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# Challenges Preventing Successful Use of ICT for Teaching and Learning Biology in Rwandan Secondary Schools

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Abstract: Information and Communication Technology (ICT) has been found to be important in the teaching and learning process for  $21^{st}$  century. However, the effective use of this contemporary paradigm was found to be subjected to many factors. This paper aimed to assess the level at which ICT is being used and the challenges met by Biology teachers in teaching and learning process. A descriptive survey research design was adopted. Both qualitative and quantitative data were collected from a sample of 64 Biology teachers randomly selected from secondary schools of Rulindo District. During data collection, a Likert' scale questionnaire and interview protocol were used. A descriptive statistic was used to analyse the obtained quantitative data while independent sample t-test was used to compare the level of using ICT between males and females. Additionally, qualitative data were used to feel the gap not filled by quantitative findings. The findings showed that ICT was basically used in general purposes like preparation of teaching notes and making scheme of works rather than being used in specific biological experiments. The main challenges preventing the adequate use ICT for teaching Biology were the lack of adequate ICT resources, lack of adequate trainings and limited technical support. On the other side, the results from independent sample t-test showed a difference in the level of using ICT between males and females (t=2.508, p=.015). It has been found that male teachers (M=2.32, SD=0.63) used ICT at high level compared to their female counterparts (M=2.16, SD=0.54). Therefore, all educational agents have to increase their investment in providing adequate ICT resources, and effective training on the best ways of integrating ICT in teaching different subjects. A strong motivation and encouragement is also needed to all teachers for preventing gender disparity in using ICT for teaching Biology and science subjects in general.

Keywords: Infrastructure, Biology, ICT, Resources, Trainings, Teachers

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### **1. Introduction**

Recently, ICT has become one of the basic tools in modern society (Daniel, 2002) and it is an essential element within this modern technology for success in life and competition for job (Rychen & Salganik, 2001). In schools, ICT has been found to be used in different aspects relevant to education. Some of these aspects include: teleconferencing, audio conferencing, television lessons, radio broadcast, interactive radio counselling and the system of interactive voice response (Sharma, 2003). The acceptance and use of ICT in education plays a key role in preparing the 21<sup>st</sup>-century generation with adequate skills and knowledge (Pineida, 2011). According to Miguel (2017), ICT enhances an easy communication among students and teachers. The study of Roy (2015) has found that ICT creates a new learning environment that enables

both teachers and learners to access new opportunities for future studies to carry out quality research in education through collaboration with different experts. In addition, ICT increases accessibility to relevant and updated teaching and learning content hence improved quality of education (Meenakshi, 2013).

In teaching Biology, ICT can increase not only the level of knowledge but also the attitudes of students towards Biology (Haunsel & Hill, 1989). In this regards, ICT was found to be used in various Biological aspects. The ICT was found to be used in virtual laboratories (Muhamad, Zaman, & Ahmad, 2012), simulations of different experiments and phenomena (Sommer & Sommer, 2003), and data logging. The virtual laboratories are crucial in carrying out the experiments that were impossible in physical laboratories due to the lack of adequate laboratory materials and reagents (Yildirim, 2021). On the other side, they could be used for performing the harmful experiments to the students to prevent possible accidents that could arise during physical experiments (Muhamad et al., 2012). Some of virtual experiments include virtual frog dissection (Kinzie, Burch, & Boker, 1996), virtual DNA replication, virtual process of mitosis and microbial culture (Bistolfi, 2020) as harmful microorganisms are not advised to be cultured in schools. Virtual laboratories and simulations provide different opportunities in teaching and learning, like enhancing easy collaboration among students and teachers (Surxonidinovna & Madrimovich, 2020), providing flexibility towards the time and place, and facilitate the access to the global resources (Osborne & Hennessy, 2003).

Regardless to different benefits provided by ICT in educational practice, its full integration has been challenged by many factors. According to Veen (1993), the effective use of ICT in teaching and learning process has been affected by technical support provided by school. Other studies revealed that personal factors such as teachers' competence, teachers' attitudes and time, may also influence the successful use of ICT in teaching and learning process. On the other side, the presence of ICT resources was found to be relevant in integrating ICT in teaching and learning. According to Beldina, Nyawire, Stanslous & Linda (2015) the whole prerequisite hardware infrastructure such as electricity, computer, internet connection provider and technical support need to be available for supporting ICT integration in schools. Additionally, Njoroge, Margaret & Joab, (2017) found that teachers' decisions about the use of computers in their classrooms are probably associated with accessibility and availability of appropriate infrastructures.

Within this context, this study was organized to identify the level at which ICT is used and challenges preventing the Rwandan teachers to its successful use in teaching and learning Biology.

### **1.2 Research Objectives**

The following research objectives guided this study:

- 1. Investigate the level at which ICT is being used for teaching and learning Biology.
- 2. Determine the challenges faced by Biology teachers in using ICT for teaching and learning Biology
- 3. Determine the effect of gender on using ICT in teaching and learning Biology

# 2. Literature Review

# **2.1 Integration of ICT in teaching and learning process**

ICT infrastructure refers to the hardware and software used for enhancing the teaching and learning process. The hardware includes computers, scanners, mobiles phones, printers, projectors, radio, camera recorders and TV sets, while software may include, some applications like data logging and simulations. In addition, electricity and internet connection are relevant infrastructures for integration of ICT in the teaching and learning process. Researchers have advised that ICT infrastructure should be easily accessed and used by all (Tsholofelo, 2015).

Integration of ICT in the teaching and learning process, is the way of using ICT tools in all activities related to teaching and learning thus creating a conductive learning environment in which students participate actively and constructively (Volman & Van, 2001). In fact, ICT should not be taken as a tool to replace the existing teaching methods, it should be used in supporting teaching and learning process. In this context, it is used to develop the skills of students in terms of cooperation, communication, problem solving and lifelong learning (Plomp, Brummelhis, & Rapmund, 1996). The use of ICT in the teaching and learning process has to be applied in all subjects rather than being taught as isolated course or topic in itself (Mwanda, Mwanda, Midigo & Maundu, 2017).

The innovative use of ICT can enhance student-centered learning (Drent, & Meelissen, 2008). Therefore, every teacher in each classroom practice should adopt it to improve the students learning in every subject. This will engage them in developing critical thinking ability, decision making skills and problem solving behaviors (Grabe, & Grabe, 2001). In teaching Biology, ICT makes learning environment more enjoyable, motivating and attractive as it increases learners' attention to the subjects, thus increasing the effective teaching and learning process (Tomljenović & Zovko, 2016).

However, most Biology teachers are still relying on traditional teaching methods where they only use books as the only source of content for teaching. Some Biology topics have been found to be difficult in traditional teaching methods, so Biology teachers have to think about how ICT can simplify the task (Mwanda, Mwanda, Midigo & Maundu, 2017).

Integrating ICT in teaching Biology provides teachers with opportunities to bring the nature into classroom activities (Demkanin, Kibble, Lavonen, Guitart, & Turli, 2008). The Edmodo interface, which is an e-learning model has been found to be successful in teaching Biology (Végh & Elbert, 2017). It has been recognized that ICT increases students' motivation through facilitating the exchange of information between groups of students (Senthilkumar, Sivapragasam, & Senthamaraikannan, 2014). The research of Kareem, (2018), described how multimedia strategy used in teaching and learning process is one of the best methods to be adopted for making teaching Biology meaningful.

Regardless to the importance of ICT in the teaching and learning process, its use was found to depend on different factors ranging from the simple to complex ones. Some of these factors are based on teachers' perception about its usefulness (Kafyulilo, Fisser, & Voogt, 2016), technical supports, professional development, ICT infrastructure, teachers' age and teaching experience (Unal, Ozturk, Onsekiz, & Education, 2012).

# **2.2 Factors that could influence the use of ICT in teaching**

#### 2.2.1 Teachers' perception

Different studies have identified that teachers' attitudes and perception influence more on the integration of ICT in education (Sánchez, Marcos, González, & GuanLin, 2012, Player-Koro, 2012). This is in line with many educational theories explaining that the use of ICT in education is started by its acceptance, which could be associated with teachers' attitudes (Koohang, 1989). Positive perception encourages teachers to adopt and use technology in their classrooms regardless of some challenges that may be found in this practice (Mustafina, 2015). Additionally, teachers with positive perception are likely to use available resources at maximum level while teachers with negative attitudes always remain complaining about the shortage of adequate materials to start using ICT in education (Norma, 2013).

For the successful implementation of this contemporary paradigm, positive attitudes and good perception on its usefulness should be developed in teachers through provision of adequate trainings to the integration of ICT in their teaching practices. The study of Al-zaidiyeen, Mei, Leong & Fook, (2010) has found that the main predictor of teachers' ability to use ICT in education is their attitudes toward its use. Teachers' attitude is the most critical factors for influencing the use of ICT in teaching and learning process. In this line, the study of Prospery (2018) has found that positive attitudes towards ICT use have to be promoted as a necessary condition for integrating ICT in teaching and learning.

#### 2.2.2 Technical and administrative support

Different researchers have found technical and administrative support to be very important in enhancing the use of ICT in classrooms (Priscilla, et al, 2012; Butler & Sellbom, 2014). This is ensured through the provision of trainings for equipping teachers with relevant skills in using ICT in education and motivating teachers to use ICT in their daily activities. ICT related technical support was found to be helpful as it has been found that its lack may affect teachers' willingness in adopting and integrating ICT in teaching practices (Charles, 2012). Technical support is also needed for troubleshooting issues. In this regards, teachers should be trained on some basic techniques used in fixing some simple technical problems. This can reduce their anxiety towards the use of ICT in teaching and learning process.

In this context, school leaders should adopt strategies that will facilitate teachers to use ICT as the basic tool in their daily teaching practices (Charles, 2012). School authorities are the ones to set and discuss with teachers the visions and ICT policies in their schools and how the available resources may be shared appropriately. Similarly, school authorities have to keep a follow up on the implementation of ICT in education policy so that they might identify early the challenges encountered by teachers and find out the possible solutions as well. Motivation on using ICT in education should be more effective if it starts from school leaders. School administrators play a great role in integrating ICT in education through acquisition and coordination of all resources required for ICT use in teaching and learning process.

#### 2.2.3 Teachers' professional development

For effective implementation of any education program, teachers' professional development was found to play a great role. Professional development increases teachers' skills, morale and motivation (Baylor & Ritchie, 2002). In line with the integration of ICT in education, teachers have to be trained on different aspects of using ICT in classroom for reducing their anxiety hence increasing their confidence and ICT use willingness. These trainings should be tailored in relation to the teachers' needs in terms of integrating ICT in education. In this context, teachers have to be trained on trends of ICT in education, best application and web platforms for both teachers and students and how to create engaging and interactive multimedia content and presentation (Manuel, 2008). In addition, teachers may be trained on the best way of integrating ICT in education as well as how to use ICT in students' motivation and innovations in classroom (Mukuna, 2014). For teaching Biology, teachers need to be trained in the areas of using virtual laboratories, simulations and video presentation, sorting and treating data during teaching and learning process.

Even though teachers' trainings are at the heart of effective implementation of any education program, it has been found that teachers' trainings on using ICT in education are still low and inadequate (Afshari, Bakar, Su-Luan, Samah, & Fooi, 2009). The study of Baylor & Ritchie (2002) revealed that most of ICT teachers' trainings focus on general ICT skills but little consideration is given to specific skills for effective integration of ICT in teaching different subject. This may be the reason behind their nonsystematic use of ICT in the teaching and learning process as they don't have enough skills for integrating ICT in their daily teaching practices. Similarly, Belay, Khatete, & Chomba, (2020) have found that the trainings provided to the majority of Biology teachers were not adequate to help them in integrating ICT in teaching Biology.

#### 2.2.4 Age and Gender

Based on Global Gender Gap Report, the gap among men and women is found all over the World in different forms of life (World Economic Forum, 2019). This gap has also been recognized in the ICT aspect where males dominate females in using ICT for different purpose (Laura, Laura, Joseph & Jeremiah, 2014).

The level of integrating ICT in the teaching and learning process has been found to be different between men and women. The study of Birgin, Çoker, & Çatl, (2010) has found that the level of using internet in women is lower compared to that of men. Consequently, women miss some opportunities for accessing useful information and online services. This low level of using ICT in women, was reported to be caused by their negative attitudes toward the new technology. In addition, it has been found that female teachers show lower computer skills and competencies compared to male teachers (Umar, Tarmizi, & Yusoff, 2014). In this line, educational institutions have to establish a clear plan for facilitating women to upgrade their skills and competencies so that they may be involved in implementation of ICT in education policy effectively.

The study has also shown that males are more experienced in using ICT in education due to their positive attitudes towards its use, less computer anxiety and more confidence in using ICT than females (Volman, Van, Heemskerk, & Kuiper, 2005). In addition, the integration of ICT in teaching and learning has been also found to be influenced by the age of teachers. The young teachers have shown positive attitudes towards the use of ICT in teaching activities compared to the old teachers (Cathrine, 2008).

#### 2.2.5 Availability of ICT resources

For integrating ICT in education in schools both hardware and software are needed. Several studies identified the lack and insufficiency of computers as one of the important obstacles in integrating ICT in the teaching and learning process (Pelgrum, 2001). On the other hand, Mumtaz, (2006) states that the lack of hardware and software is the one reason for teachers to not use ICT in classrooms. Connectivity to electricity and internet facilities are also highly needed during the implementation of ICT in the teaching and learning process hence it can be difficult to use computers without electricity. In addition, internet is needed for teachers to get enriched content from different sources. Nevertheless, electricity and internet connectivity are in short supply, which continues to be a challenge in many African developing (Mathevula & Uwizeyimana, 2014).

Based on the findings from different studies discussed above, it has been found that the effective use of ICT can influenced by different factors. In this regards, the present study, sought to investigate the level at which Biology teachers in Rulindo District used ICT in teaching Biology and the challenges preventing the successful use of this current policy.

## 3. Methodology

### 3.1 Research design

This study adopted a descriptive survey research design where both quantitative and qualitative data were collected by use of questionnaire and interview guide (Creswell, 2013).

# **3.2** Population, sample and sampling methods

The targeted population was all Biology teachers (78) in secondary schools of Rulindo district. From this population, a sample of 64 teachers were randomly selected to participate in the research.

### **3.3 Instruments**

For collecting data, both Likert's scale questionnaire and interview protocol were used for obtaining quantitative and qualitative data respectively. On the Likert's scale questionnaire, Biology teachers were required to choose among the ratings from 1 to 5, where 1: strongly disagree, 2: disagree, 3: neutral, 4: agree and 5: strongly agree. The interview protocol was used to know better about the use of ICT in classroom activities as well as the challenges they face in this application. All questions were elaborated in relation to the use of ICT in teaching and learning Biology and the challenges faced in this scenario.

### **3.4 Data collection procedure**

Data collection is the process by which data are gathered by the researcher. In this research, questionnaires were distributed to 64 Biology teachers sampled from different secondary schools of Rulindo District. All participants provided the required information voluntarily after signing consent forms. Because the questionnaires were distributed by researcher himself and as the participants requested to answer all questions immediately, all questionnaires were returned. Additionally, the interview was conducted at the same date on collecting quantitative data. The data collected during interview were used to establish the level of using ICT in teaching and learning Biology and the challenges faced in this domain.

# **3.5 Validity and reliability of research instruments**

For ensuring validity and reliability, data collection tools were piloted in 4 selected secondary schools of Gasabo district in Kigali city after which Pearson coefficient correlation (r) and Cronbach alpha ( $\alpha$ ) were computed by using SPSS software version 16.0. The questions with Pearson correlation coefficient <0.5 were eliminated while others were adjusted. On the other side, the questionnaire was found to be reliable as its reliability coefficient was 0.81. Moreover, construct validity was evaluated for ascertaining whether all questionnaire items were clear and suitable for their purpose. This was checked and approved by educational and research experts from the University of Rwanda College of Education. Comments provided by the above experts were addressed before the use of those data collection tools.

### 3.6Data analysis procedure

After entering and coding data in SPSS version 16.0, descriptive statistics was used in data analysis. The results obtained were presented in the form of tables and figures. Finally, t-test was computed to analyze if there was a difference between male and female on the level of using ICT in teaching Biology.

## 4. Results and Discussion

After analyzing data by using SPSS software, the findings were presented in different forms including tables and graphs as shown in the following section.

# **4.1 Demographic characteristics of the research participants**

Information presented in the figure 1 below is related to the gender, age, and teaching experience of Biology teachers involved in the research.



Figure 1. Characteristics of Biology teachers

In the present study, it was important to know demographic parameters of the respondents as they might influence the level at which ICT was used in teaching Biology. As presented in figure 1 above, 32 (50%) Biology teachers were males while 32 (50%) were females, the equivalent number of male and female was purposely selected for having a shared contribution in providing their views. On the other side, majority of Biology teachers involved in this research were between 31 and 40 years old. In this context, 2 (3.1%) Biology teachers were between 26 and 30 years old, 28 (43.7%) between 31 and 35, 32 (50%) between 36 and 40 while only 2 (3.1%) were over 40 years old. This variation of age among Biology teachers involved in this research showed that most of teachers were in active age to work so they were able to adopt the new technology that could help them in improving their teaching and learning process. Final demographic parameter that was investigated was the teaching experience. Generally, it was found that majority of Biology teachers involved in research were experienced in teaching professional. Here, 3 (4.6%) had the teaching experience which was less than one year, 23 (35.9%) teaching experience ranging 1-5 years, 29 (45.3%) teaching experience between 6-10 years while 9 (14%) had the range of teaching experience of 11-15 years. Based on the relevant teaching experience for most of Biology teachers involved in this research, it could be better, if the ICT is used for transmitting their content knowledge in technological way.

# 4.2 Level at which ICT is used for teaching Biology

Figure 2 below summarizes the findings on the level at which Biology teachers use ICT in various aspects of teaching and learning process.



# Figure 2: The frequency at which ICT is used in teaching and learning process (numbers are expressed in frequency per 64 Biology teachers)

Figure 2 above indicates that majority of Biology teachers used ICT in the general applications rather than focusing

on specific use of this technology in teaching and learning of Biology. It has been found that ICT was highly used in

preparation of Biology scheme of work (40/64 frequently used ICT) and students' marks recording and keeping (49/64 frequently used ICT). In line with the findings of Belay, Khatete, & Chomba (2020) indicating that majority of Biology teachers had received inadequate ICT training, the findings from this study also showed that ICT was not used specifically for teaching the specific topics in Biology that could be associated with the lack of adequate trainings for integrating ICT in teaching and learning Biology.

In this regards, 40 (62.5%) never used ICT in explaining Biological experiments, 35 (54.6%) never used ICT in searching Biology content while 34 (53.1%) never used ICT in presenting Biology content during teaching. Similarly, 54 (84.3%) never used ICT in dissection of frog, 34 (53.1%) didn't used ICT for explaining the process of DNA replication while only 4 (6.2%) Biology teachers explored different virtual laboratory experiments against 45 (70.3%) who never explored these platforms. 50 (78.1%) Biology teachers never used ICT in the teaching of nerve transmission, while 45 (70.3%) never used ICT for linking Biological concepts with real life context.

One of the trained teachers said: "I have been trained on using ICT in preparation of notes, recording student marks and the way of storing documents in a computer. I have not been trained on how to use ICT in teaching Biology I have received". Based on the above research, it is clearly indicating a generic use of ICT in teaching and learning rather than being used specifically in teaching and learning Biology. These findings are confirms by the finding of Baylor & Ritchie, (2002) which revealed that most of ICT teachers' trainings focused on general ICT skills but little consideration was given to specific skills for effective integration of ICT in teaching different subjects. Therefore, most of teachers use ICT for general purpose as they have been trained in this aspect.

During the interview, most of Biology teachers claimed that they never received any training related to the use of ICT in teaching. One of the interviewed teachers said: "I have been serving as Biology teacher in this school for 6 years, but I have never been trained on using ICT tools. My little ICT skills I have, comes from my fellow teachers who showed me how to use computer. Use of virtual laboratory in teaching Biology is new term for me". However, some of the interviewed Biology teachers declared that they have received some trainings on using ICT but these trainings were concerned on general use of the technological tools.

# **4.3 Challenges in using ICT for teaching and learning Biology**

The use of ICT in the teaching and learning Biology may be influenced by different factors. Some of these factors were investigated and are presented in the table 1 below.

STATEMENT	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Lack of technical support	6	26	1	25	6	64
Lack of technical support	(9.37%)	(40.63%)	(1.56%)	(39%)	(9.4%)	(100%)
Look of adaguate twoining or win-	6	15	3	36	4	64
ICT for teaching biology	(9.37%)	(23.44%)	(4.69%)	(56.25%)	(6.25%)	(100%)
Lack of consistency access to	9	24	0	2	29	64
computer	(14%)	(37.5%)	(0%)	(3.12%)	(45.3%)	(100%)
	11	15	3	26	9	64
Poor internet connection	(17.18%)	(23.43%)	(4.69%)	(40.62%)	(14.0%)	(100%)
Insufficient basic ICT tools	7	20	1	29	7	64
	(10.94%)	(31.25%)	(1.56%)	(45.31%)	(10.94%)	(100%)
<b>T 1 2 1 2 1</b>	14	35	2	13	0	64
Inadequate electricity	(21.87%)	(54.69%)	(3.12%)	(20.31%)	(0%)	(100%)
Lack relevant digital content	6	20	2	32	4	64
(simulations, videos)	(9.37%)	(31.25%)	(3.12%)	(50%)	(6.25%)	(100%)
The lack of materials for virtual	5	3	2	40	14	64
laboratory tools	(7.8%)	(4.6%)	(3.12%)	(62.5%)	(21.9%)	(100%)

Table 1 above presents the findings on the ratings (agreement and disagreement) of Biology teachers in relation to the challenges they faced in using ICT. Biology teachers had different perceptions on the challenges under investigation. In this context, 50% of the research participants disagreed on lacking the technical support in using ICT while 48.4% supported the statement. On the other side, the participants who lacked adequate trainings were 62.5% while only 32.81% disagreed with the lack of adequate trainings. This showed a gap in ICT training that may be a hindrance of effective use of ICT in teaching Biology.

The shortage of adequate ICT trainings among participants involved in this research concurs with findings of Afshari, Bakar, Su-Luan, Samah, & Fooi, (2009) who revealed that the ICT use trainings provided to teachers were low and inadequate. However, Baylor & Ritchie (2002) stated that professional development increases teachers' skills, morale and motivation. Yet a great effort was made in terms of distributing computers across the schools around the country, 48.42% claimed to not have accessed a computer. This indicated a need of more effort in distribution of ICT resources, including computers in terms of ending gap among those who have access to computer and those with a limited access to it.

The shortage of computers is associated with the insufficiency of other ICT tools (55.31%), and digital content (56.25%) including the videos and simulations that could be used in teaching and learning Biology. Similarly, 54.62% claimed to not have access to adequate internet connection. However, electricity was found to be available in many schools (76.56%) except some schools (20.31%) which installed electricity in the staff offices only. It contrasts the findings of Njoroge, Margaret & Joab (2017) stating that the decisions made by teachers about the use of computers in their classrooms are likely to be influenced by the accessibility and availability of the relevant infrastructures.

During the interview with Biology teachers, it was found that most of interviewed teachers were challenged by insufficient ICT infrastructure like shortage of computers and unreliable internet connections. One of the interviewed Biology teachers claimed to have few computers in their SMART classroom the reason why it was used in teaching ICT subject only. On the other side, another said that their internet connection was not powerful for downloading some simulations to be used in teaching and learning Biology.

Another key challenge investigated as a barrier for effective use of ICT in teaching and learning Biology was the lack of adequate tools and software (84.4% agreed) used in different virtual laboratory experiment in Biology like frog dissection, DNA replication and Nerve transmission across synapses. This hinders the successful use of ICT for filling the gap of physical laboratory shortage.

### 4.4. Effect of gender on the level of using ICT in teaching and learning Biology

The 3<sup>rd</sup> objective of this research was to determine the effects of gender on the use of ICT in teaching and learning Biology. In this regards, tables 2 and 3 present the findings related to t-test for evaluating the relationship between gender and use of ICT.

Gender	Ν	М	SD
Male	32	2.32	0.63
Female	32	2.16	0.54

**Table 2: Group Statistics** 

SD: standard deviation, N: number of participants, M: Mean

Table 2 presents the descriptive statistics for males and females while table 3 presents the results on independent sample t-test. From table 2, it can be observed that the males had the mean of 2.3 and SD=0.63 while the females had mean of 2.16 and SD=0.54 indicating a certain

difference in using ICT. To evaluate if there was a significant difference between males and females, an independent sample t-test was used at 0.05 level of significance.

Table 3: Results of independent sample t-test of teachers' means in males and females

Gender	Ν	М	SD	t	Df	Sign
Male	32	2.32	0.63	2 508	62	015*
Female	32	2.16	0.54	2.200	02	.010

\*: Difference is significant, **SD**: standard deviation, **N**: number of participants, **M**=Mean, **df**: degree of freedom, **Sign**: significant level.

Based on the findings in table 3 above on the effect of gender to the level of using ICT in teaching Biology, it is clear indicated that there is a different in using ICT between males and females (t=2.508, p=.015). In this perspective, males used ICT at high level (M=2.32) compared to their female counterparts (M=2.16). This is in line with finding of Volman, Van, Heemskerk & Kuiper (2005). In their study, they have found that males are more experienced in using ICT in education due to their positive attitudes towards its use, less computer anxiety and more confidence in using ICT than females. Additionally, it has been found that female teachers showed lower computer skills and competencies compared to male teachers (Umar, Tarmizi & Yusoff, 2014).

#### 5. Conclusion and Recommendations

#### **5.1.** Conclusion

Based findings related to the level of using ICT in teaching and learning Biology as well as the challenges faced by Biology teachers in this integration, it has been found that the use of ICT still at low level. This low level could be associated with the lack of adequate trainings to Biology teachers and insufficient adequate ICT infrastructure. Teachers were found to be trained on only using ICT in general purposed rather than being trained on specific applications of ICT in teaching and learning Biology. Few available ICT tools were found to be used in teaching ICT as subject because they were not enough to be shared with all teachers for teaching other subjects. However, a clear policy is needed in different schools for clarifying how the few available ICT resources should be shared for teaching all subjects towards the benefits of all students.

#### 5.2. Recommendations

Based on inadequate use of ICT in teaching and learning Biology, it was recommended that, the government and other educational actors should assist secondary schools in getting ICT related infrastructure for enhancing the integration of ICT in the teaching and learning process for all subjects. Additionally, sufficient and adequate trainings are needed to empower teachers through the way of integrating ICT in the teaching and learning process. Furthermore, the plans of sharing the few available ICT resources should be developed by schools' administrators in terms of encouraging all teachers to use ICT in teaching their respective subjects. Motivation and encouragement to the left behind groups like: females and old teachers in terms of using ICT in their pedagogical activities are also needed.

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