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AVAILABILITY OF ICT RESOURCES FOR TEACHING AND LEARNING BIOLOGY IN SECONDARY SCHOOLS IN THE SOUTHERN REGION, ERITREA

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Abstract

Purpose: The purpose of the research was to determine the availability of ICT resources for teaching and learning Biology in secondary schools in the Southern Region, Eritrea.

Methods: The study was carried out in secondary schools of the southern region, Eritrea. A descriptive survey research design was adopted. The study targeted 27 public secondary schools in the region. Stratified random sampling technique was used to get a sample of 12 secondary schools from 12 sub-regions. The sample of respondents of the study was drawn from these 12 secondary schools of 12 sub-regions. The respondents were 12 school directors, 34 Biology teachers and 175 grade eleven students. Questionnaires, interview and observation schedules were used as instruments for data collection. Questionnaire for Biology teachers and students, Interview Schedule for school Directors, were employed. Piloting and consultation were conducted to establish validity and reliability before the instruments were used for the actual data collection. The data collected included both qualitative and quantitative data. The quantitative data were analyzed using Statistical Package for Social Sciences (SPSS) version 22. The qualitative data obtained from the open-ended questions were analyzed thematically based on research objectives.

Results: The study found that that most of the sampled schools had inadequate ICT resources like computers, computer laboratories, projectors, televisions, video players, digital content, and the internet. These resources were not enough or available for use by Biology teachers in teaching and learning.

Unique Contribution to Theory, Practice and Policy: The researcher recommended that the Adequate ICT resources, including the internet, need to be provided in schools for teaching and learning Biology and other subjects.

Key Words: *ICT Resources, Biology, Secondary Schools*

1.0 INTRODUCTION

ICTs stand for information and communication technologies and are defined, for the purposes of this primer, as a "diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information (Mathevula & Uwizeyimana, 2014). Availability of ICT resources is one of the main factors for ICT integration in teaching and learning.examples of this ICT resources are desktops, projectors and photocopiers. If these resources are not available in schools, it can prevent effective use of ICT in classrooms. A study conducted in Chile on the availability and use of ICT revealed that even though favorable conditions were set, ICT integration was limited to a few specific resources like computer and projector (Brun & Hinostroza, 2014). Availability of ICT resources in the integration of technology in the classroom plays a vital role. Lack of ready access to technologies by teachers is a key barrier to technology integration in most developing countries. The finding of a study carried out in rural areas of South Africa showed that the main challenges that teachers had in using ICT in classrooms were scarcity of resources (Mathevula & Uwizeyimana, 2014).

A study to analyze the technological integration in teacher education was conducted in Ghana. The findings of the study showed that one of the challenges of Gahanna education system on integrating ICT was the lack of technological resources (Agyei, 2013). A similar result was also found by Manu (2014) in Nigeria. Finding revealed that challenges facing ICT usage were inadequate infrastructures like electricity and telecommunication services. Another study in Nigeria indicated that the level of availability of ICTs for effective use in teaching and learning was low in educational institutions (Asiyai, 2014).

A study was carried out to assess the availability, utilization and management of ICT facilities in teaching the English language in secondary schools in Kaduna State, Nigeria. The study showed that there was a dearth of ICT facilities in schools, absence of internet in most schools, very poor level of utilization of the available ICT facilities and constant electricity power failure during the instructional time. The study also revealed that most of the teachers lacked the knowledge and skills to use ICT in teaching. The majority, (78%) of the teachers considered their ICT training to be at a poor level, and this affected productivity. This study demonstrated that teachers have positive views on the use of ICT for teaching English (Yusuf et al., 2013).

A study to examine Availability and Utilization of ICT Resources in Teaching and Learning in Secondary Schools in Ardo-Kola and Jalingo, Taraba State, Nigeria, found out that: the availability, accessibility and utilization of ICT resources in secondary schools for teaching and learning was very poor. According to the responses of more than 80% of the respondents, ICT resources were not available in the schools under study; ICT resources can only be accessed and utilized by teachers and students if they are available in the schools for teaching and learning (Onwuagboke et al., 2014).

A study conducted to assess the availability and utilization of ICT for teaching and learning and to establish hindering factors for the use of existing ICT resources in secondary schools in Kwekwe, Zimbabwe. The findings showed that most of the ICT resources required for training were not available in the sampled schools, and those that were available were inadequate. The study also revealed that the available ICT resources were utilized to a very low extent. The research further identified the factors that were hindering the ICT utilization in these schools,

among which were lack of power supply, insufficient resources, fear of technology, lack of interest, ICT skills deficiency, higher ICT cost and poor physical infrastructure (Mavellas et al., 2015).

A research conducted in Ethiopia about integrating ICT in teaching and learning practice showed that some of the critical factors that have prevented integrating ICT in teaching and learning were lack of proper access to ICT resources, insufficient technical and pedagogical support. The analysis of the data indicated that integrating ICT into teaching-learning was yet to be realized (Alemu, 2015).

Eritrea has made a significant effort to reform its education system. The government of Eritrea believes that ICT has a role to play in improving both access and quality of education. Eritrea National ICT policy in education was prepared in 2005. However, as a study conducted ten years ago by hare 2007 indicated, Eritrea had low penetration level of ICT infrastructure like the internet, mobile phones and television; as a result, ICT access is limited to few people in urban areas. The hindering factors for the implementation of ICT in education in Eritrea were: poor ICT infrastructure and electricity, lack of ICT trained teachers and low literacy and awareness on ICT in education (Hare, 2007). It is not yet clear if the situation has improved or not. The researcher had, therefore tried to examine the availability of ICT services in Eritrea's secondary schools.

Statement of the Problem

The use of technology has influenced all human aspects of life, and it has an impact on how education is delivered. The Government of Eritrea, through the Ministry of Education, has placed effort in introducing a new curriculum that focuses on learner-centered, outcome-based interactive pedagogy. The new curriculum allows learners to actively participate in their learning. In addition to this, ICT policy in education has been launched for integrating ICT in education. While studying Biology is important for it generally helps us to get a better understanding about ourselves, the world and its natural processes, the performance of this subject in secondary schools in Eritrea was not satisfactory in the last five years. The performance of Biology, as indicated in table 1.1, was poor in the last five years. This can have a serious implication for the quality of education and discourage students from studying Biology. This problem of low performance could be solved by integrating ICT in teaching and learning of Biology.

Various researches conducted on ICT integration in education have proved that integrating ICT in teaching and learning improves the quality of learning and performance of learners. Moreover, ICT integration simplifies abstract and complex concepts, creates cooperative learning, and creates interest in learning among students. In essence, integration of ICT creates a learner-centered learning environment. Although the integration of ICT has many benefits that can be considered as opportunities, it also has numerous challenges. It demands educational transformation such as changing curriculum, assessment, and importantly changing role of teachers from being custodians of knowledge to being facilitators in pedagogy.

The effective integration of ICT in teaching and learning requires the availability of ICT resources, Teachers' preparedness on ICT integration, and attitude of teachers towards ICT integration in teaching-learning. However, it is not clear whether Biology teachers integrate ICT

in the classroom instruction with the purpose of improving teaching and learning of biology. This study, therefore, intended to examine the integration of ICT in teaching and learning of Biology in the Southern Region of Eritrea.

2.0 METHODOLOGY

This study used a descriptive survey research design. The study took place in the Southern Region Eritrea. The target population for the study comprised 27 public secondary schools of the southern region, 27 school directors, 78 Biology teachers and 1664 grade eleven Biology students of secondary schools of the southern region, Eritrea. In this study, stratified, purposive sampling and simple random sampling techniques were used. Stratified sampling was used to determine a sample of 12 schools from 27 public secondary schools. The school directors of the sampled schools were purposively selected to participate in the study. Simple random sampling technique was further applied to obtain Biology teachers and 10.5% of students of grade eleven, making 175 students from the sampled school. From the sampled school, three (3) Biology teachers, one teacher from the list of teachers who teach grade 9, grade 10 and grade 11 was randomly picked to participate in the study. The sample size of the study comprised of 221 secondary schools, school directors, Biology teachers and students. Three-research instruments were used for data collection: questionnaire, interview and observation schedule. The data collected included both qualitative and quantitative data. The quantitative data collected from the sampled secondary schools using teachers' questionnaire, students' questionnaire interview and observation schedules were organized, cleaned, coded and entered into a computer program Statistical Package for Social Sciences (SPSS) for analysis. The quantitative data were analyzed using descriptive statistics such as mean and percentages. The data were presented in the form of tables and figures such as percentages, bar graphs and pie charts.

3.0 FINDINGS AND DISCUSSIONS

3.1 Demographic Information of Respondents

3.1.1 Demographic Information of School Directors

This section presents the demographic information of the school directors who participated in the study. The demographic data explored in the study were gender, computer literacy and professional experience.

a) Gender of school directors

In the study, 12 school directors participated in the interview, and all the school directors were males. This shows that in the sampled school, there were not female school directors.

b) Computer training of school directors

The findings of the study show that all the school directors were computer trained and could able to play a role in supporting other teachers to use ICT in classroom teaching in their schools.

c) Professional experience of the school directors as principals

The distribution of school directors based on their professional experience was as described in table 1.

Table 1: Professional Experience of the School Directors as Principals

Years of experience	Frequency	Percentage (%)
1-5	4	33. 3
6-10	5	41.7
11-15	2	16.7
16-20	1	8.3
Total	12	100.0

Source: School Directors' Interview

The sampled school directors had varied professional experience in the current post as indicated in table 1. One-third of the directors (33.3 %) had less than or equal to five years of experience, 41.7% had between 6 and 10 years of experience. Other 16.7% of the directors had between 11-15 years of experience, and 8.3% had between 16 and 20 years of experience. This shows that most of the school directors (75%) had professional experience of less than ten years.

4.1.2 Demographic Information of Biology Teachers

This section presents the demographic information of Biology teachers involved in the study. Teachers were the main targets of the study because teachers mainly implement ICT integration. The demographic data explored were gender, age, teaching experience, computer literacy, class size and workload of teachers.

a) Gender composition of teachers

The composition of teachers based on their gender was as presented in figure 1

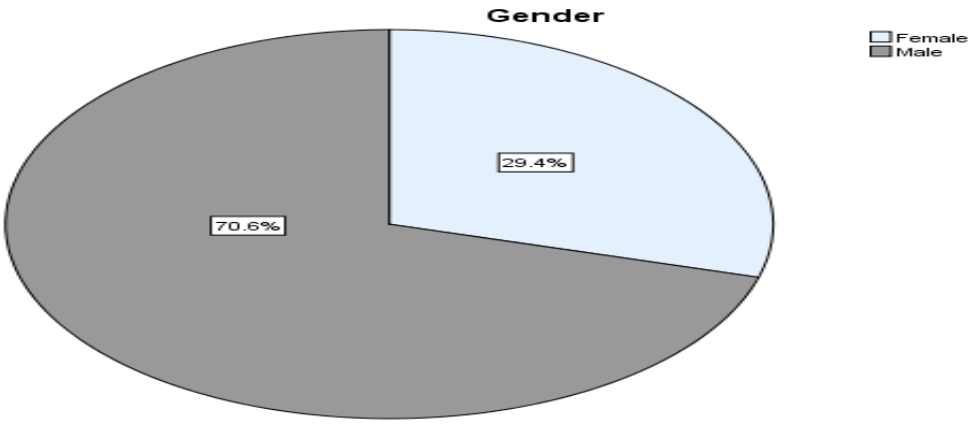

Figure 1. Gender composition of teachers

Source: Teaches' Questionnaire

The finding in figure 1 shows the gender composition of teachers who participated in the study. The greater part (70.6%) of the respondents were male teachers, and the remaining (29.4%) were female teachers. This shows that both male and female teachers participated in the study.

b) Age distribution of teachers

Age distribution of teachers was integrated into the study. The sampled teachers of Biology had varied distribution of age, as indicated in figure 2.

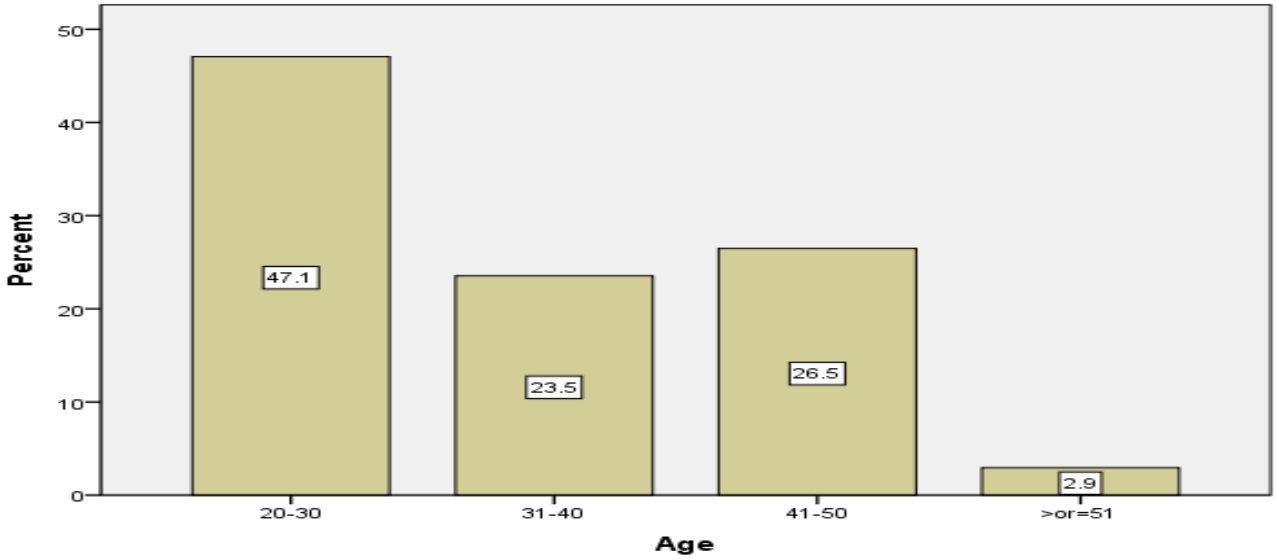

Figure 2. Age distribution of teachers

Source: Teachers' Questionnaire

Figure 2 shows 47.1% of the teachers were aged between 20 and 30 years, followed by 26.5% aged between 41 and 50 years. Another 23.5% were aged between 31 and 40 years. There was only one teacher aged above 50 years in the sampled schools. Majority of the teachers (70.6%) fall in the age range of 20 and 40 years. This shows most teachers that participated in the study were at young were they could easily accept the use of technology in their teaching.

c) Teachers' professional experience

The experience of teachers in their teaching profession was considered in the study. The distribution was as presented in table 2.

Table 2 :Teachers' Professional Experience

Experience	Frequency	Percent
1-2	10	29.4
3-4	5	14.7
5-6	6	17.6
7-8	4	11.8
>9	9	26.5
Total	34	100.0

Source: Teachers' Questionnaire

Table 2 shows 29.4% of respondent teachers had between 1 and two years of experience, seconded by 26.5% of the teachers who had nine and above years of teaching experience. Furthermore, 17.6% of teachers had the experience of between 5 and 6 years, and 14.7% of the teachers had experience of between 3 and 4 years, and 11.8% of teachers had the experience of between 7 and 8 years. The study found that the majority of the participant teachers were novice of 1-2 years and above 9 years of experiences. This shows that the teachers had different years of experiences in teaching.

d) Computer Literacy of teachers

The researcher sought information on computer literacy levels among Biology teachers. The Findings were as illustrated in Table 3.

Table 3: Computer Literacy of Teachers

Literate	Frequency	Percent%
No	3	8.8
Yes	31	91.2
Total	34	100.0

Source: Teachers' Questionnaire

From table 3, out of the 34 teachers of Biology, 91.2% had computer literacy training, while 8.8% had no computer literacy training. This shows that majority of Biology teachers had received computer literacy training, though the training was not adequate to have competency in computer.

e) Teachers' workload

The workload is the number of periods the teacher teaches in a week. The lowest and highest periods that the teachers had were 15 and 32, respectively. The mean of periods that a teacher had was 23 in a week. If teachers have a heavy workload, it can be a barrier to prepare ICT based classroom lessons.

f) Class size in Biology classrooms

Class size is the number of students in a classroom in a Biology lesson. From the sampled schools, the minimum class size was 46, and the maximum was 73 students in a Biology classroom. The average number of students per class in the sampled schools was 64. This is too large to manage the students' activity in the technology-enhanced learner-centered classroom instruction. In large class size, to use ICT and leaner-centered learning could be a challenge.

4.1.3 Demographic Information of Students

This section presents the demographic information of students involved in the study. The demographic data explored were gender and computer literacy.

a) Gender Distribution of Students

The gender distribution of students involved in the study was as presented in figure 3.

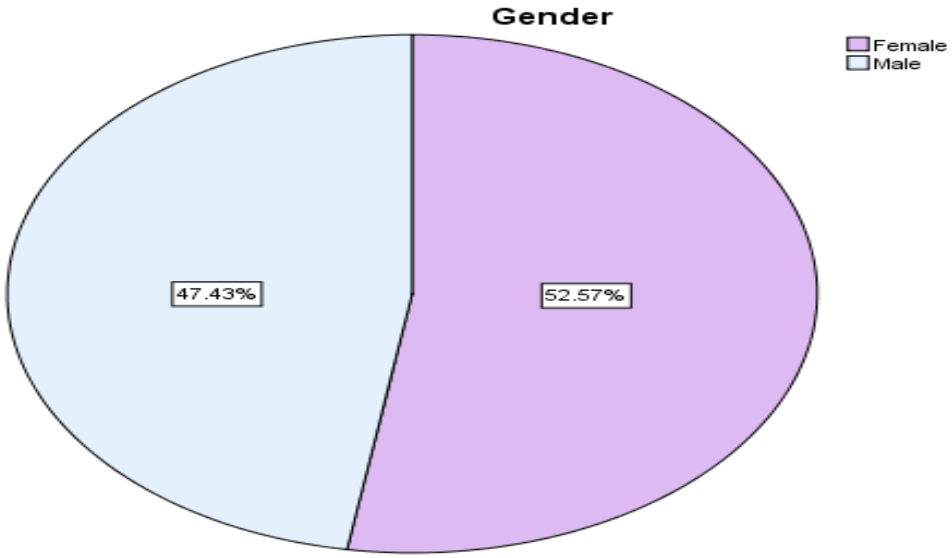

Figure 3. Gender distribution of students

Source: Students' Questionnaire

Figure 3 illustrates the gender composition of students participated in the study. Ninety-two representing 52.6% of the respondents were female students while eighty-three representing 47.4% were male students. This shows that both male and female students participated in the study.

b) Computer Literacy of Students

The level of computer literacy of students was also included in the study. The level of computer literacy of the sampled students was as presented in figure 4.

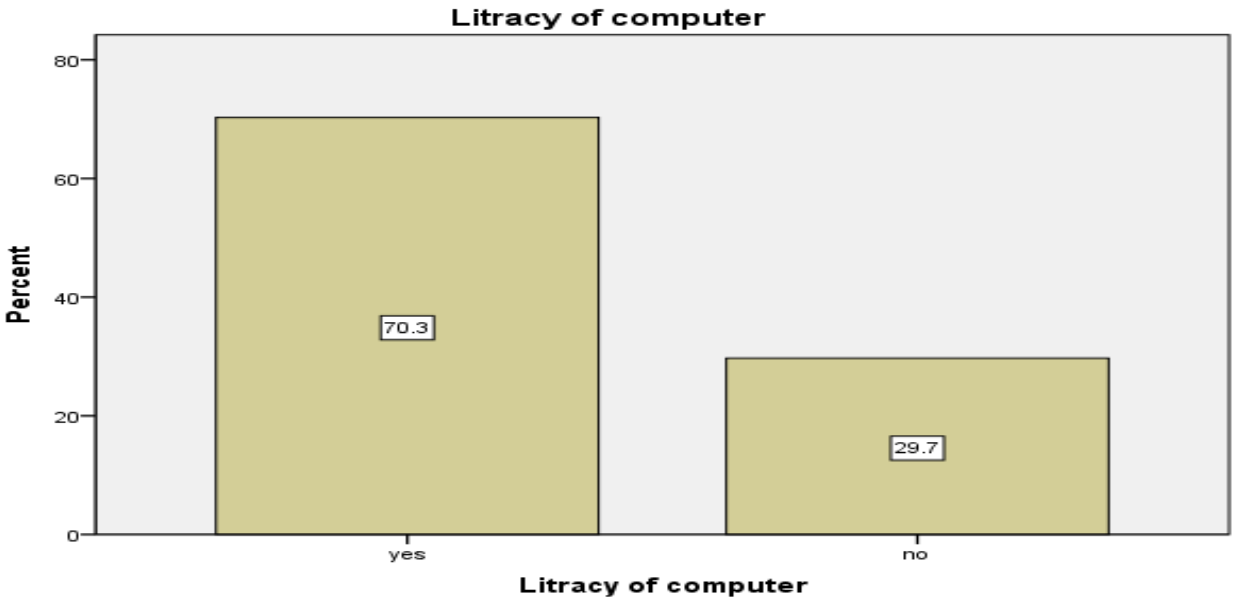

Figure 4: Computer literacy of students

Source: Students' Questionnaire

From figure 4 out of the 175 sampled students, one hundred and twenty-three representing 70.3% had computer literacy, while fifty-two representing 29.7% had no computer literacy. The finding shows that majority of the students had attended in computer training.

4.2 Availability of ICT Resources in Schools

The objective sought to determine the availability of ICT resources for teaching and learning of Biology in secondary schools of the Southern Region of Eritrea. To achieve the objective, data was obtained from an interview of school directors, observation checklist and from the questionnaires of teachers. Using the observation checklist, the researcher visited and observed the sampled twelve schools. The results of the availability of ICT resources in these schools are presented in table 4. This indicates any ICT resources available in the school that was used for teaching ICT and other purposes.

Table 4: Availability of ICT Resources in the Study Schools

NAME OF ITEMS	AVAILABLE	
	Frequency	Percentage (%)
Desktop Computers	12	100
Computer laboratory	10	83.3
Laptops	6	50.0
Projectors	7	58.3
Printers	11	91.7
Photocopier	4	33.3
Radios	3	25.0
Televisions	11	91.7
Video players	7	58.3
CDs, DVDs/VCDs	8	66.7
Storage of ICT resources	3	25.0
Digital content of biology	5	41.7

Source: Observation Checklist of Researcher

As shown in table 5, all schools had desktop computers on average of 20 computers per school. The available computer in the schools, however, were mainly used for teaching ICT as a subject. Majority (83.3%) of the schools had Computer laboratory (ICT lab). Ventilated and separate ICT storage was present in 25% of the schools. Half (50%) of the schools had laptops, 58.3% of the schools had projectors (overhead or LCD projectors). In addition to these, 91.7% of the schools had Television (TV), 66.7% of schools had digital storage devices like CDs, DVDs, VCDs. Video players were available in 58.3% of the schools. Majority of the schools had printers whereas only 33.3% of the schools had photocopiers. The digital content of Biology was available in 41.7% of the schools. Internet services were not introduced in the schools, and resources like tablets, smart phones and educational games were absent in the schools. These resources are very few and inadequate for teaching and learning of Biology. This finding was in tandem with a study conducted to analyze the technological integration in teacher education conducted in Ghana that showed one of the challenges of Gahanna education system on integrating ICT was lack of technological resources (Agyei, 2013).

These findings are also in tandem with a study conducted to assess the availability and utilization of ICT for teaching and learning and to establish hindering factors for the utilization of existing ICTs in secondary schools in kwekwe, Zimbabwe. The research showed that most of the ICTs required for training were not available in the sampled schools, and those that were available were inadequate. The study also revealed that the available ICT resources were utilized by teachers to a very low extent (Mavellas, Wellington and Samuel, 2015).

The power supply in schools is fundamental in the use of ICT resources in teaching and learning. Table 6 illustrates the distribution of power supply in the sampled schools.

Table 6:Power Supply in the Schools

Source	Frequency	Percentage
Electricity	6	50
Solar	5	41.7
Generator	1	8.3
Total	12	100

Source: School Directors' Interview

As indicated in table 6, all the sampled schools had power supply from different sources. Half (50%) of schools had electricity connection, whereas the remaining half were relying on solar energy and generator. The respondents revealed that there was frequent interruption and irregularity of power supply and this created inconveniences for the use of ICT in schools. Similar result was also found by Manu, (2014) in Nigeria. Research finding revealed that challenges facing ICT usage were inadequate infrastructures like electricity and telecommunication services.

In the availability of ICT resources, qualitative data gathered from school directors interview also corroborated the data found from observation. All the school directors revealed that majority of the schools had computer laboratory which was equipped with computers, laptops and projectors. In addition to that, printers, TV set, digital storage devices and photocopiers were available either in the offices or in stores. Internet services were not yet introduced in schools.

Besides the availability of resources, school directors had a concern on the adequacy of the resources. A school director from one of the sampled schools described that:

> *As per the question to mention the availability of resources majority of our schools are equipped with ICT resources such as computers, computer laboratories, projectors and laptops for teaching ICT subject. However, the resources are inadequate for teaching other subjects. In addition to that, electricity is available in our school, but it is not regular. (School director No. 5, 2018).*

As per the school director quotation, the ICT resources available in the schools are inadequate and were accessible only for teaching ICT subject. Based on the data from school directors even in ICT lessons, the ratio of computers to students in the computer laboratory was 1:3 on average. In the computer laboratory, three students shared one computer in ICT subject lessons. Teachers' response to the availability of ICT resources for Biology teaching and learning in the schools were reported as illustrated in figure 5 for ICT resources accessible for teaching ICT as a subject and table 7 for the ICT resource center for teaching Biology.

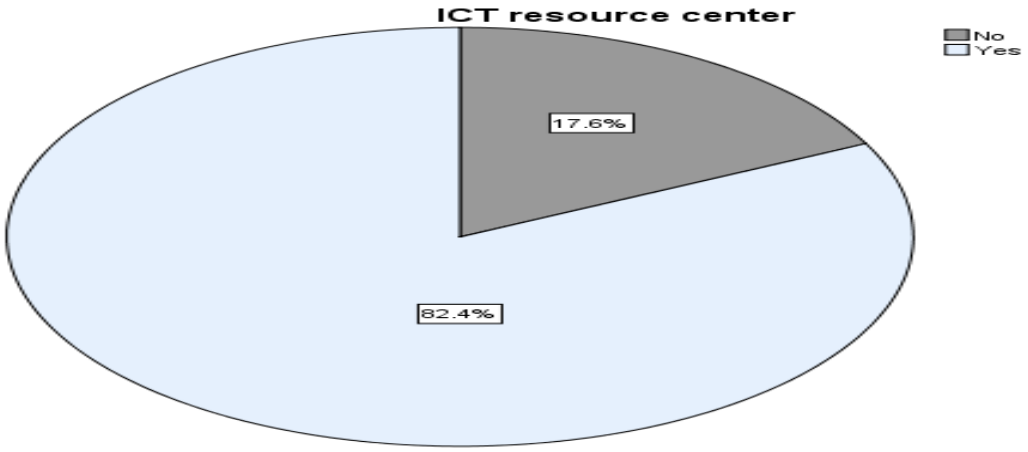

Figure 5. Availability of ICT resource center in schools

Source: Teachers Questionnaire

Figure 5 illustrates that 82.4% of teachers confirmed the availability of ICT resources center in the schools and the remaining 17.6% of teachers said there was no ICT resource center in their schools. The ICT resources commonly mentioned by teachers were computers, TVs, video players, printers, laptops, projectors. This finding shows that in the majority of the schools ICT resource center were available. Various studies ascertained that the availability of ICT resources is one of the main factors for ICT integration in teaching and learning. If these resources are not adequate in schools, it can prevent effective use of ICT in classrooms. A study conducted in Chile on the availability and use of ICT revealed that even though favorable conditions were set, ICT integration was limited to a few specific resources like computer and projector (Brun & Hinostroza, 2014). ICT resources for Biology were as described in table 7.

Table 7: ICT Resources for Teaching Biology

ICT for Biology	Frequency	Percent
No	30	88.2
Yes	4	11.8
Total	**34**	**100.0**

Source: Teachers' Questionnaire

As shown in table 7 majority (88.2%) of Biology teachers reported there were no ICT resources for teaching and learning of Biology. Teachers of Biology also revealed that internet service was not introduced in schools, and the supply of electricity was irregular during schooling time. Biology teachers had no access to available resources. The available ICT resources were accessible only for ICT teachers teaching ICT as a subject. So that secondary school biology teachers reported that they do not use ICT resources in Biology lessons on a weekly basis. Few teachers (11.8%) said they use ICT resources in summarizing the topic at the end of chapters.

This finding is in agreement with Onwuagboke, Singh and Onwuagboke, (2014) that the extent of availability, accessibility and utilization of ICT resources in secondary schools for teaching and learning was very poor. According to the responses of more than 80% of the respondents, ICT resources were not available in the schools under study; ICT resources can only be accessed and utilized by teachers and students if they are available in the schools for teaching and learning.

4.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary

The study found that most of the sampled schools had ICT resources in a diverse amount, where some schools are better equipped with ICT resources. The schools had computers, computer laboratories, projectors, Televisions, video players, storage hard discs, digital content, and printers. Internet services not yet introduced in the schools and power supply was not regular in most schools. The resources in the schools were inadequate to be used for teaching and learning Biology. The available resources were used mainly for teaching ICT as a subject. Biology teachers never used them in their classroom lessons

4.2 Conclusions

The study concluded that most of the schools had inadequate ICT resources like computers, computer laboratories, projectors, televisions, video players, digital content, and the internet. These resources were not enough or available for use by Biology teachers in teaching and learning. The available resources were used mainly for teaching ICT as a subject. Biology teachers never used them in their classroom lessons. Therefore, there was no integration of ICT in Biology instruction.

4.3 Recommendations

The study recommended that adequate ICT resources, including the internet, need to be provided in schools for teaching and learning Biology and other subjects

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