EVALUATION OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) CHALLENGES IN TEACHING CHEMISTRY, A CASE OF ZIMBABWEAN POLYTECHNICS

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ABSTRACT

We are living in a new age in which Information and Communication Technology (ICT) has become a key motivating force in almost all aspects of teaching and learning. The aim of this study was to ascertain the challenges faced by lecturers in the use of Information and Communication Technologies (ICTs) in the teaching of Chemistry at Polytechnics in Zimbabwe. The challenges faced by lecturers in teaching Chemistry were found to be extrinsic barriers such as inaccessibility of ICT resources, time constraints, limited technical support and lack of training as well as intrinsic barriers such as lack of competency, attitudes towards use, resistance to change and personal beliefs. The need to continuously train Chemistry Lecturers on the use ICTs was ascertained. Provision of adequate ICT gadgets, facilities and services in the teaching and learning of Chemistry is strongly recommended.

Keywords: *Barriers, Chemistry, Information and Communication Technology, Teaching.*

1. INRODUCTION

ICT has become a critical part and parcel of the teaching and learning in all courses [3]. The global swing towards a knowledge based society has seen the role of ICTs in education becoming increasingly important [10]. ICT is bringing many exciting opportunities for schools and colleges, impacting what, where and how education is delivered. Yunus (2009) [16], defines Information and Communication Technology (ICT) as types of technology that are specifically used for communication purposes and includes cell phones, the internet and wireless networks. ICT is technology that supports activities involving information [11]. Such activities include gathering, processing, storing and presenting data. These activities also involve collaboration and communication. ICT in teaching and learning encompasses all digital teaching materials and aids like laptop computers, desktop computers, palmtop computers, televisions, smart-phones, cameras, projectors and appropriately improvised digital materials.

Today's students are highly immersed into information and communication technologies in nearly all aspects of their lives and they can learn and work more independently and effectively when they use ICTs [2]. The digital revolution provides new learning opportunities that are increasingly abundant, in which students are learning all the time, online, off-line, in classrooms, as well as after school, in homes, community centers, libraries and museums. ICT has changed over the recent decades; there is introduction and accessibility of a variety of digital technological materials relevant for teaching and learning scientific and engineering concepts. The increasing variety and accessibility of ICT has expanded the educator's professional toolbox [3]. The introduction of computers, computer based devices and the internet has revolutionized ICTs used in education, research and other areas. Computer based devices are more powerful and come in different forms, from large mainframe machines to small hand-held palm

top computers. The internet connects digital devices and allows learners to be connected to each other in the classroom, through the school and around the whole world, enhancing their motivation and participation in class [4].

Several countries in the world are increasingly investing in digital and computer science based education. Today's world could be organized by the availability of ICT technology; information and knowledge are becoming the driving force of the global economy [14]. They are providing or enabling digital devices and digital content for students and educators to use in school and at home, redefining textbooks to include digital content and the necessary devices. Some nations are investing in training for educators in digital and computer science to better incorporate information and communication technology in the teaching and learning of 21st century skills [9, 14].

Chemistry has been around for a long time and is known to date back to as far as the prehistoric times. The earliest practical knowledge of chemistry was concerned with metallurgy, pottery, and dyes. The teaching of science subjects like chemistry often requires creativity and improvisation [5]. To make scientific concepts comprehensible to students, educators must employ creative teaching methods and be prepared to respond to queries and explain concepts in an atypical manner [13]. Chemistry knowledge is control to vocations in health services, pharmaceuticals, petroleum and petrochemical industries, food processing, teaching services and extractive industries, which are relevant for economic development. The teaching of Chemistry should therefore aim at developing in the students, those manipulative and experimental skills necessary to make them competent and confident in the investigations of the material resources around them [5]. To fulfill the intended goals and objectives in the teaching of Chemistry, its teaching has to be physical and real [1]. Manipulative and experimental skills can be successfully developed in learners when ICTs are used. The effective use of ICT in the teaching of chemistry has the potential to enhance achievement among learners through greater collaboration, improved communication and opening of wider opportunities to share information [15]. From a broader perspective, the benefits from advances in ICTs could also mean an acceleration of economic and social development and greater inclusion of isolated, particularly rural populations, into the mainstream of society [7].

Besides enjoying the benefits of using ICTs in teaching, educators face some challenges when using ICTs. The opportunities provided by ICT to support teaching and learning are not problem-free; some barriers may discourage educators to integrate ICT in the classroom and prevent them from introducing supporting materials through ICT usage [6]. Likewise, educators in Zimbabwean Polytechnics are also facing some challenges in using these ICTs in teaching Chemistry. This study investigates the challenges faced by lecturers in the use of ICTs in teaching Chemistry at Polytechnics in Zimbabwe. Examining such challenges can assist in coming up with information that the educators can use to overcome the obstacles in ICT use and promote the integration of ICT in everyday education.

1.1 Problem Statement

There is little doubt that Zimbabwe's education sector is missing out on the benefits of ICTs as the country lags behind in the adoption, use and innovation of ICT [8]. Polytechnics are part of the Zimbabwean education system falling under the Ministry of Higher and Tertiary Education, Science and Technology Development. Chemistry Lecturers in Zimbabwean Polytechnics do not seem to be adopting ICTs in the Chemistry curricula. There are some barriers that discourage lecturers from integrating ICT in their chemistry classes. Failure to incorporate ICTs in teaching is contributing to poor instructional delivery, leading to mere abstract learning and high failure rate in chemistry and related subjects.

1.2 Aim and Objectives of Study

Aim

To ascertain the challenges faced by lecturers in the use of ICTs in teaching Chemistry at three selected Polytechnics in Zimbabwe.

Objectives of Study

- To determine ICT gargets possessed by Chemistry Lecturers at Zimbabwean Polytechnics.
- To ascertain the barriers and challenges faced by Chemistry Lecturers at Zimbabwean Polytechnics in using ICTs in the teaching process.
- To determine the major ICT needs for Chemistry Lecturers in Zimbabwean Polytechnics.

1.3 Justification of Study

ICTs are a vital component in creating a global knowledge-based society. Many educators in Zimbabwe and abroad are increasingly getting to realize the benefits of ICTs. According to the Modernization Theory, adoption of technology is a building block to better quality of life [12]. The purpose of this study was to investigate challenges that Chemistry lecturers are facing and suggest possible solutions in an effort to enhance effective teaching and learning which would culminate into good performance among learners. Examining the barriers and challenges in using ICTs in education can assist the educators to overcome the obstacles and integrate ICTs in everyday education. As a developing nation, Zimbabwe needs to be part of this new dispensation which entails integrating new ICT processes into the education system [10].

2. METHODOLOGY

A descriptive survey design was adopted for this study. The survey is the most frequently used method for collecting information about peoples' attitudes, opinions, habits or views. The research was carried out at three selected Polytechnic colleges across Zimbabwe. The concerned Polytechnic departments were communicated with and the responsible authorities were notified. The target population comprised of 20 practicing Chemistry lecturers from Zimbabwean Polytechnics that offer applied science courses. Eighteen (18) practicing Chemistry lecturers with at least four years work experience were randomly selected for the study. Having had a longer period of exposure to the Chemistry curriculum, they were better placed to provide more concrete information required for the study. The consent of the respondents was sought before they were engaged. The researchers also maintained confidentiality of data obtained from all respondents.

The major tools for the study were interviews, questionnaires and observation schedules. The researcher used one interview schedule, one questionnaire for the Chemistry lecturers and an observation guide. The observation guide was used to observe the ICT facilities, infrastructure and gadgets at the Polytechnics and get reliable first-hand information. Interviews aided in compiling detailed and in-depth information for the study.

3. RESULTS AND DISCUSSION

3.1 ICT Gargets

Table 4.4 Contains summaries of data obtained from the respondents on the adequacy of different ICT Gadgets at their institutions.

Table -1: Institution's ICT Gadgets

ICT gadgets	Adequate		Inadequate		Not Sure		Total	
	f	%	f	%	f	%	f	%
Computers for students	3	16.7	8	44.4	7	38.9	18	100
Computers for Lecturers	2	11.1	12	66.7	4	22.2	18	100
Laptops for Lecturers	2	11.1	14	77.8	2	11.1	18	100
Projectors	2	11.1	15	83.3	1	5.6	18	100
Video Cameras	0	0	10	55.6	8	44.4	18	100
Printers	0	0	17	94.4	1	5.6	18	100

The results revealed that 3 (16.7%) of the respondents said Computers for students were adequate whilst 8 (44.4%) indicated that Computers for students were inadequate and 7 (38.9%) of the respondents were not sure. In response to computers for lecturers, only 2 (11.1%) indicated that they were adequate, 12 (66.7%) indicated that they were inadequate and 4 (22.2%) were not sure. As regards to Laptops for lecturers, only 2 (11.1%) respondents said they were adequate whilst 14 (77.8 %) said they were inadequate and 2 (11.1%) indicated that they were not sure. Regarding Projectors, 10 (55.6%) indicated that they were inadequate, 8 (44.4%) indicated that they were not sure and none of the respondents indicated that projectors were adequate. As for Video Cameras, 10 (55.6%) indicated that they are inadequate, 8 (44.4%) indicated that they were not sure and none of the respondents indicated that Video cameras were adequate. Regarding Printers, 17 (94.4%) of the respondents indicated that they were inadequate, only 1 (5.6%) was not sure and none of the respondents indicated that Printers were adequate.

In terms of facilities, the responses from the respondents were as follows: 8 (44.4%) of the respondents said classrooms are adequate whilst 10 (55.6%) indicated that classrooms are inadequate; 2(11.1%) indicated that computer laboratories are adequate and 16 (88.9%) indicated that they are inadequate; 2 (11.1%) respondents said computer furniture is adequate whilst 13 (72.2 %) said is inadequate and 3 (16.7%) indicated that they were not sure. Regarding uninterrupted power supply, 3 (16.7%) indicated that there is adequate uninterrupted power supply, 14 (77.8%) indicated that uninterrupted power supply was inadequate and only 1 (5.5%) was not sure.

3.2 Challenges faced by Chemistry Lecturers

Challenges affecting chemistry lecturers were found to be either extrinsic or intrinsic factors. The results revealed that inaccessibility to ICT resources is the major extrinsic factor affecting most Chemistry Lecturers in the use of ICTs at their institutions. The results also show that limited technical support and lack of computer training are the second major extrinsic factors affecting most chemistry Lecturers in the use of ICTs at their institutions. Insufficient time allocation was indicated to be the least major extrinsic factor affecting most Chemistry Lecturers in the use of ICTs at their institutions. Chart -1 below summarises the findings on the major extrinsic factors affecting most chemistry Lecturers in the use of ICTs at their institutions.

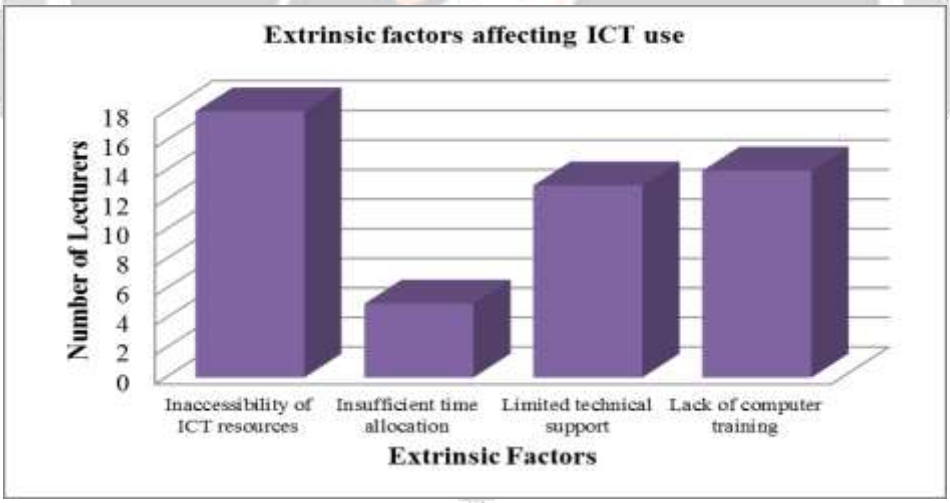

Chart -1: Extrinsic factors that inhibit chemistry lecturers from using ICTs

On the other hand, the results reveal lack of competency and resistance to change as the major intrinsic factors affecting most chemistry Lecturers in the use of ICTs at their institutions. The results show that attitude towards ICT use is the third major intrinsic factor affecting most chemistry Lecturers in the use of ICTs at their institutions. Personal beliefs were indicated to be the least major intrinsic factor affecting most chemistry Lecturers in the use of ICTs at their institutions.

3.3 ICT needs for Chemistry Lecturers

Several ICT needs were mentioned by the respondents. The results for ICT services, facilities and gadgets needed by the chemistry Lecturers are summarized in Table -2 below.

Table -2: Institution's ICT Gadgets

ICT services	ICT facilities	ICT gadgets
Technical support	Enough classrooms	Personal computers
ICT training/ short courses	Reliable power supplies	Laptops
ICT workshops	Enough computer laboratories	Projectors
Wi-Fi for smartphones and laptops	Modern computer furniture	Video Cameras
Enough time allocation		Printers

4. CONCLUSIONS

ICTs play several important roles in the teaching and learning of Chemistry. Amongst the challenges faced by Chemistry lecturers in Zimbabwean Polytechnics are extrinsic (school-level) barriers such as inaccessibility of ICT resources, time constraints, limited technical support, and lack of training and intrinsic (teacher-level) barriers such as lack of competency, attitudes towards use, resistance to change and personal beliefs. Most of the Chemistry lecturers in Zimbabwean polytechnics lack major ICT gadgets such as personal computers/laptops, projectors, video cameras, printers and major ICT facilities which includes enough classrooms, reliable power supplies, enough computer laboratories and modern computer furniture. In order to address the challenges faced by Chemistry lecturers in Zimbabwean Polytechnics, the researchers suggested the following:

- Education stakeholders in the Polytechnics should finance provision of computers and other ICT gadgets.
- All chemistry lecturers should be trained on using computers and other ICTs gadgets in teaching.
- The government should consider curricular re-design of the chemistry syllabus to accommodate the use of computers and other ICTs in its teaching.
- Polytechnics to empower computer and ICT use through providing full support for ICT use among lecturers.
- Internet connectivity and accessibility to Wi-Fi should be improved in all Polytechnics.
- ICT infrastructure which include classrooms and computer laboratories to be improved in all polytechnics

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