarizes learners with the possible examinable parts to be tested in biology practicals and how to deal with them. The study sought to establish the number of times the learners carry out practicals per term. The results are recorded in table 2.

**Table 2: Class Participation in Practical Activities in a Term**

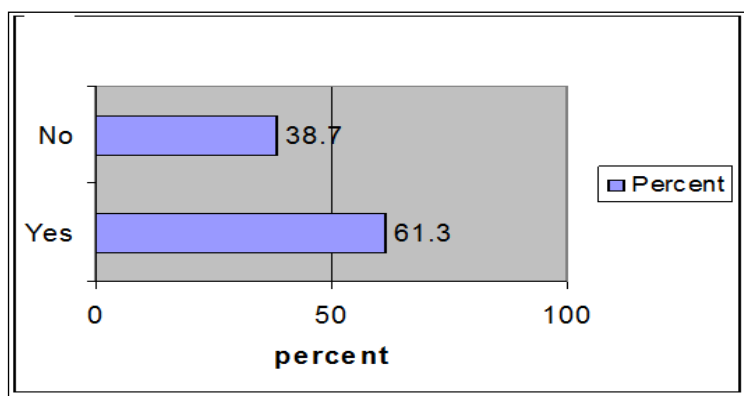
Class	Times	Frequency	Percentage
Form 3	More than 10 times	10	3.3
Form 2	More than 5 times	114	38.0
Form 1	Less than 5 times	176	58.7
	<b>Total</b>	<b>300</b>	<b>100.0</b>

The results indicate that majority of the students (form 1), 58.7% (n=176) admitted that they carried out practicals less than five times in a term. Given that students were supposed to conduct practicals on a weekly basis at a frequency of 5 times in a term, it is well below this stipulated frequency. This reduced the process of coordination of previously learnt knowledge and the newly taught concepts as well as a link between theory and practice in biology. This also implied that most teachers do not emphasize learning by self-discovery, but focus more on theoretical approach covering the syllabus. This approach certainly disadvantaged most learners when it came to biology practical examinations since they were not used to performing these practicals. Therefore, they lacked the necessary basic practical skills tested in biology practicals.

Only 10(3.3%) of the respondents (form 3) admitted performing practicals more than ten times per term. Thus, since the frequency of doing practical is very low, thus learners are bound to forget what they learnt before the next practical session.

**(b) Adequate Time for Completion of Practical Activities**

In the final examination, practical examinations are taken within stipulated time limits. This requires that learners should get used to doing practical activities within specific time limits. They need also to test their speed and accuracy with which they can carry out practical activities. The study wanted to establish whether enough time is given for the learners to carry out practical work in each lesson.

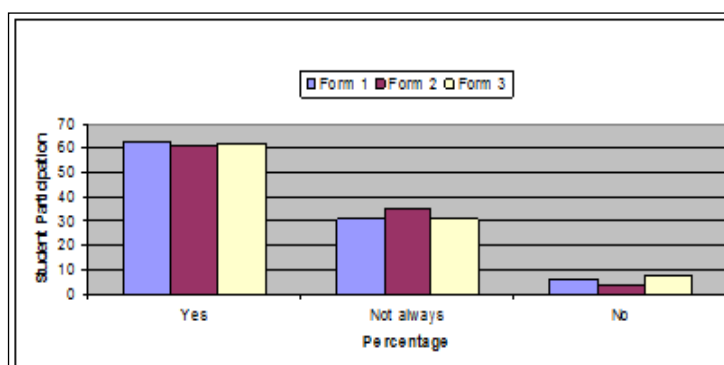


**Figure 1: Enough time is given to finish practical work in each lesson**

The results indicate that a majority, 61.3% (n=184) of the respondents admit that they had enough time to complete their practicals with a minority 116 (38.7%) of them asserting that they do not have enough time to finish the practical lessons. Hence majority of the respondents have enough time to conduct and complete their practical activities. This implies that most of the respondents have a good opportunity to learn and familiarize themselves with examinable practical activities and thus be in a position to perform better. The problem therefore lies in the lack of proper planning of practical activities by the biology teachers rather than availability of adequate time.

**(c) Participation in Group Work in Biology Practical**

Depending on the number of students per class and the available facilities within the school, either all or a few of the students may participate in practical work per given session through group work. This study sought to establish whether all students get involved in practical activities during a practical lesson. The results are summarized in figure 2.



**Figure 2: Participation in practical group work**

**Figure 2.** indicates that 62% (n= 186) of the respondents admitted getting involved in practical activities during practical sessions; with 32.2% (n=97) participating only some times. Only 5.7% (n=17) of the respondents claim not taking part at all in practical activities during practical lessons. This may be due to lack of enough facilities and perhaps large number of learners per class which makes it difficult for all the students to participate in a given practical activity.

This implies that majority of learners get involved in practical activities, whenever such sessions are available. The majority of learners reported adequate participation during biology practical sessions, through group work. Group work is periodically known to foster scientific attitudes such as cooperation and foster development of scientific concepts since the slow learners are encouraged by faster learners. Most learners thus should be in a position to carry out practical activities confidently and come up with meaningful results and conclusions.

## 5. CONCLUSION AND RECOMMENDATIONS

The study concluded that most of the sampled schools performed biology practicals less than five times with majority of them not using notebooks for practicals. Sample schools sometimes discussed practicals of the results. As such it is recommended that they need to take advantage of the positive attitudes students have towards biology practical work to involve them in as many activities as possible in order to enhance the acquisition of the various biological scientific skills. To facilitate biology practical, schools that had more than one laboratory need to employ one technician per available laboratory to reduce the load on the biology teachers so that they could concentrate on the actual lesson planning and teaching. The study also recommends that all public secondary schools should have laboratories with adequate supplies of equipment and reagents for practical work where biology process skills can be practiced and tested. These initiatives may act as a motivation to high school teachers and learners to take practical work more seriously than what it is currently. Lastly, there is need to increase in time allocated to teaching and learning biology to enable students participates in inquiry-based practical and activity work.

## REFERENCES

- [1] Ahadzi, D. K. (2017). *An investigation into the status of biology practical activities in designated mathematics and science Colleges of Education in the Volta region, Ghana* (Doctoral dissertation, University of Education, Winneba).
- [2] Asaph Mogofe, R., & Kibirige, I. (2015). Factors Hindering Science Teachers From Conducting Practical Work In Sekhukhune District, Limpopo.
- [3] Bello, S. (2015). Effect of some teacher factors on the conduct of effective biology practical lesson. *Global Advanced Research Journal of Educational Research and Review*, 4(3), 048-054.
- [4] Daba, T. M., & Anbesawb, M. S. (2016). Factors affecting implementation of practical activities in science education in some selected secondary and preparatory schools of Afar Region, North East Ethiopia. *International Journal of Environmental and Science Education*, 11(12), 5438-5452.
- [5] Gacheri, G. & Ndege, N. M. (2014). Science process skills application in practical assessments in Maara District secondary schools, Kenya. *International Journal of Social Sciences and Entrepreneurship*, 1 (12), 102-131.
- [6] Hofstein, A. (2017). The role of laboratory in science teaching and learning. In *Science education* (pp. 355-368). Brill Sense.
- [7] Jote, C. A. (2019). Major Factors that Influencing Experiments of Chemistry Courses in Nekemte College of Teacher Education, Oromia Region, Ethiopia. *Annals of Social Sciences & Management studies*, 3(2), 48-59.
- [8] Kihumbas, G. F. (2009). *Availability and use of school laboratory facilities and their influence on students' achievement in Sciences: A case of secondary schools in Trans-Nzoia District* (Doctoral dissertation, Moi University).
- [9] Muleta, T., & Seid, M. (2016). Factors affecting implementation of practical activities in science education in some selected secondary and preparatory schools of Afar region. *African Journal of Chemical Education*, 6(2), 123-142.
- [10] Muleta, T., & Seid, M. (2016). Factors affecting implementation of practical activities in science education in some selected secondary and preparatory schools of Afar region. *African Journal of Chemical Education*, 6(2), 123-142.
- [11] Ngozi, D. I., & Halima, S. (2015). Inadequate Laboratory Facilities and Utilization: Pedagogical Hindrance to Students' Academic Performance in Biology in Senior Secondary Certificate Examination in Zaria Metropolis, Kaduna State, Nigeria. *International Business Research*, 8(9), 124.
- [12] Owan, V. J., Basse, B. A., & Agurokpon, D. C. (2020). Path analytic study of factors affecting students' attitude towards test-taking in secondary schools in afikpo education zone, Ebonyi State, Nigeria.