

The Impact of Compulsory Computer Studies on ICT Literacy at Junior Secondary Schools in Livingstone District

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ABSTRACT

The study investigates the impact of compulsory computer studies (CS) on information and communication technology (ICT) literacy in secondary schools in the Livingstone District, Zambia. The objectives were to investigate the availability of specialised ICT teachers, to find out the availability of ICT equipment and infrastructure, and to establish the impacts of compulsory ICT. The study was mainly qualitative using primary data, however, had a component of quantitative research using secondary data in form of Examination Council of Zambia (ECZ), ICT examinations results for grade nine. The study established that the introduction of ICT as a compulsory subject had an impact on teacher and pupil literacy in ICT, and due to insufficient ICT equipment, may have negatively affected the performance of the pupils in the ICT final examination.

KEYWORDS

Examination Results, ICT Equipment, ICT Literacy, Specialized ICT Teachers, Zambia

INTRODUCTION

In 2014, the Zambian Government through the Ministry of Education (MOE) introduced ICT Subjects in Schools and made the subject compulsory at Junior Secondary (Ministry of Education Science Vocational Training and Early Education, 2013a), with the ICT subject at Junior Secondary being called Computer Studies (CS), This development was a source of concern to many due to the fact that most rural areas of the country were not electrified (Banda, 2016; Mulenga, 2016; Lusaka Times, 2015). Junior Secondary in Zambia runs from Grade 8 to Grade 9. It was also reported that, the MOE had made the Subject compulsory at Junior Secondary despite schools having inadequate facilities (Banda, 2016). Furthermore, it was reported that, most stakeholders were of the view that the introduction of the Subject was rushed (Mwambazi, 2015). This study was aimed at establishing the impact of making ICT Subject compulsory on ICT literacy in Secondary Schools. The Specific Objectives were to investigate the availability of specialised ICT Teachers, to find out the availability of ICT Equipment and Infrastructure in Secondary Schools of Livingstone District, and to establish the impact of making ICT Subject compulsory at Junior Secondary on ICT Literacy in Secondary

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Schools in Livingstone District. The rest of the Article is arranged under the following Sections, Background, Results, Discussion of Results and then the Conclusion.

BACKGROUND

For quite some time now, Information and communication technologies (ICTs) have been considered as a necessity to education as they are seen to have the potential to transform education and student learning, especially in developing countries (Behar & Mishra, 2015). In Zambia, many efforts have been made to integrate ICT in the education sector. In 2006 a project called iSchool was established for the purpose of delivering the National curriculum online, this project aimed at changing the pedagogies used in schools and deliver exciting, hands-on learning to students of all ages, or ability across the country (Habler et al., 2011). This is a good program which encourages the use of ICTs to customise learning and teaching but does not emphasise on integrating ICT as a subject. However, the iSchool Project would help to successfully integrate ICT Subjects in Schools and further promote ICT literacy among Teachers and Learners.

By 2010, sixty percent of the country's population was still leaving in rural areas (Central Statistical Office Lusaka Zambia, 2015), this may be an indication that most people in the country were not accessing ICT efficiently due to lack of electricity, therefore most of them remained ICT illiterate since most ICT equipment require the use of power. The integration of ICTs in learning and teaching practice was very limited in the beginning, but after the introduction of computer studies (SC) as a compulsory subject, the situation started changing (Shafika, 2007).

The Government of the Republic of Zambia has made significant reforms to improve the ICT sector in the country, this is partly demonstrated by the adoption of ICT as the priority sector in the Fifth National Development Plan (FNDP) (2006-2010), the introduction of teacher education in ICT at all teacher training institutions (TTIs) in the country, developing a national ICT curriculum, implementing special schemes and policies to facilitate easy acquisition of ICT equipment for both learners and teachers and promoting internet access at all levels of the education system (Ministry of Communications and Transport, 2006).

In view of the above stated adoptions and approval of the 2006 National ICT policy, the Zambian government through the Ministry of Education (MOE) introduced ICT subjects in the schools in 2014 and made the subject compulsory at junior secondary (Ministry of Education Science Vocational Training and Early Education, 2013b).

Related Literature

Banda (2016) conducted a study in Chipata District of Eastern Province, Zambia, and investigated whether or not the teachers and pupils were using ICTs in their teaching and learning of other curricula subjects, what materials were available in the implementation of ICTs in primary schools and what challenges teachers were experiencing in the implementation and interventions to improve the delivery of ICTs. The study established that there was low availability of ICT teaching and learning materials including poor infrastructure in schools. Findings of the study also indicated that some teachers resorted to using some personal ICT materials to help in teaching and that some schools were not electrified. Findings further indicate that the teachers were lacking knowledge and skills in ICT but had much interest in teaching the subject. The study however did not state the whether the implementation was a success and what impact it had on the ICT literacy in the school.

On the other hand, Mulenga (2016) tried to investigate whether the implementation of computer studies curriculum was a failure or a success, the study was conducted in Ndola District of Zambia and indicate that the implementation of the curriculum faced a number of challenges which included: inadequate funds to purchase ICT equipment, lack of infrastructure such as computer laboratories, lack of trained teachers to teach the subject and inadequate books and other materials. The study concluded that the implementation of CS curriculum was a failure in Ndola District (Mulenga, 2016).

Furthermore, a study which was conducted in the Mwanabombwe District to investigate barriers to effective implementation of CS curriculum in selected Junior Secondary Schools, established that there was lack of ICT equipment and basic infrastructure in schools to support the implementation process and further highlighted on the effects of teacher training and exposure to ICT by teachers. The study employed descriptive statistics to analyse the data collected and it was reviewed that only about 10% of the schools investigated had successfully implemented the curriculum. Major challenges outlined in the study include inadequate funds to procure ICT equipment, lack of computer laboratories, lack of trained computer teachers and lack of revision materials (Mambwe, 2016). The study did not indicate whether transfer of ICT literacy skills was taking place effectively.

Pelekole (2017) investigated experiences of teachers and learners in the teaching and learning of computer studies at junior secondary school level in three selected secondary schools of Luanshya District. Findings indicate that the teaching and learning of computer studies had positively empowered teachers and learners with various long-life technological skills such as browsing, typing and researching via internet. The study further indicates challenges that were experienced by teachers and learners which include: lack of teaching and learning materials and other ICT facilities, incidences of power outages, lack of modern school computer laboratories, inadequate trained personnel, negative attitudes from parents toward the teaching and learning of computer studies, lack of funding from government, limited time, overcrowding of classes, and high rate of theft of computers in schools among others challenges (Pelekole, 2017). Findings of the study review the benefits of computer studies on both teachers and the learners but do not clearly state whether skills development in ICT was demonstrated by the performance of the pupils in the ICT final examinations.

Another study conducted in Mazabuka district investigated teachers' and pupils' perceptions of information communication technology (ICT) as an examinable curriculum subject in secondary schools, the study utilised descriptive research design. Findings of Moono (2017) indicate that both the teachers and pupils had positive perceptions towards ICT as an examinable curriculum Subject as most of participants were of the view that current times demanded for ICT knowledge and skill in order for one to be effective and contribute positively in the world of work. The study also established that: lack of trained ICT teachers, inadequate computer hardware and software and irregular power supply were some of the challenges secondary schools faced in the management of ICT Subject. However, the study did not state whether positive perception by both teachers and pupils translated into effective ICT literacy skills transfer of which this study was looking at.

From related literature, it can be noted that lack of specialised ICT teachers and insufficient ICT equipment and infrastructure has been a common challenged faced by most schools in the country. However, other studies did not categorically state in detail the impact of ICT Subject on ICT literacy and how these challenges impacted the performance of the pupils in the final ICT examinations. However, this study like other studies also established the lack of both specialised human and material resources but went further and established the impact of compulsory CS at junior secondary grades on ICT literacy in schools and how the stated challenges had were likely to affect ICT literacy skills transfer and thereby affect performance of the pupils in the ICT final examinations.

METHODOLOGY

The purpose of the study was to establish the impact of making ICT Subject compulsory at junior secondary on ICT literacy in secondary schools of the Livingstone District. In order to fulfill this purpose, the study was guided by the following specific objectives:

1. To investigate the availability of specialised ICT Teachers in secondary schools of the Livingstone District;
2. To find out the availability of ICT equipment and infrastructure in secondary schools of the Livingstone District;

3. To establish the impact of making ICT subject compulsory at junior secondary grade level on ICT literacy in secondary schools of Livingstone District.

Research Site

The study was conducted in Livingstone District of Zambia. The district covers an area of about 695 square kilometers (District Education Board Secretary, 2017) sharing boundaries with Kazungula and Zimba Districts and shares its border with Zimbabwe in the south. Conducting the study in this area enabled the researcher to compare the findings of this study to the findings of other studies which were conducted in other districts of Zambia thereby giving a picture of what was obtaining at national level regarding teaching and learning of ICT subject in the schools.

Population and Sampling Techniques

The Livingstone District has 44 public schools with a junior secondary section, of these 15 are secondary schools running up to grade 12, and 29 are basic schools running only up to grade 9. The study targeted all 15 public secondary schools to avoid the problem of outliers which was the case with some basic schools. The surveyed schools were coded from 1 to 15. The study population covered officials at the District Education Board Secretary (DEBS), head teachers, teachers and pupils in secondary schools of Livingstone District. The study employed non-probability purposive sampling (Kombo & Tromp, 2014) to select the examination standards officer (ESO) and the statistician at DEBS, 15 head teachers of all public secondary schools and 26 teachers who teach ICT subject at junior secondary in the Livingstone District. Furthermore, forty pupils in groups of 10 were randomly selected in four different schools for group discussions, making a sample size of 83 respondents.

Research Instruments

The study utilised interview guide, questionnaires, classroom observation guide and focus group discussion guide (Phellas, Bloch, & Seale, 2011). For head teachers, interviews were used for the sake of clarification where necessary. Low response rate on the questionnaire was not expected since the study was not a country wide or over a very large area. For site visits to the computer lab or classroom observations, observation guide was used.

Validity and Reliability

A pilot study was conducted in two secondary schools in the Mumbwa District to check the validity of the instruments. Weaknesses in the instruments were identified and necessary adjustments made so that the instruments would be used to collect data necessary to this study. Also, triangulation of information from different sources within the same School was used to make the study more robust and reliable.

Data Analysis

The study utilised various data analysis techniques, using notes from interviews with head teachers, documents were generated and thereafter thematic analysis was used, for data gathered from questionnaires and notes made from classroom observations, a quick impressionist summary in the form of narrative reports were used (Kombo & Tromp, 2014). In addition, direct interpretation was employed where necessary (Thompson, 2010). For secondary data, descriptive statistics (Banda, 2016) using Microsoft Excel.

FINDINGS

For primary data (PD), findings were presented under emergent themes and then information tabulated for clarity. For secondary data (SD), descriptive statistics was used then charts, tables and graphs were drawn for easier understanding.

Availability of Specialised ICT Teachers

To determine the availability of specialised ICT Teachers in public secondary schools in Livingstone District, head teachers were asked on the number of teachers they had at their schools that were trained to teach ICT subject. Responses from head teachers were analysed under the following emergent themes: Trained to teach ICT, trained to teach other subjects, employed on parent teachers associations (PTA) basis and teacher background and competences in ICTs:

1. **Trained to Teach ICT:** Head teachers from two secondary schools indicated that they had one teacher trained to teach ICT who were employed by the MOE. The other head teachers indicated that she had two specialised ICT teachers, bringing the total number of schools with specialised ICT teachers to three;
2. **Trained to Teach Other Subjects:** Eight secondary schools representing 53% of the surveyed schools indicated that, they had no teachers who were trained to teach ICT so they had engaged teachers trained in other fields to handle the subject;
3. **Employed on PTA Basis:** Four secondary schools representing 27% of the surveyed schools indicated that they had one ICT teacher each who were employed on PT basis to cushion the lack of trained ICT Teachers at their school;
4. **Teachers' Background and Competences in ICTs:** To find the teachers' background in ICT, teachers were asked whether they had done any form of training in ICT or at least did ICT during their initial teachers training, of the 26 consulted, 12 (46%) teachers indicated yes, the other 14 (54%) indicated that they had no training in ICT and were teaching the Subject out of interest.

Table 2 shows teacher training and background in ICT.

When the teachers were asked how they would rate themselves in terms of skills and competences in ICT, eight (30%) indicated "above average," 18 (70%) indicated "average" and none indicated "below average." Table 3 shows teacher competences and skills as rated by the teachers themselves.

Table 1. Availability and distribution of teachers teaching ICT in public secondary schools

Status of Teachers	Teachers		Schools	
	No.	Percent	No.	Percent
Trained to Teach ICT	04	14%	03	20%
Trained to Teach other Subjects	21	72%	08	53%
Employed on PTA Basis	04	14%	04	27%
Total	29	100%	15	100%

(Source: Data from the field, June 2016)

Table 2. Teachers' background in ICT

Teachers' Background in ICT	Teachers	
	No.	Percent
ICT Trained/ Did ICT during initial training	12	46%
No training in ICT	14	54%
TOTAL	26	100%

(Source: Data from the field, June 2016)

Table 3. Competences and skills of teachers in ICT

Rating	Teachers	
	No.	Percent
Above Average	08	30%
Average	18	70%
Below Average	00	00%
Total	26	100%

(Source: Data from the field, June 2018)

Availability of ICT Equipment and Infrastructure

When head teachers were asked the number of computers and classes the school had and what infrastructure was available to facilitate the teaching of ICT subject at junior secondary grades. Findings were analysed under the following emergent themes: computers are not sufficient, internet is a challenge, specialised computer laboratory and additional ICT equipment and infrastructure:

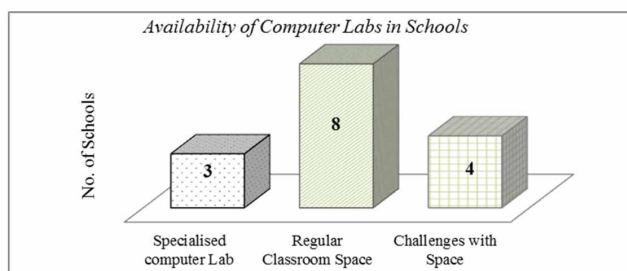
1. **Computers are Not Sufficient:** Head teachers from two secondary schools indicated that they had enough computers. One head teacher said the school had a whole block dedicated to ICT with three computer laboratories and over 40 computers in total, however, the exact number of computers was verified using field notes. The school had 4 streams of classes at junior secondary excluding APU. Head teachers of 13 (87%) secondary schools indicated that the schools had computers but were not enough. One head teacher stated that the school was using refurbished computers and they did not have enough to go around a class. The other head teachers said that the school had 25 computers against 2 streams of classes with an average of 45 pupils per class. Table 4 shows availability of computers in public secondary schools of the Livingstone District;
2. **Internet is a Challenge:** Six head teachers representing 40% of the surveyed schools indicated that it was very costly for the schools to meet internet subscription charges; therefore, internet connectivity was not available most of the times at the school. One head teacher said the school was connected by ZAMLINK and the school was paying K6000 (\$600) plus per month. Head teachers from nine (60%) secondary schools indicated that they had no internet connectivity at the school;
3. **Specialised Computer Laboratory:** Three secondary schools indicated that they had specialised computer labs, eight secondary schools representing 53% of the public secondary schools had converted regular classroom space to be used as computer labs, and four secondary schools indicated that they had serious challenges with space to be used as a computer lab even infrastructure such as computer desks was a problem. Figure 1 shows availability of computer laboratories in schools and Figures 2 and 3 show pictures of computer labs in two secondary schools;
4. **Back-Up Power Supply:** Two secondary schools indicated that they had back up power supply to power the computer lab during Zambia Electricity Supply Company (ZESCO) power outages. The other 13 representing 87% public secondary schools had no back-up power sources. One Head teacher informed the interviewer that one of the challenges they had was with back-up power supply, he further told the interviewer that in 2017 during practical exams power went and was only restored around 11:00 hours. Table 5 shows availability of back-up power sources in public schools;
5. **Additional ICT Equipment and Infrastructure:** Teachers were asked what other equipment and infrastructure was available at the School to facilitate the teaching of the ICT subject. Most (80%) teachers indicated that the schools had a wide range of ICT equipment but the quantities

Table 4. Availability of computers in the secondary schools of Livingstone

School	Number of Classes		No. of Pupils in a Class	Number of Computers		Computer to Pupil Ratio in a Lesson Class	Computer to Pupil Ratio in at Grade 9 Examinations
	G8	G9		2014	2018		
1	3	3	46	32	32	1:2	1:4
2	4	4	40	48	48	1:1	1:2
3	2	2	47	13	25	1:2	1:4
4	4	4	43	6	15	1:3	1:11
5	3	3	40	4	10	1:4	1:6
6	3	3	45	30	42	1:1	1:3
7	1	1	45	20	20	1:2	1:3
8	3	3	45	0	20	1:2	1:7
9	2	2	40	0	24	1:2	1:3
10	3	3	45	20	20	1:2	1:7
11	1	1	40	0	9	1:4	1:4
12	4	4	42	42	42	1:1	1:4
13	3	3	43	20	42	1:1	1:3
14	3	3	40	0	28	1:2	1:5
15	1	1	28	N/A	16	1:2	1:2
TOTAL				235	377		

(Source: Filed data June 2018)

Figure 1. Specialised Computer laboratory in public secondary schools (Source: Data from the field, June 2018)



were not sufficient. Below is a table showing additional ICT equipment and infrastructure available in public secondary schools of the Livingstone District.

The Impact of Making ICT Subject Compulsory at Junior Secondary

Using findings of objectives 1 and 2, the impacts of compulsory CS on ICT literacy in secondary schools in the Livingstone District were established and analysed under the following themes: impact on teachers literacy and competences in ICT, impact on pupils' literacy in ICTs, impact on ICT equipment availability in schools and impact on pupils' performance in the ICT final examinations:

Figure 2. Computer laboratory at secondary school 2 (Source: Captured in the Field, 14/06/2018)



Figure 3. Used as a computer laboratory at secondary school 11 (Captured in the field on 27/06/18)

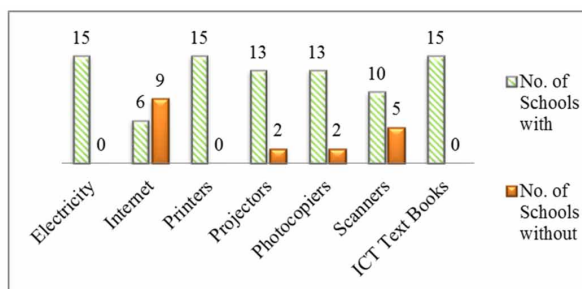


Table 5. Availability of backup power supply in public secondary schools

Backup Power Sources	Schools	
	Number	Percent
With	02	13%
Without	13	87%
TOTAL	15	100%

(Source: Data from the field, June 2018)

Figure 4. Additional ICT equipment and infrastructure available in public secondary schools (Source: Data from the field, June 2016)



1. **Impact on Teacher’s Literacy and Competences in ICT:** Findings reviewed that in 2014 when the ICT subject was introduced, one secondary school had two trained ICT teachers while 14 (93%) secondary schools had none, the number had risen to a total of four trained ICT teachers in three secondary schools by June 2018. Findings further reviewed that in 2014, teachers who had no training in ICT were teaching out of interest, however, by June 2018, seven teachers had done short courses in ICT and four teachers were pursuing bachelor’s degree courses in ICT with various institutions by distance education. Table 6 shows the training and professional development of teachers in ICT;
2. **Impact on Pupils’ Literacy in ICT:** Before the introduction of ICT as a compulsory subject at junior secondary, most (75%) pupils had no access to a computer, therefore, acquiring ICT literacy skills was not easy. This was reviewed when forty pupils were consulted whether they had a personal computer (PC) or if they had access to a computer while at home, two pupils said they had PCs, 8 (20%) said there was at least one at home and 30 (75%) said they had no access to a computer while at home. Table 7 shows pupil access to computers at home;
3. **Impact on ICT Equipment Availability in Schools:** Findings indicated that following the introduction of ICT Subject, there has been an increase in number of computers in the schools. At inception the total number of computers in the 15 public secondary schools surveyed was 235, but this number increased to a total 372 computers by 2018, in increase of 137 computers. Table 8 illustrates the increase in number of computers in Schools;
4. **Impact on Pupils’ Performance in the ICT Final Examinations:** The introduction of compulsory ICT Subject at junior secondary when most schools did not have specialised ICT teachers and equipment may had a negative effect on pupil performance in the ICT final examinations, where performance can be used as a measure of ICT literacy levels among pupils. To appreciate the impact of availability of specialised ICT teachers and equipment on the performance of the pupils in the ICT final examinations, results analysis of the grade nine ECZ ICT examinations for public secondary schools in the Livingstone District was done using Microsoft Excel, and the performance of the pupils was as shown in the Figure 6.

Table 6. Summary of teachers’ training and professional development in ICT

Training of Teachers in ICT	Year	
	2014	2018
Trained to Teach ICT	02	04
Short Courses in ICT	00	07
On Study in ICT	00	04

(Source: Data from the field, June 2018)

Table 7. Pupils access to computers at home

Access to Computer at Home		Pupils	
		No.	Percent
YES	Own Computer	02	5%
	Others’ computer	08	20%
No		30	75%
TOTAL		40	100%

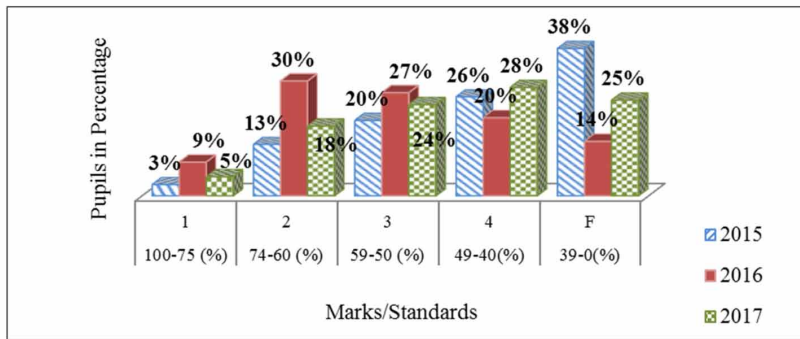
(Source: Data from the field, June 2018)

Table 8. Increase in number of computers accessible to pupils

Number of Computers Accessible to Pupils	Number of Schools	
	2014	2018
Above 20	4	8
11-20	4	5
1- 10	2	2
0	5	0
TOTAL	15	15

(Source: Data from the field, June 2018)

Figure 5. Overall performance of pupils in the Grade 9 ICT ECZ examinations in public schools of Livingstone District (Source: Grade 9 ECZ Examinations Results)



The outcome of the analysis showed that in 2015, some schools were more affected than others, which could be attributed to insufficient or lack of ICT equipment. Mostly affected were the upgraded primary and secondary schools. To further appreciate the correlation of availability of competent ICT teachers and ICT equipment to pupil performance in the final ICT examinations, pupil failure rate in four selected schools, Schools 1, 3, 8 and 9 was plotted. Table 9 shows the number of computers accessible to pupils in the selected school and Figure 6 shows the failure rate of the pupils in the ICT final examinations in these selected schools.

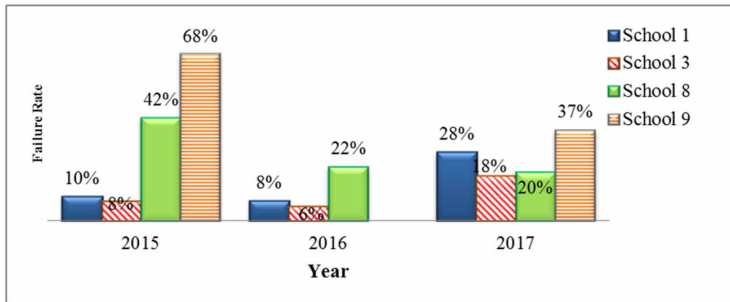
The outcome shows that in 2015 schools 8 and 9 had higher failure rate compared to the other two schools. High failure rate in these schools could be attributed to lack of computers as indicated

Table 9. Availability of computers accessible to pupils in four selected secondary schools

School	No. of Computers		
	2014	2015	2018
1	3	2	3
3	1	3	2
8	0	2	0
9	0	2	4

(Source: Data from the field, June 2018)

Figure 6. Failure rate in the Grade Nine ECZ ICT examination for four selected secondary schools (Source: Grade 9 ECZ Examinations Results)



in Table 9. In 2016 pupils at school no. 9 did not seat for the ICT examinations due to lack of ICT equipment at the school.

DISCUSSION OF FINDINGS

The discussion of findings was guided and presented under specific objectives.

Availability of Specialised ICT Teachers in Public Secondary Schools

Findings revealed that 3 (20%) public secondary schools in the Livingstone District had trained teachers employed by the MOE to handle the ICT subject, while 12 (80%) public secondary schools did not. Furthermore, findings indicated that not only were the schools with few trained ICT teachers, but that these specialised ICT teachers were not sufficient in that only one secondary school had two well-trained teachers to teach ICT subjects, the other two schools had one ICT trained teacher each against at least three streams of classes at junior secondary.

Even though these findings may not be generalised to other districts, this result is consistent with the findings of other studies such as Mambwe (2016) and Mulenga (2016) that were conducted in other districts, giving an impression that the lack of specialised ICT teachers in secondary schools could be a national challenge and this could negatively impact the teaching and learning of ICT literacy skill in schools. This is because teachers who are not trained to teach ICT subjects could possibly be incompetent to handle the subject (Enochsson, 2010). This is likely to compromise the quality of service delivery.

Findings further reviewed that some teachers had done short courses in ICT which had helped the teachers to have general knowledge in the subject. As much as this strategy may be helpful, systematic and organised training for teachers is required to fully equip them with necessary skills in ICT (Shafika, 2007) and Khvilon & Patru (2002) also confirms that, a well-organised training programme is necessary for teachers in any subject area.

This finding does not agree with findings of Çapuk (2015) which highlights that the US government puts much emphasis on the availability of specialised teachers to teach ICT in secondary schools. In addition, Abuhmaid (2017) argues that technology alone cannot have much effect in the implementation of ICTs, this is a clear demonstration that availability of well-trained Teachers in ICT cannot be overlooked if we are to have a positive impact on ICT literacy in the schools. Also, time spent during short course may not be sufficient to fully equip a teacher with necessary ICT skills.

Findings further indicated that in terms of skills and competences in ICTs, eight (30%) Teachers rated themselves as “above average,” 18 (70%) teachers indicated “average” and none indicated “below average.” It was noted that most of those who indicated “above average” had degrees and diplomas in computer studies and a few had degrees in business studies while most of those who had indicated

“average” had no formal training in ICT. This may mean that teachers who have formal training in ICT exhibit confidence in their teaching of ICT subject while those who are not trained to teach the subject may have low confidence levels to handle the subject which may disadvantage pupils under such a scenario, since confidence is as important as competence (Anderson & Weert, 2002).

Availability of ICT Equipment and Infrastructure

Findings indicated that 12 (80%) public secondary schools in the district had challenges with computers. This is likely to affect the exposure of pupils to computers and many schools may not be able to achieve the minimum requirement of four 40 minutes periods per week broken down as a single double period for practical and 2 single periods for theory lessons per week as stipulated in the computer studies syllabus for grade 8 and 9 (Ministry of Education Science Vocational Training and Early Education, 2013a).

These findings agree with findings of studies which were conducted in other parts of the country and also are consistent with results of other studies which were conducted in other Developing Nations such as findings of Mavellas, Wellington, and Samuel (2016) conducted in Kwekwe, Zimbabwe, and findings of Ngajie and Ngo (2016) conducted in Cameroon. However, this finding is not consistent with findings of Haydn (2009) and Enochsson (2010) which were conducted in the United Kingdom (UK) and Sweden, respectively. Therefore, it appears the problem of insufficient ICT Equipment in secondary schools could be common to most developing nations but not developed ones, this may be an indication that developing nations like Zambia still need to invest more in ICT in education if their ICT sector is to contribute significantly to socio-economic growth.

Findings also highlighted that most (80%) public secondary schools did not have specialised computer laboratories. This finding is in line with findings of Mulenga (2016), Mambwe (2016), and Nyanja (2018), this could be an indication that most schools may not have been ready at the time the subject was introduced and some were still facing challenges to conduct ICT practical lessons and examinations. This could be confirmation that pupils in different schools and Districts were potentially not equally advantaged which could be a barrier to the achievement of fairness in education as stated in the Zambia Education Curriculum Framework 2013 (Ministry of Education Science Vocational Training and Early Education, 2013b).

The Impact of Making ICT Subject Compulsory at Junior Secondary

Objective 3 sought to establish the impact of making ICT Subject compulsory at junior secondary on ICT literacy in secondary schools. Using findings of objective 1 and 2 of the study, the impacts were established and discussed under the themes: impact on teachers’ literacy and competences in ICTs, impact on pupils’ literacy in ICTs, impact on ICT equipment availability in school and impact on pupils’ performance in the final ICT examinations:

1. **Impact on Teacher’s literacy and competences in ICT:** Findings reviewed that the number of specialised ICT teachers had risen from a total of two in 2014 to a total of four by June 2018 in all public secondary schools in the district. Findings further reviewed that by June 2018 seven (07) (24%) Teachers had done short courses in ICT and four teachers were at the time pursuing bachelor’s degree courses in ICT with various institutions on distance basis. Findings demonstrate that after the introduction of ICT as a compulsory subject, teachers developed interest in ICT and were acquiring skills, knowledge and becoming more literate and competent in ICTs. Training in ICT has the capacity to increase awareness among teachers of the benefits ICT brings to education thereby encouraging the use of ICTs in the teaching and learning of other subjects. This is in line with the findings of Abuhmaid (2017) who indicates that 110 teachers in Sweden became aware of the benefits of ICT after being trained in ICT;
2. **Impact on Pupils’ Literacy in ICT:** Findings indicated that 10 (25%) pupils had access to computers at home while 30 (75%) pupils had no access to computers while at home. Introduction

of ICT as a compulsory subject at junior secondary provided most pupils with an opportunity to be exposed to computers, thereby likely to become ICT literate. This means that before the introduction of ICT as a compulsory subject at junior secondary, few pupils had access to computers, therefore had no much opportunity to learn ICT literacy skills. It was also observed that two 13% public secondary schools indicated that they were offering ICT Subject to their pupils even before it was introduced in the curriculum. 13 (87%) said they started offering the subject after it was introduced in the curriculum in 2014 and later. This finding further confirmed that before the subject was introduced in the curriculum few pupils had access to ICTs especially computers but after the introduction of ICT subject more pupils have an opportunity to be exposed to a computer thereby have an opportunity of learning ICT literacy skills. This will help to build a well informed and ICT competent society which is the case with many developed nations (Maryland School, 2015);

3. **Impact on Availability of ICT Equipment in Schools:** Findings indicated that at inception 47% public secondary schools in the Livingstone District had 20 computers or more, but this number had increased to 73% secondary schools with 20 computers or more by June 2018, an increase of 26% schools. Findings also showed that at inception total number of computers in public secondary schools was 235, but this number increased to 372 computers by June 2018, in increase of 137 (58%) computers. Findings demonstrate that the introduction of ICT as a compulsory subject at junior secondary had a positive impact on equipment availability in public secondary schools;
4. **Impact on the Pupils' Performance in the ECZ ICT Examinations:** Findings reviewed that making ICT subject compulsory at junior secondary when schools did not have specialised ICT teachers and sufficient ICT equipment may have strongly contributed to the poor performance of the pupils in the national ICT examinations especially in Schools which had serious challenges or had no computers as was further demonstrated by the outcome of the results analysis for selected public secondary schools in the district. This may mean that the transfer of ICT literacy skills may not be effective.

Results further showed that in 2017 the failure rate had gone up which could be attributed mainly to the manner in which ECZ ICT Practical Examinations were conducted. ICT practical examinations were written over a period of three days and each day, pupils wrote a different paper.

CONCLUSION

The study outlined that most (80%) public secondary schools in the Livingstone District had no specialised teachers in ICT employed by the MOE to teach the subject at Junior Secondary. It was further outlined that some teachers who were trained to teach other subjects had done short courses in ICT. However, it was noted that, as much as this may be a good initiative, organised formal training for teachers in ICT cannot be overlooked.

The study further established that public secondary schools had necessary ICT equipment to support the teaching of the ICT subject, however, computers were not sufficient, in some cases with a ratio of 1 computer to 4 pupils in a lesson class and 1 computer to 11 pupils at final examinations. Therefore, the teaching of the subject and imparting of ICT literacy skills may not have been effective in most cases.

It was also established that the introduction of compulsory ICT subject at junior secondary in schools had an impact on teachers' literacy and competences in ICT, also provided pupils with an opportunity to be exposed to ICTs mainly computers thereby likely to learn ICT literacy skills. Furthermore, it was established that compulsory computer studies at junior secondary amidst lack of specialised human and material resources in the schools may have strongly affected the performance of the pupils in the ICT ECZ Examinations, which may be used as a measure of ICT literacy skill transfer to learners.

REFERENCES

- Abuhmaid, A. (2017). Ict training courses for teacher professional development in Jordan ICT. *TOJET: The Turkish Online Journal of Educational Technology*, 10(October), 195–210.
- Anderson, J., & van Weert, T. (2002). *Information and communication technology in education: A Curriculum for Schools and Programme of Teacher Development*. UNESCO. doi:10.1007/978-3-319-13999-9
- Banda, D. (2016). GES5881 Lecture 2 Scientific Method and Qualitative Quantitative Methods.
- Banda, I. (2016). *The Implementation of Information Communication Technology in the Primary Education Curriculum in Selected Schools of Chipata District*. University of Zambia. Retrieved from <http://dspace.unza.zm:8080/xmlui/>
- Behar, A., & Mishra, P. (2015). *ICTs in Schools: Why Focusing Policy and Resources on Educators, Not Children, Will Improve Educational Outcomes*. Michigan State.
- Çapuk, S. (2015). ICT Integration Models into Middle and High School Curriculum in The USA. *Procedia: Social and Behavioral Sciences*, 191, 1218–1224. doi:10.1016/j.sbspro.2015.04.409
- Central Statistical Office Lusaka Zambia. (2015). Zambia Demographic and Health Survey 2013-14.
- District Education Board Secretary. (2017). *2017-2021 LIVINGSTONE Strategic Plan Draft*.
- Enochsson, A. (2010). ICT in Initial Teacher Training: Sweden Country Report.
- Habler, B., Hennessy, S., Lord, T., Cross, A., Jackson, A., & Simpson, M. (2011). An investigation of appropriate new technologies to support interactive teaching in Zambian schools (ANTSIT) Final report to DfID.
- Haydn, T. (2009). Teacher education and ICT : some points for consideration from the UK.
- Khvilon, E., & Patru, M. (2002). Information and Communication Technology. In J. Anderson & T. VanWeert (Eds.), *Education: A Curriculum For Schools and Programme of Teacher Development*. Paris: UNESCO.
- Kombo, D. K., & Tromp, D. A. L. (2014). *Proposal and Thesis Writing: An Introduction (14th ed.)*. Nairobi, Kenya: Paulines Publications Africa, Daughters of St Paul.
- Lusaka Times. (2015). Introduction of Information and Communication Technology (ICT) subject in primary schools. Retrieved from <https://www.lusakatimes.com/2015/03/29/introduction-of-ict-subject-in-primary-schools-is-a-source-of-worry-znut/>.on:02.02.2017
- Mambwe, G. (2016). *Barriers to Effective Teaching of Computer Studies in Selected Government Schools of Mwanabombwe District in Luapula Province*. University of Zambia and Zimbabwe Open University.
- Mavellas, S., Wellington, M., & Samuel, F. (2016). Assessment of The Availability and Utilization of ICTs For Teaching and Learning In Secondary Schools - Case of a High School in Kwekwe, Zimbabwe. *International Journal of Scientific & Technology Research*, 5(5), 282–288.
- Ministry of Communications and Transport. (2006). National information and communication technology policy.
- Ministry of Education Science Vocational Training and Early Education. (2013a). *Computer Studies Syllabus: Grade 8 and 9*. Lusaka: Curriculum Development Centre.
- Ministry of Education Science Vocational Training and Early Education. (2013b). *Zambia Education Curriculum Framework 2013*. Lusaka: Curriculum Development Centre.
- Moono, S. (2017). *Teachers' and Pupils' Perceptions of Information Communication Technology (ICT) As an Examinable Curriculum Subject in Selected Secondary Schools of Mazabuka District*. Zambia: The University of Zambia.
- Mulenga, C. L. (2016). *The Implementation of Computer Studies Curriculum in Selected Public Primary Schools in Ndola District of Zambia: Failure or Success*. University of Zambia. Retrieved from <http://dspace.unza.zm:8080/xmlui/>
- Mwambazi, H. (2015). Times of Zambia. Zambia: Has Introduction of ICTs in Schools Been Rushed. Retrieved from <http://allafrica.com/stories/201510211462.html>. Viewed.20.01.2017

Ngajie, N. B., & Ngo, M. M. C. (2016). Integration of ICTs into the curriculum of Cameroon primary and secondary schools: A review of current status, barriers and proposed strategies for effective integration. *International Journal of Education and Development Using Information and Communication Technology*, 12(1), 89–106.

Nyanja, N. (2018). *Effects of the Implementation of the ICT subject(s) in Primary Education in Selected Schools Under Lusaka Province*. The University of Zambia.

Pelekole, K. (2017). *Experiences of Teachers and Learners in the Teaching and Learning of Computer Studies at Grade 9 Level in Selected Secondary Schools in Luanshya District*. Zambia: University of Zambia.

Phellas, C. N., Bloch, A., & Seale, C. (2011). Structured Methods: Interviews, Questionnaires and Observation. In *Doing Research* (pp. 181–205). Academic Press.

Jackson, L. & Cooper, L. (2015). *Research Into Integration of ICT in Swedish Schools*. Maryland School.

Shafika, I. (2007). *Survey of ICT and Education in Africa: Zambia Country Report*. ICT in Education in Zambia.

Thompson, S. W. (2010). *The Caring Teacher: A multiple case study that looks at what teachers do and believe about their work with at-risk students*.

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