Assessment of Infrastructural Facilities and Personnel Available for Teaching Physics in Secondary Schools, A Case Study of Ubungo District, Tanzania

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ABSTRACT

This study sought to assess the infrastructure facilities and personnel available for teaching physics in secondary schools in Ubungo District, Tanzania. The research used a mixed method approach and convergent parallel research design. A total of 117 respondents comprising of 13 teachers, 98 students, 5 heads of schools, and 1 District Education Officer were involved in this study. The study used a combination of simple random sampling and purposive sampling techniques to select the respondents. The data was collected through questionnaires, interviews and observation. The analysis for quantitative data was done using descriptive statistics with the aid of Statistical Package for Social Science (SPSS) version 21, while that of the qualitative data was done through thematic analysis. The findings of the study revealed that, Most of secondary schools in Ubungo district are suffering from inadequate infrastructure facilities like libraries, laboratories, class rooms, computers. The findings also show that most schools do not have ICT resources to facilitate teaching and learning. Also from the study it was realized that most of physics teachers employed teacher –centered pedagogy. Many students are unable to perform any kind of experiment or demonstration and few teachers use teaching aids during teaching and learning process. The study recommends that the government should increase funding for schools to provide and support adequate teaching and learning materials.

Keywords: Physics teaching, infrastructure, Physics practical, Ubungo district, random sampling, questionnaire, interview.

INTRODUCTION

Physics is “the science concerned with energy and matter and the interactions with one another.

Physics has played and continues to play a great role in human development, especially in the areas of energy, communication, textile and industries to mention but a few. Facilities for teaching physics include the infrastructures and equipment. Others are computers, laboratories and libraries. School infrastructural facilities have been observed as a key factor to a quality education. With regard to the teaching of physics in secondary schools, Infrastructural facilities include equipment and materials that are available to foster teaching and learning process. It includes good buildings for classrooms and laboratories, laboratory equipments, books for related subjects , audio-visual, software and hardware of educational technology; also, size of classroom and laboratory, sitting position and arrangement, availability of tables, chairs, chalkboards, shelves on which instruments for practical are arranged. Farombi (1998), and Farrant 1991), claimed that the wealth of a nation or society could determine the quality of education in that land; insisting that a society that is financially stable will establish good schools with professional personnel (competent teachers), learning infrastructures that enable students to learn with ease thus bringing about good academic performance and attainment of educational objectives. With regard to the importance of infrastructural facilities in teaching, Balogun (1982) remarked that no effective science education programme including physics can exist without equipment for teaching. This is

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because facilities enable the learner to develop problem-solving skills and scientific attitudes. In the same context,

Ibe-Moses etal**.** (2024) emphasized that when facilities are provided to meet relevant needs of a school system, students will not only have access to the reference materials mentioned by the teacher, but individual students will also learn at their own pace and there is room and necessary equipment for the teacher to do further research and constant practice.

In Tanzania, secondary school education occupies a pivotal role in the functioning of the economy and the education itself. Experience shows that, the majority of the people in both the private and public sectors are expected to be secondary education leavers. The whole primary education system relies on teachers who are products of the secondary education system. Candidates of higher and tertiary education and training and universities are products of the secondary education system. This is the essence of being pivotal (URT, 2010). Since 2001, the Tanzanian government has taken many initiatives to reform its primary and secondary education systems to achieve this pivotal role. These reforms include implementation of Primary Education Development Programme (PEDP) from 2002 to 2006 and Secondary Education Development Plan (SEDP) starting in 2004 and free education for all policy in 2016, all focusing on the Tanzania development strategies in combating ignorance, disease and poverty along the line with the National vision 2025 (Samra and Rajani, 2006).

Statement of the Problem

In Tanzania, The Tanzania Institute of Education (TIE), stipulates that in secondary schools there should be adequate infrastructure, standard physical resources and facilities to be provided to public schools by both central and local governments, TIE (2013). These include classrooms, laboratories, libraries, ICTs, and dormitories. In the case of Tanzania, Ubungo District in particular, the government has improved school infrastructure from 2015 to 2020 and student results have improved significantly compared to previous years. It is in this context that the researchers sought to find out the extent to which the government had succeeded in providing necessary infrastructural facilities and personnel in secondary schools. Unfortunately, research has not yet been fully assessed the available infrastructural facilities and personnel for teaching physics in secondary schools. Therefore, this study was conducted to assess the same.

Objectives of the study

The main purpose of this study is assessment of infrastructural facilities and personnel for teaching Physics in Tanzanian secondary schools, case of Ubungo district.

In order to accomplish the core objective of the study, the following specific objectives were attained:

1. To gauge the effectiveness of personnel in relation to the teaching of physics in Tanzanian secondary schools.

2. To explore the effect of infrastructural facilities on effective teaching of physics.

3. To determine the influence of school environment to effective teaching and learning of physics in Tanzania secondary schools.

4. To assess the effectiveness of teaching strategies employed in teaching physics subject in secondary schools.

Research questions

1. Are there adequate infrastructural facilities for teaching Physics in secondary schools in Ubungo district, Tanzania?

2. What is the quality of personnel involved in the teaching of Physics in Tanzanian secondary schools?

3. What are the effects of teaching strategies employed in teaching physics subject in secondary schools?

4. What is the role of school environment in the effective teaching and learning of physics subject?

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Scope and Limitations of Study

This study tried to cover the level of infrastructural facilities and personnel available for teaching Physics in secondary schools in Tanzania, specifically in Ubungo district.

The following are the limitations of the study:

Financial barrier- Insufficient funds tend to retard the efficiency of the researcher in finding necessary and most relevant materials, literature or information and during the process of data collection such as access to internet, preparation of questionnaire and conducting of interviews.

Time barrier- The researchers were simultaneously engaged in this study while continuing with their studies. This consequently reduced the time dedicated for the research work and minimized the work efficiency.

Poor cooperation- During the study, researchers faced a challenge of poor cooperation from students, teachers and school administrators.

Significance of study

The findings of the study will be of many benefits to the Tanzania ministry of education, as it will help to provide adequate and necessary facilities that will promote effective teaching and learning of physics in secondary schools. The study is also expected to benefit greatly the experts and teachers in secondary schools as the study pinpoints the causes of poor or declining performance in physics subject in Tanzania. This research also serves as a resource base to other scholars and researchers who intend to embark on further research in this field.

LITERATURE REVIEW

The researchers used Maslow's Hierarchy of needs to supplement the socio-cultural learning theory.

It is probably safe to say that the most well-known theory of motivation is Maslow's needs hierarchy theory (Jerome, 2013). This means that even in education setting as well as during teaching and learning process, Maslow's hierarchy of needs should be highly considered so that the students achieve excellence by creating good environment for studying. The importance of this theory is to have safe learning environment, to ensure that teachers, other staff and students are safe. Every person has strong desire for appreciation, acceptance and recognition from others to build more confidence and be more creative (Mawere etal., 2016).

Many studies have been done to assess the availability of infrastructural facilities and its influence on student's academic performance, it includes;Usaini and Bakar (2015) investigated the influence of the school environment on the academic performance of secondary schools in Malaysia .The researchers used a descriptive survey design. The sample size was 377 and sampling techniques were stratified random sampling (Kothari, 2019). They used regression to analyze data. The study findings indicated that students from schools with adequate facilities, good teachers and favorable environment performed better than those from schools with less or inadequate facilities. The research concluded that there is a need to improve the availability of facilities in schools to create a good teaching and learning environment. Although the findings of this study seem to be valid, this research used a single approach to collect data, which is limited as a research methodology and can result into inability of the researchers to collect data and to capture the true image of the problem under study.

Ntahomvukiye and Sikubwabo (2024) conducted a study on the Impact of physical facilities on Students level of motivation and academic performance in Nigeria. The researchers used a quantitative approach and the sample size was 1050. The researchers did not show the sampling techniques used in their research. They employed questionnaires and inventory methods to collect data. Their findings show that some physical or material resources are available in public schools to motivate students towards learning but these are not found in all secondary schools. Even though, the study was complex due to the use of quantitative methods as the only approach in the study this leads to a lack of some basic information. Ngwaru and Oluga (2015) performed a study on education and resources for sustainable access to schooling and educational outcome in Tanzania. The

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researchers used a mixed–methods approach employing questionnaires, interviews, and observations instruments for data collection. The study found that the windows in the classrooms were very small so that the doors had to be left open all the time, causing the dust to come in through the door. The floor also had holes and a school building collapsed, luckily, nobody was hurt in this incident. The textbooks, chairs and other equipment too were inadequate leading to overcrowding of students.

The Knowledge Gap

Many studies related to school infrastructure investigated the influence of school infrastructure to students' academic performance such as Parnwell (2015), Koroye (2016) and Gichu, Kibaara and Njagi (2017) as well as (Kimeu, Tanui & Ronoh, 2015) but they used a single approach. One of the weaknesses of using a single approach is that it may fail to capture some important information according to the nature of the study.

The current study used a mixed approach to build on knowledge and strength of the data collection on both qualitative and quantitative approaches in understanding the phenomenon under study in detail. Moreover, geographically most of the studies related to this study have been done in developed countries like the United States of America, Indonesia, and the Malaysia, and the other developing countries like Cameroon, India, Pakistan Nigeria, Kenya, and Uganda. Only a few studies such as, Kapinga (2017) and Gasper (2015) were conducted in Tanzania. Furthermore, in Ubungo District there are no documented researches about the assessment of infrastructural facilities and personnel for teaching physics in secondary schools. So, the researchers decided to investigate this problem in Ubungo district.

RESEARCH DESIGN AND METHODOLOGY

The researchers used the mixed research approach whereby both quantitative and qualitative methods are used to collect and analyze data. In the current study, these approaches helped the researchers to obtain more details and specific information about the problem of the study. It also gave freedom to the researchers to use narration and numbers during data analysis on the assessment of infrastructural and personnel for teaching physics in secondary schools.

Among the types of research design is convergent parallel, which meant the researchers simultaneously collect the quantitative and qualitative data in the same phase of the research process, weigh the methods equally, analyze the two components independently and interpret the results together (Creswell, 2018). The researchers collected data from students and teachers by using a questionnaire, and then the researchers analyzed the data collected by using qualitative and quantitative methods of analysis. The researchers went to the specific schools to administer questionnaires to teachers, and students then met with the heads of schools for the interviews.

The target population for this study involved all Physics students (5168), physics teachers from five (5) secondary schools who made a total of 15, heads of schools from (5) secondary schools and (1) District Education Officer in Ubungo District, totaling to 5189.

The study was conducted in Ubungo district. Ubungo municipal council is one of the five (5) municipalities that constitute the city of Dar-Es- Salaam which is the major business city of Tanzania. Ubungo is bordered by Kibaha district to the south, Kinondoni district to the North-East and Kisarawe district to the East (see Figure 3.1).

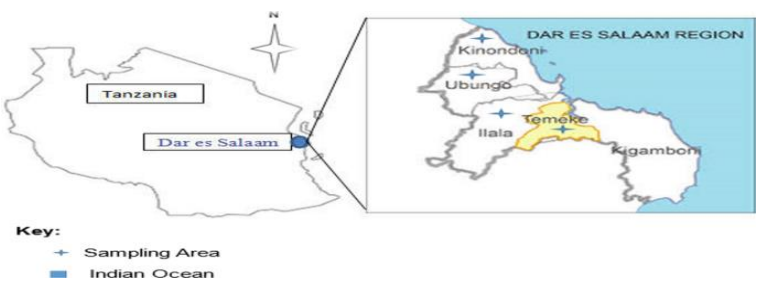

Figure 3.1: Map of Ubungo district in Tanzania

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The municipality is well linked by roads and other communication networks to the rest of the city and other parts of the country. Major road links are Morogoro-road, Mandela –road and Sam Nujuma –road. The municipality has a total area of 260.40 square kilometers and population about 1,086,912 according 2022 population census. It comprises of 69 secondary schools of which 28 are government owned school and 41 are private owned schools.

In the current study, the researchers employed both probability and non-probability sampling techniques to select participants from five secondary schools. In probability sampling, simple random sampling technique was used to select teachers and students, Singh & Masuku (2014). Non-probability sampling technique was used to select participants who had full information about school infrastructure and teaching personnel. In the current study the researchers employed purposive sampling technique for the District Education Officer and Heads of schools.

The researchers used Yamane formula (1967) to compute the sample size.

$$\mathbf{n} = \frac{N}{1+N(e)^2} \quad (1)$$

whereby n = sample size, N = total population and e = level of precision. The level of precision is 0.1, 0.05 or 0.07 depending on the size of the population. Thus, the sample size of students was 5168, then, n = $\frac{5168}{1+5168(0.1)^2}$ = 98 Therefore 98 students were selected from 5 secondary schools. Likewise, 15 Physics teachers constitute from the population thus, to get the sample size of teachers n = $\frac{15}{1+15(0.1)^2}$ =13 Therefore 13 teachers were selected from 5 secondary schools. Also, the researchers purposively selected 4 heads of schools and 1 District Education Officer from Ubungo District. To obtain a sample size of students and teachers of each school the researchers used the proportional sample size to find the number of students and teachers who would be given the questionnaire. The researchers used a formula that is due to Singh & Masuku (2014) which stated that;

$$\boldsymbol{n_i} = \frac{\boldsymbol{N_i}}{\boldsymbol{N}} \times \mathbf{n} \quad (2)$$

Where:

$\boldsymbol{n_i}$ = Proportional sample size to each school,

$\boldsymbol{N_i}$ = Total number from each school

N = Total population of students for the 5 secondary schools, **n** = Main sample size obtained from Yamane formula.

Therefore By starting with students, the total number for each school was "A" =1393, "B" =1110, "C" = 1265, "D" =600 and "E" = 800, totaling to 5168 for five secondary schools. While main sample size obtained from Yamane formula was 98. To get the number of students involved in answering the questionnaire for each school the researchers used equation (2), and the results are summarized in table 3.1.

Table 3.1 Numbers of Students Involved in Answering the Questionnaire

SCHOOL	N_i	**N**	n_i	**n**
A	1393	5168	26	98
B	1110	5168	21	98
C	1265	5168	25	98
D	600	5168	11	98
E	800	5168	16	98

Therefore, from school A were 26, B = 21, C = 24, D = 11 and E = 16 of the respondents used in data collection. In total there were 98 students. The total number of teachers for each school was "A" =52, "B" =49, "C" = 16, "D" =36 and "E" = 33, totaling 186 teachers for five secondary schools. While the main sample size of teachers

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obtained from Yamane formula was 65. To get the number of teachers involved in answering the questionnaire for each school the researcher used equation (2) again.

Table 3.2

SCHOOL	N_i	**N**	n_i	**n**
A	3	15	3	13
B	2	15	2	13
C	3	15	3	13
D	4	15	4	13
E	3	15	3	13

Therefore, using equation (2), from school A was 3, B = 2, C = 3, D = 4 and E=3 of the respondents were used to collect data. The total number of the sample size was therefore 13 teachers (see table 3.2).

Sampling of Secondary Schools

In Ubungo District, there are 28 government owned secondary schools. The researchers selected five schools from Ubungo District by using a non-probability sampling procedure (purposive) to select secondary schools. The researchers used this method because these schools had poor performance in physics for consecutive three years, and therefore, the researchers observed the availability of necessary facilities responsible for teaching physics in these secondary schools.

Simple random sampling was applied to select 5 secondary schools from the target population of 28 public secondary schools in Ubungo District. 98 students out of 5168 students were selected by using simple random sampling and stratified sampling techniques. Stratified sampling technique to students was based on gender (female and male) and class level. In the current study, the researchers used the simple random sampling to sets of blank and numbered pieces of paper; those who picked the papers with numbers are the ones that were taken as respondents. Sampling of Teachers, 65 teachers out of 186 teachers were selected by using a stratified and simple random sampling technique. Also, stratified sample technique to teachers' status based on gender, level of education and experience in working place. Teachers were put in different categories such as gender and teaching experiences.

Five heads of schools were selected from public secondary schools out of 28 secondary schools by using purposive sampling. The researchers also used purposive sampling to District Education Officers from the Ubungo district in the study to get more detailed information about the topic under study.

Table 3.3 Summary of Sample Size

No	**Categories**	**Target population**	**Respondent**	**Sampling techniques**
1	Students	5168	98	Simple random and stratified sampling
2	Teachers	15	13	Simple random and stratified sampling
3	Head of schools	5	5	Purposive sampling
4	DEO	1	1	Purposive sampling
Total			117	

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Source: Researchers 2022

Table.3.3 describes the composition of the sample size, whereby participants who were involved in the study were 117. The respondents who were involved in the interview were 6, while 111 participants were involved in answering the questionnaire: 13 teachers and 98 students.

The current study employed questionnaires, interviews, and observation in data collection

In the current study, both close-ended and open-ended questions were employed. The researchers selected 13 Physics teachers and 98 students that helped to get detailed data from dissimilar sources, as well as they, had a wider chance of giving detailed explanations.

The researchers used open-ended interviews for the heads of schools and the District Education Officer through face to face and note-taking. The techniques were flexible as they allowed the researchers to restructure any question accordingly in order to obtain appropriate information. Opdenakker (2006) stated that the advantage of a structured interview is that the interviewer has a lot of possibilities to create a good interview environment.

The researchers encouraged freedom, openness among the interviewee assuring them of confidentiality of information that was provided. The use of interviews too, helped the researcher to get more information, and provide in-depth data.

In this study, the researchers employed non-participatory observation whereby a researcher made a visit to observe school infrastructure in each school. Also, the researchers prepared an observation schedule which was used in the process of data collection. The researchers assessed the presence of classrooms with chairs and tables, library, laboratories, ICT room and art room that preserves artistic tools.

The researchers conducted a pilot study to test the instruments of data collection in one public secondary school in Ubungo District to validate the questionnaire and to ensure the reliability of the questionnaire, Hassan, etal. (2006).

In this study, the researchers used different ways to ensure the validity of the research instruments. Likewise, the researchers ensured that the face and content validity was maintained through triangulation and maintaining trustworthiness. The face validity was tested through careful preparation of tools by observing its clarity, appearance, consistency of arrangement as well as grammatical aspects of language (Mugenda 2003). Triangulation ensured the validity of the process through corroborating evidence from different individuals, types of data, and different methods of data collection (Fusch & Ness 2018). The researchers used different methods to make sure the instruments were valid. Moreover, before starting the data collection process, the researchers passed the instruments to the researcher experts and academic peer groups for purposes of testing and proofreading the instruments for validity. The researchers proceeded because the instruments were found to be clear.

The researchers also used the split-half to assess the reliability of the data, Mugenda (2003). The coefficients of 0.6, 0.7 and 0.8 or more suggest there is a high degree of reliability of the data. In the current study, the researchers used Statistical Package for Social Sciences (SPSS) to examine the strength of the instrument whereby, the piloted questionnaire was recorded by number and then, coded into the SPSS program in the scale for processing and interpretation. The result correlated positively at 0.7 or 70 percent. Therefore, the result was strong and reliable because the coefficient of the instrument was high.

DATA PRESENTATION, ANALYSIS AND DISCUSSION

A total number of 111 questionnaires were administered to the teachers and students whereby 13 questionnaires were administered to Physics teachers and 98 questionnaires were administered to students from five secondary schools selected in Ubungo District. All the 111 questionnaires were completed. Also, a total of 6 interviews were conducted to the heads of schools and District Education Officer whereby 5 heads of schools were interviewed and one District education officer (DEO) from Ubungo District was also interviewed. Finally, the

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researchers made observations on five secondary schools in Ubungo district. This helped the researchers to make correlations from one research tool to another.

Teachers Demographic Information

Table 4.1: Teachers demographic information (n = 13)

ITEM	CATEGORY	FREQUENCY	PERCENTAGE %
Gender	Male	2	15.4
	Female	11	84.6
Age	24-33 Years	9	69.2
	34-43 Years	3	23.1
	44-53 Years	1	7.7
	54 and above	0	0
Education level	Diploma	3	23.1
	Bachelor	10	76.9
	Masters	0	0
Working experience	5 Years and below	12	92.3
	6-11Years	1	7.7
	12 Years and more	0	0
	Total	13	100

Source: Field data, (2022)

Table 4.1 above indicates the distribution of teachers based on their gender as 84.6 percent of 13 of the respondents were male teachers while 15.4 percent of the respondents were female teachers. The study included the gender of the participants to avoid acquiring biased information.

Table 4.1 also shows that the age difference of teachers being 69.2 percent of teachers aged 24-33; 23.1 percent aged 34-43 and 7.7 percent aged 44-53. This signifies that the majority of teachers were young adults. Therefore, the findings revealed that teachers were aware about importance of infrastructural facilities required in the teaching of physics subject.

Table 4.1 also shows that 23.1 percent of the respondents had a diploma in education, 76.9 percent of the respondents had a Bachelor's degree, and none of the respondents had a master's degree in education. This reveals that the majority of teachers had a Bachelor's degree and few headmasters were degree holders.

Table 4.1, in addition highlights the teaching experiences of the respondents whereby 92.3 percent of the teachers had taught for a period of 5 years; 7.7 percent of the teachers had taught for 6-11 years while none of teachers had taught for 12-20 years. This supposes that most teachers who have more than 11 years are likely to be given other positions due to their seniority. Also, the majority of teachers indeed gave out desirable information as they had much experience with school infrastructure. The long duration of experience as teachers in secondary schools enabled them to better understand the availability of infrastructural facilities and personnel for teaching a subject. They were also aware of the school's infrastructure in connection with students' academic performance.

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Students' Demographic Information

The student demographic information aimed at establishing the participants' gender, age and level of education as presented in table 4.2

Table 4.2 Distribution of Students Demographic Information (n = 98)

ITEMS	CATEGORY	FREQUENCY	PERCENTAGE
Gender	Male	47	48
	Female	51	52
Age	13-16 Years	25	25.5
	17-20 Years	70	71.4
	21 and above	3	3.1
Class level	O – level	98	100
	A – level	0	0
Total		98	100

Table 4.2 shows the distribution of students' respondents based on gender, whereby; 48 percent were male students and 52 percent were female students. This shows the almost equal chance for both male and female students in accessing education. Hence, in the area where the study was conducted the number of females in schools is higher than the number of males.

Table 4.2 also shows that 25.5 percent of the students were aged between 13-16 years, while 71.4 percent of students were aged between 17-20 years. However, 3 percent of the 98 students were aged 21 years and above. This implies that students were within the secondary education active age and they were aware of the importance of school infrastructures as well as the need to achieve better academic performance.

The data in table 4.2 also show that 100 percent of students were at an ordinary secondary school level, whereas none of them were at an advanced secondary school level.

Availability of Infrastructure facilities for teaching physics in Public Secondary Schools

The findings of this study revealed that school infrastructures like classrooms, laboratories, library, Information Communication Technology (ICT) rooms, dormitories, chairs, desks and art room were not available as indicated in the findings shown in Figure 4.1

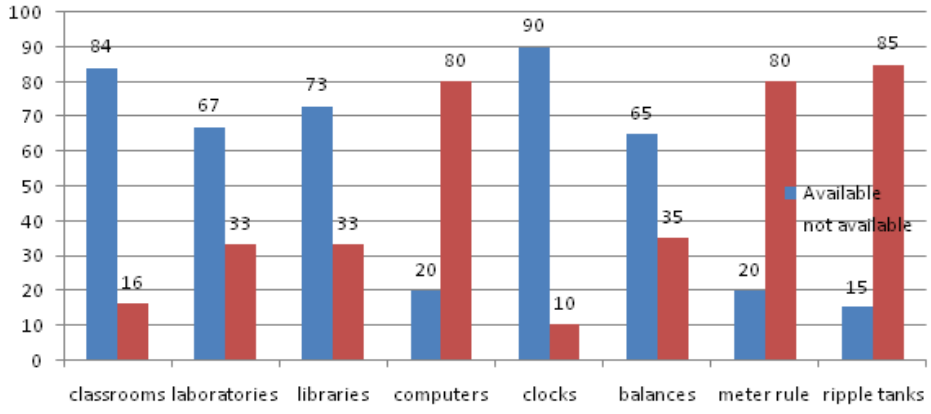

Figure 4.1 Availability of Infrastructure facilities (Students Responses)

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Figure 4.1 shows that 16 percent of the respondents indicated that classrooms were not available, 84 percent of the respondents answered that classrooms were available. On the other hand, 33 percent of the respondents agreed that laboratories were not available, while 67 percent of the respondents agreed that, laboratories were available. The findings indicate that a higher percentage of respondents agreed that classrooms and laboratories were available. From the findings, it is shows that a higher percentage of respondents agreed that classrooms automatically result in better influence in the teaching and learning process which enabled getting better results. Few laboratories were available because not all public secondary schools had the said infrastructure.

Furthermore, Figure 4.1 indicates that 73 percent of the respondents indicated that libraries were not available while 27 percent of respondents noted that libraries were available. However, 80 percent of respondents showed that computers were not available, while 20 percent of respondents noted that computers were available. Likewise, 10 percent of the respondents showed that stop clocks were not available, while, 90 percent of the respondents showed that the stop clocks were available. This means that the school infrastructure was not adequate compared to the number of students.

Figure 4.1 also shows that 35 percent of the respondents indicated that weighing balances were not available, while 65 percent of the respondents indicated that they were available. Finally, 85 percent of respondents indicated that ripple tanks were not available; while 15 percent of respondents indicated that ripple tanks were available. These findings imply that although there are some efforts made by the government to ensure that this problem is eliminated, the problem still exists in most of the schools due to the increase of student numbers, especially the enrolment of students from primary to secondary education. Therefore, unsatisfactory instructional materials and physical facilities in most schools affect academic performance.

In this study, teachers from five selected secondary schools responded on the availability of infrastructure. Their responses are as shown in the Figure 4.2

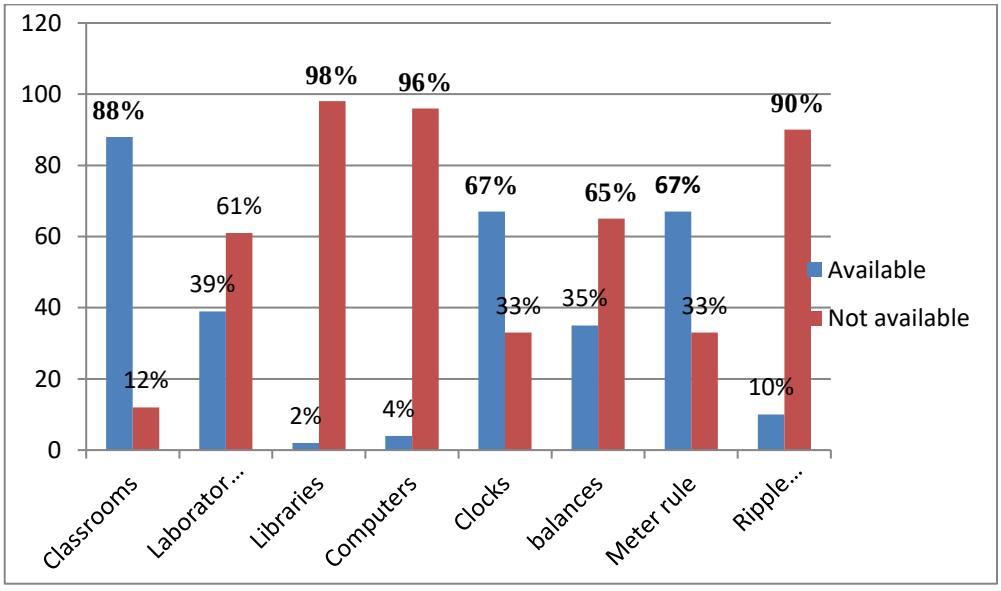

Figure 4.2 Availability of Infrastructure facilities (Teachers Responses)

Figure 4.2 shows that 12 percent of the respondents responded that classrooms were not available and 88 percent of the respondents said that classrooms were available. This implies that some of the schools in Ubungo district did not have enough classrooms, a situation that made students be overcrowded in the classrooms, leading to poor students' academic performance.

The researchers observed that there was a shortage of classrooms compared to the number of students enrolled in the schools. The researchers got permission from the head of school "B" to observe the real situation, the researchers saw the students were squeezed in such a way that it became difficult for them to stand up for the greetings. This observation is supported by Thing (2016) who states that small classroom size leads to poor understanding and lack of confidence in some students.

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Figure 4.2 further shows that 61 percent of the respondents agreed that laboratories were not available and 39 percent of them said that laboratories are available. This finding implies that most public secondary schools do not have enough laboratories for students to do practical; which will be a contributing factor in their dismal performance. Maslow's Hierarchy of needs in part of esteem suggests that in order to achieve something, motivation is very important to influence various activities as well as students to do well in their studies.

"*In Tanzania, we do not have enough scientists because in many secondary schools there are not enough laboratories where students can do their practical*" one teacher remarked (Interview, July, 2022).

There is a need therefore for more well-equipped laboratories to be added in rural public secondary schools, and not just buildings.

The study findings presented in Figure 4.2 above also indicates that 98 percent of the respondents affirmed that libraries were not available and 2 percent of respondents noted that libraries were available. This implies that students need to interact with the school environment by using libraries to be able to build a study culture. The observation made by the researchers also showed that in most public secondary schools there is a lack of libraries and facilities like books, magazines, newspapers, and other documents. Ali, etal. (2017) added that a school library plays an active role in learning, in the educational process where it helps students continue education effectively. In this study those students who were observed in the field were seen using notes provided by the teachers without other supplementary materials that can be obtained from the library. This leads to the lack of abilities among the students to acquire and develop knowledge and skills on their own. The head of school "A" said;

"*There are problems with libraries, there are no textbooks, the books which we have are those used by teachers for teaching only, if we tell the students to read, they read only what they have been given by their teacher in the classroom. Also, the teachers cannot prepare lesson notes from various textbooks to enhance students' knowledge"* (Interviewee "A" July 2022).

The culture of teaching and learning goes hand in hand with things that are closely related. There is also an interaction between the study materials and students. Therefore, a library is a source of knowledge, skills, and creativity for students and teachers, to enable them to implement the school goals.

Figure 4.2 also displays that 96 percent of the respondents show that ICT facilities like computers are not available and 4 percent of the respondents noted that Computers are available. This implies that most schools do not have ICT resources to facilitate teaching and learning. Thus, the absence of computers with its facilities are detrimental to the student's ability to reason. The study also observed that four schools had no computers except one school which had one computer. To effectively achieve the 21st century skills, educational institutions need to utilize ICT to enrich the students with skills and knowledge. This means that the use of computers in secondary schools at this time is very helpful in the learning and teaching process. The government should provide appropriate facilities for information and communication technology to help the youth to advance in science and technology and acquire necessary knowledge related to the subject.

Likewise, 90 percent of the respondents showed that ripple tanks were not available and 10 percent of the respondents shows that ripple tanks were available.

In general, the information obtained from the interviews with the heads of schools stated that school infrastructure was inadequate, as compared to the number of students. This situation was reported by all the five heads of the schools. On this, the head of school "A" said,

"*School infrastructure that inspires students to study and succeed in their studies such as libraries and physics laboratories does not exist. Also, boys' toilets are very few compared to the 680 boys' out of 1128 students in school. There are very few chairs and tables for students and teachers; as a result, teachers stay outside to prepare lesson notes*" (Interviewee "A" July, 2022).

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Below is a summary of the infrastructure found from all five (5) secondary Schools as given by the Heads of schools.

Table 4.3: Infrastructure facilities available in five (5) secondary schools

S.N	Type of facility	Requirements	Available	Not available
1	Laboratories	15	5	10
2	Library	13	3	10
3	Computers	104	4	100
4	Balances	15	6	9
5	Stop Clocks	90	60	30
6	Meter rule	100	85	15
7	Ripple tank	10	1	9
8	CRO	10	0	10
9	Micrometer screw gauges	100	54	46
10	Vernier Calipers	100	44	56
11	Gold leaf electroscopes	15	5	10
12	Projectors	10	0	0
13	Wall charts	50	20	30

Source: Heads of Schools, July, (2022)

Effectiveness of personnel in relation to the teaching of physics

Researchers provided open ended and close ended questions to both physics teachers and the students from all five (5) selected secondary schools, their response are well described below.

The researchers also provided other probing questions to gauge the Students ability of performing physics practical and demonstrations .Their responses are as follows:

Table 4.4: Students' ability to perform physics practical and demonstrations

S.N	Name of school	No of students able	Total no of respondents	Percentage
1	A	15	26	58
2	B	10	21	48
3	C	6	24	25
4	D	4	11	36
5	E	8	16	50

Source: field data, July, (2022)

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The findings presented in table 4.4 above show that 15 of the respondents from school '**A'** were able to perform physics practical and demonstrations out of 26 of the total respondents which is about 58 percent of the total respondents, While 10 of the respondents from school '**B'** were able to perform demonstrations and practical out of 21 of the total respondents which is about 48 percent of the total respondents. Furthermore, table 4.4 reveals that 6 respondents from school '**C'** were able to perform it out of 24 of the total respondents which is 25 percent of the total respondents.

Also, the table indicates that only 4 respondents from school '**D'** were able to perform the experiments and demonstrations out 11 of the total respondents which is about 36 percent of the total respondents. Finally, only 8 respondents from the school '**E'** were able to perform the experiments out of 16 of the total respondents which is about 50 percent of the total number of respondents. With no doubt, it can be observed about three (3) schools out of five selected schools under the study their percentage of the respondents who are able to perform experiments is less than 50 percent , as is indicated in the table for school B, C, and D respectively. Schools A and B have percentage above 50 percent.

This implies that, most of the students from the visited schools were unable to perform any physics practical or demonstrations, and some of those who were capable were unable to do it in a correct manner. The situation is very serious since the practical takes a part in the final examination and demonstration helps the learners to understand the difficult concepts related to the subject as well as building the sense of love to the subject and increase student motivation. It can be realized that many of the students fail to perform experiments and demonstrations due to a number of factors including the teachers who fail to be responsible in teaching and guiding the students to perform those experiments and demonstrations.

Also, the researchers provided the closed ended questions to the physics teachers from five selected secondary schools aimed at determining their effectiveness on their teaching based on the numbers of experiments performed by their students per each term. The results obtained are represented in the pie chart in Figure 4.4;

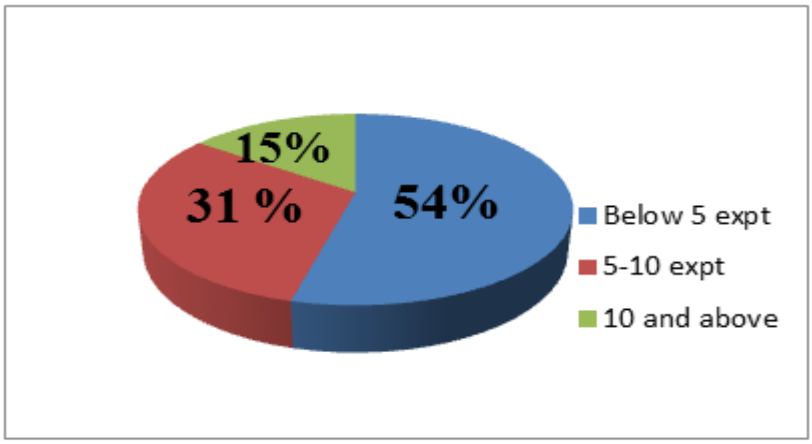

Figure 4.3 Percentage distribution of number of experiments provided by teachers per week

Figure 4.3 shows that only 15 percent of all respondents (physics teachers) from five selected schools provide ten (10) experiments and above to the students per term, While 31 percent of all respondents (teachers) provide 5 up to 10 experiments to the students per term. Finally about 54 percent of all respondents provide below five (5) experiments to the students per term. This implies that the number of experiments done by the students per term which make them to acquire minimum skills and knowledge and hence become competent is minimal. The question arises, what is the cause of this, it may be due to a number of factors including some teachers to be irresponsible. Furthermore most of those laboratories were less equipped lacking important apparatus and equipment for performing physics practical. The head of school 'A' was quoted;

"*The problem should not be laid on the teachers alone, but also on the poor conditions of our*

Laboratories with less equipment. The daily class timetable does not include practical as part of it" (Interviewee "A" July, 2022).

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CONCLUSION AND RECOMMENDATIONS

Conclusion

The study found that most of the public secondary schools in Ubungo district have unsatisfactory infrastructural facilities which leads to poor performance for the students in the physics subject. Vygotsky theory, correlates teaching and learning materials tools like , tables, the library, the classroom, laboratory and other facilities which will assist students to capture faster and apply it to their examinations and in their daily life. Therefore, when there are inadequate school facilities, it means that students' academic performance will be poor. These findings are in line with Koroye (2016) who says that if schools do not have adequate physical facilities such as classrooms, laboratories, libraries, and dormitories it will affect students' academic performance. This idea means that with the investment of school infrastructure, students can perform well in academic issues. Therefore, according to the findings, for the students to perform, conducive environment can facilitate high academic performance to students, especially in public secondary schools. Moreover, the findings revealed that most of the public secondary schools in Ubungo District have inadequate libraries, Classrooms, Physics laboratories, Computers and others to facilitate the teaching and learning process. It is very difficult for them to focus on self-study hence poor student academic performance.

The research findings from a questionnaire distributed to teachers and students indicated that some of physics teachers available in those schools were irresponsible, as it was proved by many of the students from those schools, that they were unable to perform experiments and demonstrations. Also very few experiments were administered to the students per term. Furthermore the findings revealed that most of physics teachers employed student centered pedagogy through group discussion, observation, field visit and experiments. Among the factors that hinder the effective performance of teachers in those schools are poor working conditions, less equipped laboratories and lack of necessary instructional resources.

Recommendations for Action

The researchers recommend the following; the government needs to design standard school infrastructure according to the current situation; school infrastructure should be improved in the area to enhance students' academic performance by increasing more access to instructional materials and equipment. This will enhance students' understanding, awareness and ability to perform well academically. Also the government should employ many physics teachers in public secondary schools to fill the gap of inadequate physics teachers in public schools where the demand is still very high. Lastly, the ministry of education should ensure good school infrastructure in all public secondary schools to enhance performance in the physics subject.

Recommendation to the heads of the schools: The school academic committee needs, from time to time to assess the school's infrastructure in their schools to ensure that a conducive environment is maintained for teaching and learning for their students. Heads of schools too should motivate their teachers and students by providing different strategies and skills to improve the students' academic performance. In addition, heads of schools need to put in more effort to overcome the challenges facing their schools associated with school infrastructure and aim to improve students' academic achievement by establishing different school projects.

The recommendation to the Physics teachers: They need to use their profession to enhance the teaching and learning of the subject. They need to build a sense of responsibility by providing more experiments to the students as well as encourage the use of related teaching aids during teaching and learning process and to prepare well themselves before lesson so as to effectively impart knowledge and skills to the learners and hence improve the performance of the students in the subject. Furthermore the teachers should motivate the learners to love the subject, and encourage the use of teaching strategies which are student centered.

Recommendation to the community members: Community members should provide more support in improving school infrastructure to ensure the provision of better and quality education by getting involved in schools and supporting to construct school infrastructure especially school libraries and other physical facilities to reduce overdependence on the government fund. Also the community should support the students who are studying Physics rather than discouraging them.

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Recommendations for Future Research

Since this study involved only five public secondary schools in Ubungo District in finding out available infrastructure facilities and personnel for teaching physics in secondary schools. A study based on the education ministry's budget toward improving school infrastructure should be done in order to improve students' academic performance in physics subject. This can be achieved by involving different stakeholders like donors, parents and community members. In a nutshell a well-funded education system is likely to promote effective teaching and learning processes as well as enhance students' good academic performance in the subject.

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