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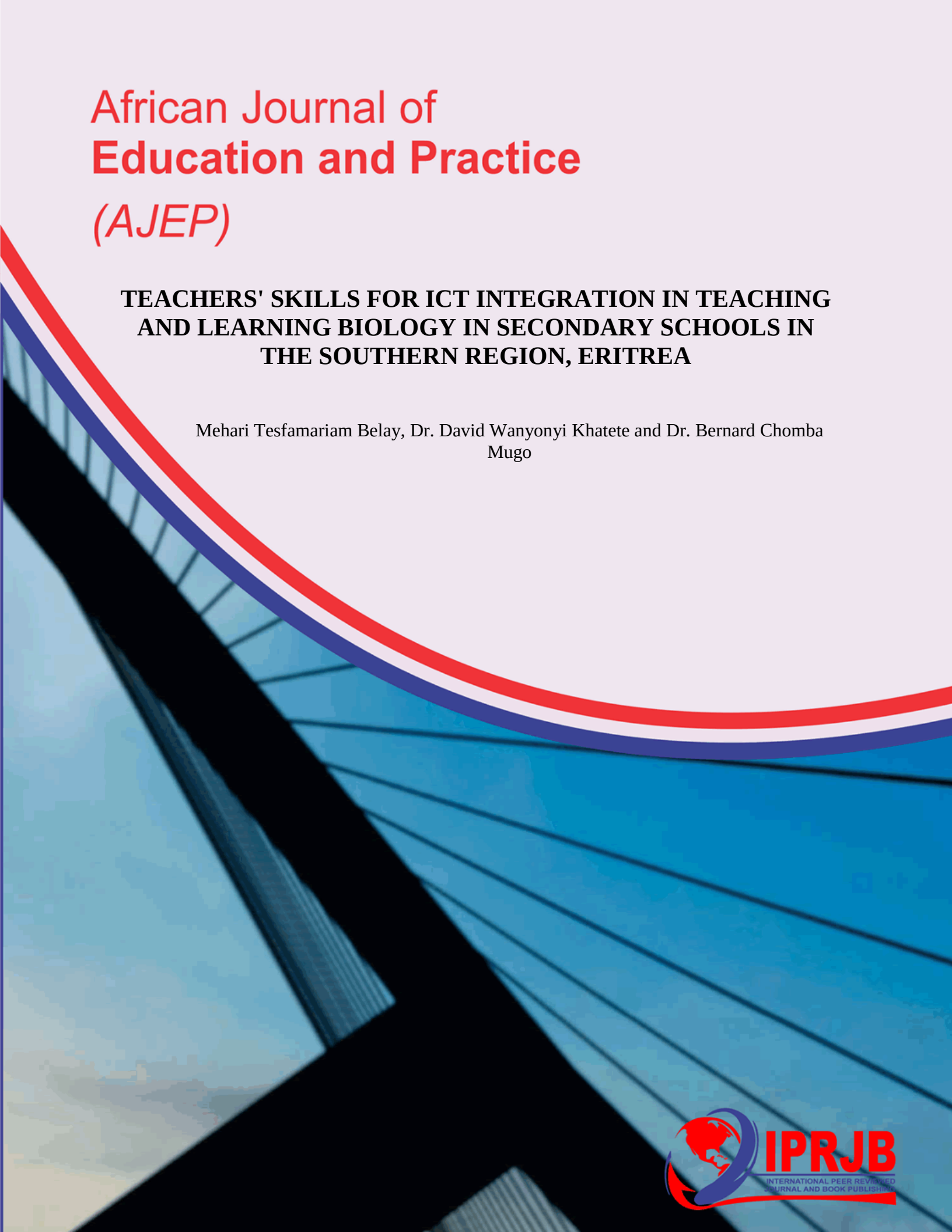

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TEACHERS' SKILLS FOR ICT INTEGRATION IN TEACHING AND LEARNING BIOLOGY IN SECONDARY SCHOOLS IN THE SOUTHERN REGION, ERITREA

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Abstract

Purpose: The purpose of this study was to ascertain teachers' skills for ICT integration in teaching and learning of Biology.

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). The qualitative data obtained from the open-ended questions were analyzed thematically based on research objectives.

Results: The study found that majority of Biology teachers had received inadequate training on computer literacy. Although they have attended computer training, they did not have sufficient computer skills. Majority of the teachers did not receive any formal training on how to integrate ICT in teaching and learning practices. Hence, there was low integration of ICT in teaching and learning Biology.

Unique Contribution to Theory, Practice and Policy: The study recommended that Teacher training college should incorporate computer education and training on how to integrate ICT in education in the curriculum so that pre-service teachers leave the college being well prepared with ICT competency uniformly

Key Words: *Teachers' Skills, ICT Integration, Teaching and Learning*

1.0 INTRODUCTION

ICT has become an important part of education in many countries of the world. Samuel and Zaitun (2007) study findings in Malaysian schools revealed that, for the effective integration of ICT in education, teachers need to have the skills on how to integrate ICT in the teaching and learning activities. Training teachers in ICT skills is central in implementing ICT integration in teaching and learning practices. As teachers become more competent in ICT tools, there would be more ICT integrated activities in the classroom.

Integration of Information Communication and Technology (ICT) assists teachers to adjust more with best global practices. Teachers' preparedness nowadays has replaced traditional teaching methods with technology-based teaching and learning tools and facilities (Ghavifekr, 2015). As a result, preparation by capable teachers makes the core for the integration of ICT in instruction. A study on the educational use of IT by Finnish teachers was conducted with 292 participants. The researcher used a survey design to investigate ICT use in the classroom. The result showed that teachers who have advanced ICT competence used ICT frequently in education. However, for those teachers who did not have adequate knowledge and skills in ICT, integration was not fully achieved. In developed countries, there are contradictions between the formal structures of educational institutions and daily practices in the classrooms (Sipila, 2014).

According to Ghavifekr (2015), a study carried out in Malaysia on the effectiveness of ICT Integration in Schools; the researcher used a survey questionnaire with a sample of 101 participants. The findings of the study indicated that one of the major factors that influenced the success of technology-based teaching and learning was well-prepared teachers on ICT integration. Another study was conducted to examine the levels of ICT skills and ICT use in the classrooms among technical and vocational teachers in Malaysia. In the study, Quantitative technique was applied. Data were collected through a questionnaire from 329 teachers using survey method. The findings of the study revealed that the level of teachers' ICT skills was moderate, and the majority (70%) of the teachers studied were frequent users of ICT in classroom teaching. That is, teachers were moderate users of ICT in classroom teaching. Furthermore, the study found out a significant correlation between the ICT skills of teachers and ICT integration in classroom teaching (Alazam et al., 2012). The study went in line with the study of Samuel & Zaitun (2007) that found out a large number of English teachers had the necessary ICT skills even though the utilization of the available resources were far from satisfactory in Malaysian schools.

Sulaiman, Hindatu and Lawal (2017) investigated teachers' awareness of the utilization of ICT for Biology teaching in secondary schools in Matazu Local Government Area, Katsina State, Nigeria. The study used a survey method, and a questionnaire was administered for 18 Biology teachers and five school principals. The result of the research showed that teachers were aware of the usefulness of ICT in the teaching and learning process. However, the majority of them were not using ICT for Biology teaching. The hindering factors for the integration of ICT in classrooms were inadequate ICT facilities and power failure.

Moluayonge and Innwoo (2017) carried out research on teachers' use of information and communications technology in education in Cameroon secondary schools. The study used a survey method to collect data from 320 teachers. The result showed that low usage of ICT in

teaching and learning partly due to poor ICT infrastructure in secondary schools of Cameroon. Further, the study found out that there were low competence and confidence of teachers, low access to available resources and insufficient ICT support for teachers in using ICT in their teaching.

Agyei (2013), in analyzing the technological integration in teacher education in Ghana, the result revealed that shortage of skilled human resources and other institutional factors were the challenges of ICT integration in Ghana. According to Tedla (2012), most teachers in East African countries do not integrate ICT into their instruction as expected. The reason could be due to several interrelated factors, one of which could be the teacher factor.

A study was conducted in Kenya on the Influence of Teacher Competency on Integration of ICT in Teaching and Learning in Public Secondary Schools. The findings revealed that majority of the respondents received ICT training to literacy level, and they showed limited ICT competence and confidence to use ICT for teaching and learning process. The result also indicated that teachers believe ICT enhances learning (Michael et al., 2016).

Another study was also conducted in Kenya about the opportunities and challenges influencing integration of ICT in teaching and learning, using descriptive survey design in 12 secondary schools in Nairobi County. The finding of the study showed that teachers face significant challenges, such as developing their own technical skills and knowledge as well as for self-training in the use of ICTs in their teaching (Amuko, 2015). Teachers' skills for ICT integration in Eritrean secondary schools are imperative. However, least is known if secondary school teachers in the Southern Region in Eritrea are trained on the integration of ICT in classrooms. Hence, this study developed an interest in this issue.

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, 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) version 22 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

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

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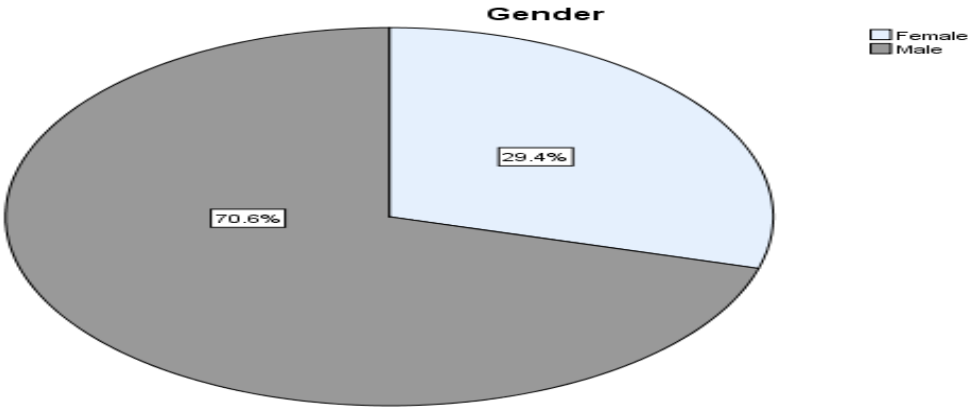

Figure 1. Gender composition of teachers

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.

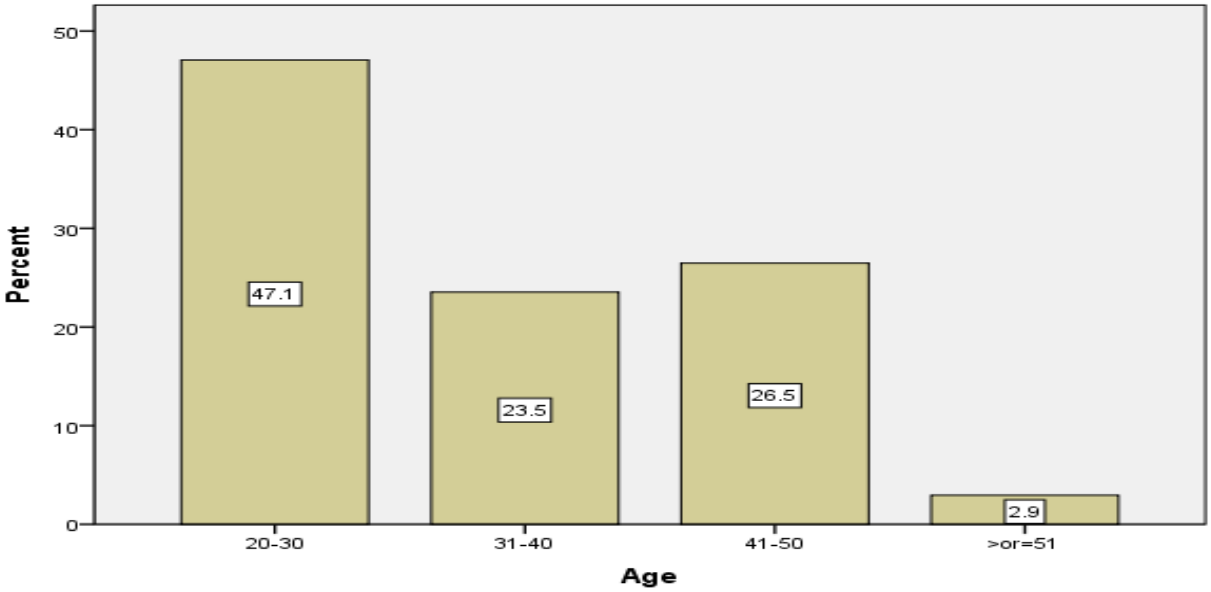

Figure 2. Age distribution of teachers

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.

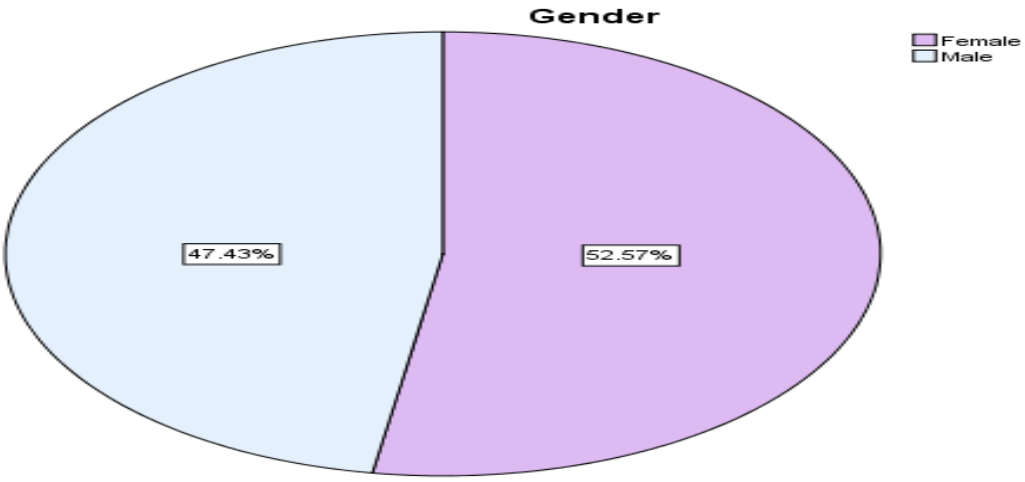

Figure 3. Gender distribution of students

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.

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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.

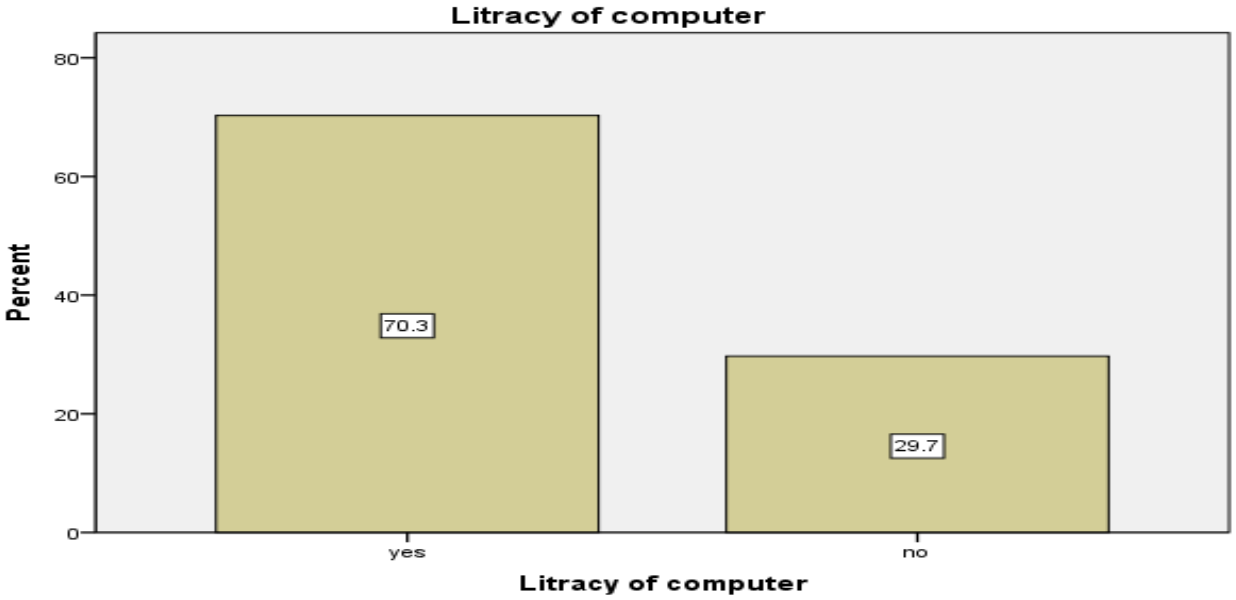

Figure 4: Computer literacy of students

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 Teachers' Skills for ICT Integration in Teaching and Learning

The study sought to investigate teachers ICT skills for integration in teaching and learning of Biology. To achieve this objective, the researcher collected data from the interview with school directors and a questionnaire distributed to teachers. Before reviewing the knowledge and skills of teachers on how to integrate ICT in teaching and learning, it is vital to look at the teachers' literacy level on computer or ICT. This is because literacy in computer is a prerequisite to ICT integration skills in instruction. Inadequate computer literacy may lead to spending time in learning technology than using technology for teaching and learning (Mwanaszumbah, 2015). Figure 5 describes computer training level of teachers.

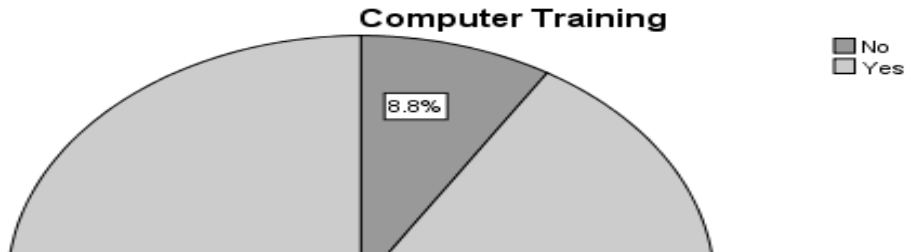

Figure 5. Computer training of teachers

Source: Teachers' Questionnaire

Concerning computer literacy, majority (91.2%) of the Biology teachers were computer literate whereas few (8.8%) of the teachers were not computer literate. This finding aligns with Michael, Maithya and Cheloti, (2016) that majority of the respondents received ICT training to literacy level and they showed limited ICT competence and confidence to use ICT for teaching and learning. This shows that majority of Biology teachers had computer literacy training, though the training was not adequate to have competency in computer.

On the other hand, all school directors confirmed that majority of the teachers had received computer literacy training at least once in their previous studies. This computer training was an introductory level. The computer class was dominated by theory due to the limited ICT resources, and trainees use on the computer for three students. However, having computer literacy does not imply having the knowledge and skill of ICT integration in teaching and learning.

Table 4 : Teachers' Formal training on ICT integration Education

Training	Frequency	Percent
No	29	85.3
Yes	5	14.7
Total	34	100.0

Apart from ICT or computer literacy, Biology teachers were asked whether they had received any specific formal training on how to integrate ICT in teaching and learning. When teachers undergo formal and adequate training on how to use ICT in education in addition to computer training, it enables them to use ICT in their teaching. Table 4 illustrates the Biology teachers' ICT integration skills.

Source: Teachers' Questionnaire

From table 4, the majority (85.3%) of Biology teachers reported that they had received no formal training on how to integrate ICT in education. In comparison, 14.7 % said they had participated a training on ICT integration in instruction. School directors also confirmed that there was no formal training given to teachers on how to integrate ICT in teaching and learning. Therefore, teachers were not aware of how to integrate ICT in Biology classrooms. The findings were in tandem with the study that showed teachers face major challenges such as developing their own technological skills and knowledge as well as self-training in the use of ICTs in their teaching (Amuko, 2015). However, this result was in contrast to the findings of Sulaiman, Hindatu and Lawal (2017) that revealed Biology teachers were trained and aware of the usefulness of ICT in the teaching and learning process. However, the majority of them were not using ICT for Biology teaching due to other hindering factors such as inadequate ICT facilities, power failure and allocation of time in the timetable of the lessons. This finding was also in contrast to Mwanaszumbahs' (2015) study, whereby majority (72%) of the teachers in Nairobi had received some form of formal training on how to integrate ICT in classroom teaching and learning.

Use of ICT in the classroom can be influenced by several factors. ICT competency of teachers is one among other factors (Makanda, 2015). When teachers have adequate knowledge and skill of ICT, they can easily use ICT in their classroom teaching. Table 5 illustrates the use of ICT in Biology classrooms.

Table 5: Use of ICT in Biology Classrooms from Teachers' Responses

Statement	SA	A	N	D	SD
Teachers of Biology in this school can easily access the various ICTs.	3 8.8%	5 14.7%	2 5.9%	9 26.5%	15 44.1%
Students of Biology in this school can easily access the various ICTs	1 2.9%	6 17.6%	3 8.8%	13 38.2	11 32.4%
Teachers of Biology in this school always use the ICT resources in every Biology lesson	0 0	1 2.9%	2 5.9%	10 29.4%	21 61.8%
All teachers of Biology allow students to perform tasks using the ICT resources	0 0	2 5.9%	5 14.7%	8 23.5%	19 55.9%
Teachers of Biology in this school use laptops and projectors in teaching	2 5.9%	4 11.8%	3 8.8%	9 26.5%	16 47.1%

Source: Teachers' Questionnaire

Key: SA= Strongly agree, A= Agree, N= Neutral, D= Disagree, SD= Strongly Disagree

Teachers were asked to rate the use of ICT in biology lessons by teachers and students on the provided likert scale. Teachers had to answer strongly agree, agree, neutral, disagree and strongly disagree for each statement. For the statement "Teachers of Biology in this school can easily access various ICT resources," 70.6% of the teachers were aware that no access to available ICT resources for Biology teachers.

In the second statement, 38.2% of teachers disagreed, 32.4% of them strongly disagreed that students in this school can easily access the various ICT resources. Few teachers (8.8%) were neutral whereas 17.6% of teachers agreed to that. The study indicated that the majority (61.8%) of teachers strongly disagreed that teachers of Biology in this school always use the ICT resources in every Biology lesson. For the statement "All teachers of Biology allow students to perform tasks using the ICT resources," 79.4% of Biology teachers were aware that students not allowed performing tasks using ICT resources.

Lastly, 73.6% of the teachers did not agree that teachers of Biology in this school use laptops and projectors in teaching. These findings show that Biology teachers were not using ICT resources in their teaching. The findings were congruent with Yusuf, Maina and Dare (2013) that revealed there were 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 skill to use ICT in teaching. Majority, (78%) of teachers considered their ICT training to be at poor level. Students were also asked whether their Biology teachers use ICT in classes. The following table shows students responses to the use of ICT in Biology classrooms.

Table 6: Use of ICT in Biology Classrooms from Students' Responses

Statement	SA	A	N	D	SD
Students can easily access the various ICT resources in this school.	13 7.4%	15 8.6%	24 13.7%	57 32.6%	66 37.7%
Teachers of Biology always use ICT in each Biology lesson	3 1.7%	11 6.3%	11 6.3%	41 23.4%	109 62.3%
Teachers of Biology allow students to perform tasks using the ICT	11 6.3%	16 9.1%	22 12.6%	65 37.1%	61 34.9%
Biology teachers give reference to the internet as source of information	8 4.6%	9 5.1%	7 4.0%	57 32.6%	94 53.7%

Source: Students' Questionnaire

Key: SA= Strongly agree, A= Agree, N= Neutral, D= Disagree, SD=Strongly Disagree

As in table 5, greater part (70.3%) of the students indicated that students were not accessing various ICT recourses in the schools. Majority (85.7%) of students responded that teachers do not always use ICT in each Biology lesson. For the statement "Teachers of Biology allow students to perform tasks using the ICT," 72% of students were aware that Biology students do not perform tasks using the ICT.

On the same note, the finding of the study showed that 86.3% of students did not accept that Biology teachers give reference to the internet as a source of information. These findings of the study show that majority of the teachers and students either strongly disagreed or disagreed to the use of ICT resources by Biology teachers in the school.

All school directors reported that Biology teachers did not fully use ICT in their lessons; only a few teachers show video and still pictures related to their topics when summarizing the topic or the chapter. Classroom observation by the researcher also confirmed ICT was not used in Biology lessons of the schools involved in the study. Teachers and students of Biology have not engaged in any ICT integrated lessons. This shows that majority of teachers were not well trained on how to integrate ICT in classroom instruction.

The findings from teachers' and students' questionnaires, school directors interviews and classroom observations confirmed that ICT was not effectively used by Biology teachers and students in Biology classrooms. This study is in agreement with Mavellas, Wellington and Samuel, (2015) that found out that most of the ICTs required for training were not available in the sampled schools and those that were available were inadequate, the available ICT resources were utilized to a very low extent. The study also identified lack of power supply, insufficient resources, fear of technology, lack of interest, ICT skills deficiency, higher ICT cost and poor physical infrastructure were the factors hindering the ICT utilization in these schools. The research findings of Alzahrani (2017) also showed that although there were adequate ICT types of equipment in the schools, the need for training on ICT for teachers was found to be fundamental. This indicates that there should be an emphasis on training of Biology teachers on

how to use ICT in teaching and learning and on providing ICT resources for teaching and learning activities.

4.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary

In the study, it was found that the majority of Biology teachers were computer literate, but the training was inadequate to have competency in computer**.** Moreover, due to the lack of computers, the training was more theoretical, and they did not use computers after taking the training. Having computer literacy alone is not sufficient to integrate ICT in instruction. It was also established that majority of the teachers did not receive any formal training on how to integrate ICT in teaching and learning practices.

4.2 Conclusions

The study concluded that majority of Biology teachers had received inadequate training on computer literacy**.** Although they have attended computer training, they did not have sufficient computer skills. Majority of the teachers did not receive any formal training on how to integrate ICT in teaching and learning practices. Hence, there was low integration of ICT in teaching and learning Biology.

4.3 Recommendations

The study recommended that teacher training college should incorporate computer education and training on how to integrate ICT in education in the curriculum so that pre-service teachers leave the college being well prepared with ICT competency uniformly

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