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The integration of ICTs in the learning and teaching of science at Namibian College of Open Learning

The Namibian government developed the ICT Policy for education which was created by the Education and Training Sector in order to enhance the use and development of ICT in the teaching and learning environment (MoE 2005). This policy was launched in 2005 by the Ministry of Education. According to this Policy, schools with secondary education phase are expected to be at Level 2 of the five levels of ICT development in the educational institutions. The criteria for Level 2 expect secondary schools, among others, to:

- have computers accessible to all teaching staff and internet connectivity
- have teachers who are able to use the internet, e-mail and word processor
- enable students spend at least one hour every two weeks on the computer
- have teachers who are able to download and create learning materials and
- integrate the use of technology in the teaching and learning situation.

The integration of ICTs in education, which is the focus of this paper, is stated as one of the five distinct development areas in the use of ICT (MBESC 2005). The development of the ICT policy and the recent initiatives of increasing investments in ICTs facilities are proof that the Namibian government emphasized the importance of ICTs in education.

According to Dickson & Irving, (2007: 97) all teachers will be faced with a challenge of knowing how to use in the Open and Distance sector are not exempted from this challenge including those at computers and have the ability to use the computers confidently in the teaching and learning set up.

The Namibian College of Open Learning (NAMCOL) is a state funded educational institution which provides educational opportunities for adults and out-of-school youth. NAMCOL's core activity has traditionally been its Secondary Education Programme (SEP), which enables those who cannot or do not wish to attend a conventional school to study for either the Junior Secondary Certificate (JSC) or the National Senior Secondary Certificate (NSSC). Learners who register for the SEP receive a full set of self-study materials for each subject. In addition, they are provided with a range of academic supports, including face-to-face sessions with tutors. Those who opt for the Contact Mode of study receive three to four hours of tuition per week in each subject at one of the hundred tutorial centres located across the country. Learners on the NSSC level are having the option to register for the Non-Contact mode where they do not attend classes. Secondary Education Programme learners follow the same curricula and sit the same examination as in the conventional schools.

NAMCOL has an average annual enrolment of 35,000 learners. The college enrolled 35 746 learners for the 2013 academic year of which 65.4% are female and 34.6% are male students.

Science Education

Learners' enrolment for science subjects increased over the past years, 9 060 learners enrolled for science at NSSC level in 2011 compared to 8 223 learners recorded in 2010 (NAMCOL, 2011). During the 2011-2013 academic year, the College committed resources and produced e-lessons, radio, television lessons and established over ten computer laboratories in various towns across the country (NAMCOL, 2012).

For the past two years NAMCOL has trained tutors on how to access and utilise the web based lessons. Tutors are also trained on how to retrieve information from the internet and develop own teaching materials. Participants in this study are NSSC Physical Science and Biology tutors and learners at NAMCOL centres in Windhoek, Otjiwarongo, Keetmanshoop, Rundu and Ongwediva. All these centres have computer laboratories.

This paper presents assessment on the extent to which the Information Communication Technologies (ICTs) have been integrated in the teaching and learning of science subject at the NAMCOL centres.

The paper will present the finding of the study on the following questions:

1. To what extent do tutors currently integrate and use ICT in their tutoring of Science subjects at NAMCOL centres?
2. What challenges are experienced, which hamper the integration of ICTs in the teaching and learning of Science subjects at NAMCOL centres?

In this paper the term ICT refers to the computer and internet connections used.

Methodology

Seven science teachers and 102 learners at the NSSC level at five NAMCOL centres with computer laboratories participated. Questionnaires were used to collect data.

Findings and Discussions

Learner and teacher profiles

Most teachers (57%) were aged between 30 to39 and their teaching experience ranged between 5-13 years. Forty three percent were female teachers. Most (73%) of the learners were aged between16-20. Female learners were in majority (67%) and at all the five centres the number of female learners was higher than the males in the science class.

The Infrastructure and location of computers

The number of computers found at the centres varied from between 25 to 30. On average, 80-100% of the available computers were reported to be in working condition with good internet connectivity. The most common operating systems were MS-Windows 2000 and XP. Table 1 shows the exterior devices at the centres. All centres are having printers which are either in the computer laboratory of the centre administrators. Teachers indicated that if they want to print documents they load them on the memory sticks and take them for printing. Scanners are used by the administrators and none of the teachers could report on how they use it for teaching.

Computers were located mostly in computer laboratories. However, two centres reported that there are computers centres in the science laboratories. These computers are accessible when the computer training facilitator is not busy with training. The location of computers determines who used the computers and when.

**Table 1 Devices available at centres & usage by science teacher**

Peripheral Devices	Available at the 5 Centres	Teacher usage %
Printers	5	100
Scanner	5	14
CD-ROM	5	14
CD-ROM writer	1	0
Beamer /data projector	5	48
Digital camera	4	14
Modem for Internet Connect	5	48

Teacher and Learner access to ICTs at school and at home

Six out of the seven teachers in this study had a computer at home. They mainly used it for:
- Typing tests and reports
- Downloading files
- Searching information for private and career related

The picture reflected in **diagram A** below illustrates that the science teachers have access to computers when they need them. During the interview it came out clearly that the computer laboratories are used for training and therefore cannot always be booked for the teaching of subjects. Of the seven teachers, one teacher said he never got access to the computers at the centre, while two said they always had access when they need it. Five indicated they used ICT for purposes of science teaching.

Teacher Access of ICT at Centres for teaching Science

- Always
- Sometimes
- Never

1
2
4
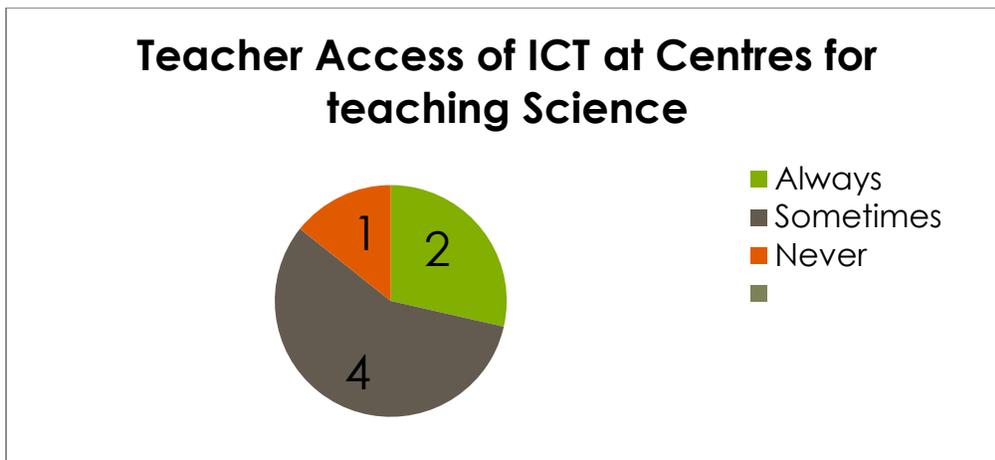
Diagram A: Teacher access to school computers

Learners indicated they could access ICT for learning at the centre and home which include their friends, relatives and cellphones. Forty four learners of the 102 leaner participants indicated that they had access to computers at home. Refer to table 2 for the use of home computers by the learners. At two of the centres learners reported that they can use the computers in the Resource centres, but expressed concern that usually they are occupied by other users. Some learners indicated that computer facilitators are strict and they do not allow them to use the computers.

Table: 2

Learner Use of Home computer	%
a. Research for school assignments	32
b. Listening to music, records CDs,	32
c. Typing on MS Words	27
d. Playing games	17
e. Checking mails and downloading journals	7

Teacher and learner training in ICT

The table below reflects the learners and teachers' level of ICT training. In table 3 reflects that 23% of the learners did not get any ICT related training, while 27% have attended the Basic ICT courses offered to learners by the college at a very low cost. Eighty percent (86%) of the teachers reported that ICT was part of the main courses at university when they were studying, refer to table 4. None of the teachers have done ICDL compared to 4% of the learners who have attained the ICDL.

Table 3: Learner computer training

Computer courses done by Learners?	Course done
a. ICDL course	4
b Computer Literacy	24
c. Short computer courses	4
d. Computer Literacy at home	10
e. Computer Studies	9
f. others: NAMCOL Basic ICT	28
g. No training in computer	23

Table 4 Teacher computer training

ICT Training experience	Yes	No
a. Formal as part of main course at University	6	1
b. ICT literacy course at university	4	
c. Self initiative part-time	3	
d. ICDL course	0	
e. Workshops	2	1
f. Teaching self on the job	3	1
g. other (specify)	2	

The focus of use of ICT in the schools

All five centres offered International Computer Driving Licence (ICDL) and computer literacy classes to the general public. All seven teachers reported that they have skills in the use of ICT and do use them. Refer to the table below which reflects the degree of usage. Of the seven teachers five indicated that they used ICT for purposes of science teaching.

Table 5 Teacher computer training

Use of artifacts	How often learner use the skill				
	0=not availble	?=unkwn	1=never	2=sometime	3=often
	0	?	1	2	3
Basic ICT artifacts					
1. Laptop	2		1	2	4
2. Printers			1	3	3
3. Scanner		3	3	1	0
4. CD-ROM	0	0	2	3	2
5. CD-ROM writer	0	0	3	4	1
6. Memory stick			1	1	5
7. Data projector	0	1	4	1	1
8. Digital camera			5	2	
9. Internet www				1	6
10. e-mail			1		6
11. MSWord			1		6
12. MSPowerpoint			1		4

Extent of use of ICT

The reported use of ICT by the five of the seven science teachers is as follows:
- download worksheets in all topics
- download pictures used in tests
- topics on genetics for learners
- power point presentations
- learn how to draw genetic diagrams

Student use of ICT for learning science

Computer core skills included use of the mouse and keyboard most learners have indicated that they are confident. Refer to diagram B below. Spreadsheet section included data entry, use of formulas and creation of graphs. Spread sheet section had the highest number of learners who do not have the skills followed by the section on multimedia. Multimedia included the use of CDs. Internet reported the highest number of experts among the learners and had the least number of those who do not know it. Most learners search internet via their mobile phones.

On the question about the learners' uses of ICT in learning science only 14% indicated that they used computers for learning purposes. They use it to search for topics they do not understand and typing their assignments. A number of learners reported that they use Notemaster, which is a platform to search for more information on the topics covered in the syllabi. Ninety five learners

of the 102 indicated that their science teachers never use computers, while one reported sometime, another one said often and the other five did not respond to the question.

Diagram B Learner Level of Computer skills
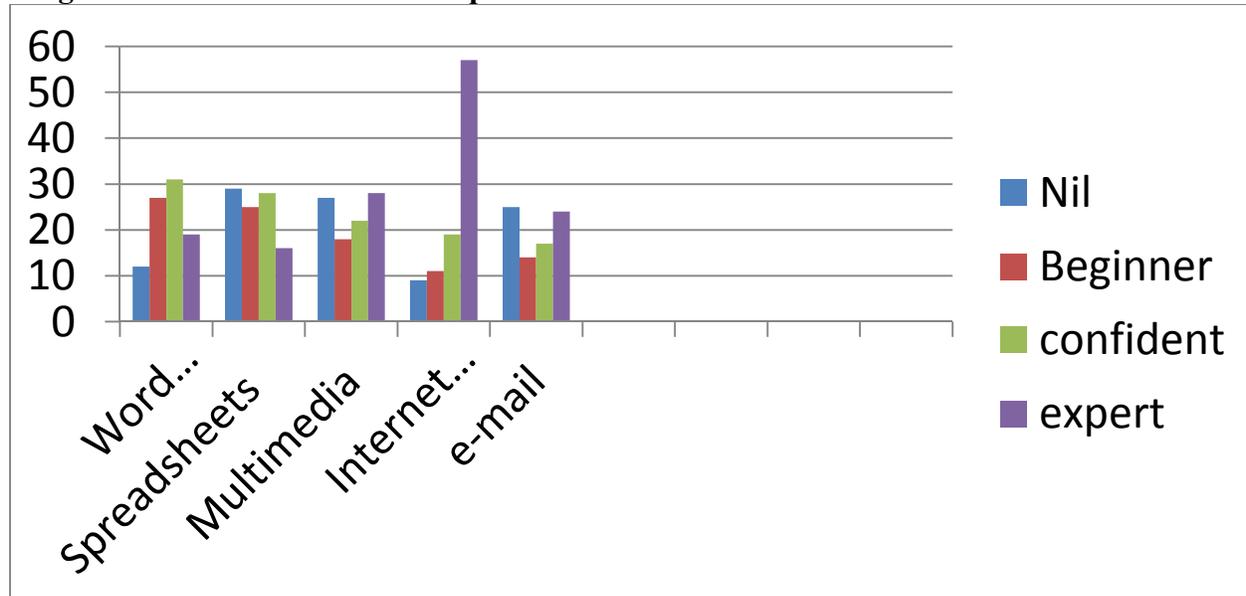
Challenges for Integration

The hindrances that teachers face when using ICTs

The act of using ICTs in teaching and learning is a complex exercise and through the process one could encounter a number of hindrances (Bingimlas, 2009). Schoepp (2005) identifies the common widespread barriers (hindrances) that teachers normally face when integrate ICTs in their classrooms. These hindrances are:

> "lack of computers, lack of quality soft-wares, lack of time, technical problems, teacher attitudes towards computers, poor funding, lack of teacher confidence, resistance to change, poor administrative support, lack of computer skills, poor fit with the curriculum, lack of incentives, scheduling difficulties, poor training opportunities, and lack of vision as to how to integrate" (p. 3).

Lack of teachers' knowledge of ICTs makes them feel nervous and uncomfortable to use technologies in their teaching classrooms.

Understanding the need for change

It is very important that the teachers are given a clear explanation as to why there is a need for them to integrate ICTs in their teaching. Especially the elderly teachers who have been obtaining

good grades without having used the sophisticated ICTs such as TV and computers will not see its need. Therefore if teachers see no need to change their current teaching practice they may not accept the use of ICT in their teaching.

Teacher and learner computer literacy

A number of teachers spoken to, do not use computers because they are not trained as to how to use them with regard to instruction of subject content and how to incorporate ICT in the curriculum. Therefore, teachers will concentrate on trying to cover the syllabi and prepare learners for examinations rather than taking learners to the computer room. Learners need to be trained on how to use ICT to understand subject content, because a numbe of them use it for social matter such as facebook, music and downloading movies.

Conclusion

Technology itself is a barrier, for instance, many teachers experience difficulties to handle and use new tools. If teachers discover the usefulness of computers in the classroom and education at large, then hopefully that will change their attitude and they might embrace its use in their classrooms and offices daily. With the right attitude towards computer usage in school, then all hindrances can be tolerated (Cox et.al. 1999)

Despite numbers of constrains in the integration of ICTs in school subjects and science subjects in particular; ICTs make teachers' work easier. ICTs are also vital for enhancing learners' thinking capacity and promoting their conceptual understandings beyond what they have learned in classrooms.

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