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Assessing the Integration of ICT as a Pedagogical Tool in Secondary Education: A Case Study in Tanzania

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Abstract: *This study focused on the use of technology by teachers and administrators to enhance teaching and assessment in secondary schools in Tanzania. A total of 199 scientific instructors from secondary schools took part in the study. Out of a sample of 179 secondary schools selected randomly, one instructor was picked at random. Surveys were sent to teachers for completion. The coded answers from the surveys were processed using M-Excel. The findings were presented in tables displaying both percentages and absolute numbers. Based on the findings, educators used their knowledge in assessment and teaching by using internet resources to obtain course materials (90%), transcribing notes (80%), analysing test results (59%), and utilising projectors (56%). Regrettably, no instructor was found to be using any kind of digital assessment. Several impediments hampered teachers' capacity to use ICT, including inadequate equipment availability (78%), insufficient proficiency and skills (59%), unreliable internet connectivity (35%), and power disruptions (34%). According to the research, it is recommended that everyone get education on the utilisation of ICT for teaching and assessment. To properly incorporate and integrate ICT in secondary school, it is necessary to overcome the hurdles that have been identified in its use.*

Keywords: Information and Communication Technology, teaching, assessment, secondary school

Introduction

ICT has significantly enhanced the spread and availability of information in our contemporary, scientifically and technologically advanced, globally linked society. The use of information and communication technology (ICT) may improve both instructional methods and student advancement (Murithi & Yoo, 2021). In order to meet the constantly evolving requirements of the labour market, it is necessary for the workforce to possess extensive

knowledge and skill in using information and communication technologies (ICTs). The topic of ICTs in the classroom encompasses more than just theoretical aspects. Therefore, it is essential for the school to include Information and Communication Technology (ICT) into its day-to-day activities (Murithi & Yoo, 2021). Niebel (2018) observes that several countries, such as the United States, China, Japan, and several others, have attained significant economic development by making substantial investments in information and communication technology (ICT).

Several African countries, like Tanzania, have recognised the need of integrating ICT into their educational systems. The primary objective of the country's recently formulated Education and Training Policy, created in 2014, is to enable the integration of information and communication technologies (ICTs) as a pedagogical instrument for both classroom teaching and the assessment of student advancement. The Tanzania Institute of Education (TIE) has proposed a goal of ensuring that all secondary schools have access to information and communication technology (ICT) resources, such as computers, printers, photocopiers, scanners, and internet connectivity, after reviewing the curriculum to align it with the education policy. Implementing this would greatly simplify the process of teaching and evaluating pupils' progress.

Considerable effort has been dedicated to training educators to use information and communication technologies (ICTs) effectively in the classroom and for student assessments since the 2014 update of the Education and Training Policy to include ICTs as a teaching tool. Government initiatives have facilitated the establishment of information and communication technology labs in schools. For instance, the African Digital Schools Initiative (ADSI) programme and the Universal Communications Service Access Fund (UCSAF) Project have enabled 40 secondary schools in Tanzania to participate in these efforts (GESCI, 2020; URT, 2020). This research examines the use of technology in secondary schools to augment their instructional approaches. The study aimed to ascertain the number of educators who received training in information and communication technology (ICT) from 2016 to 2022, the frequency of ICT usage by teachers in the classroom and their methods of evaluating student progress, as well as the challenges they face when integrating ICT into their lessons.

Research Questions

The study's research aims were guided by the following research questions:

1. What is the teachers' use of technology in the classroom and how do they assess student progress?

2. What challenges do educators have while using technology in the classroom and assessing student progress?

Significance of the Research

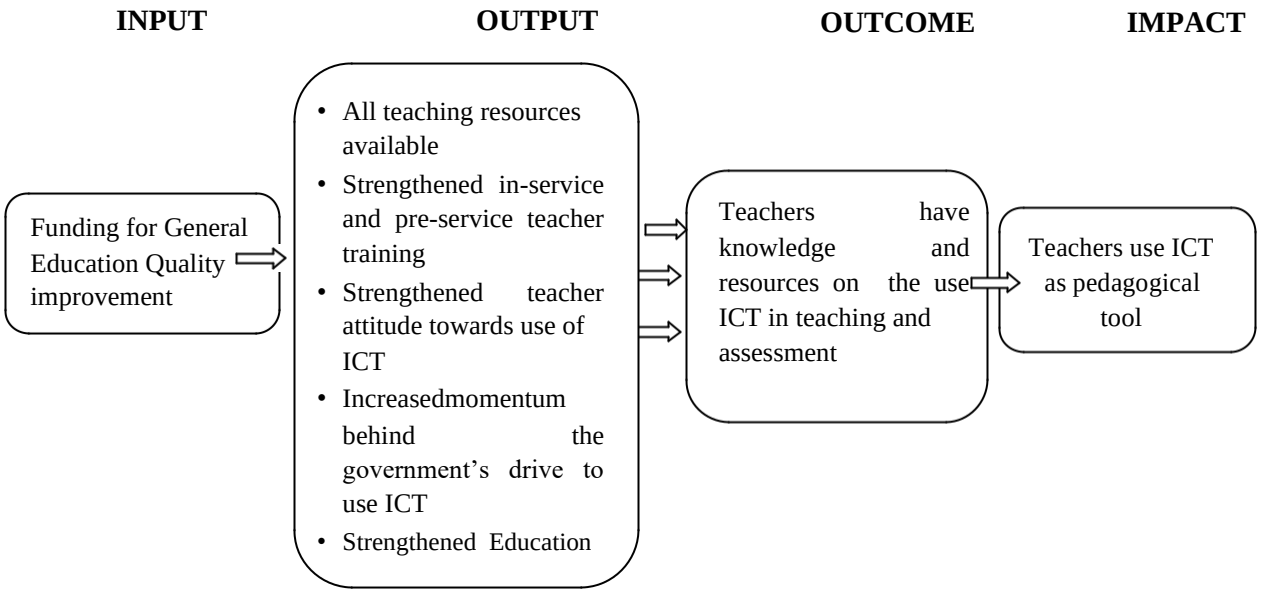
It is imperative that educators possess a high level of proficiency in using information and communication technologies (ICTs) for instructional purposes and evaluating student advancement. This includes, but is not limited to, activities such as taking digital notes, generating and distributing online quizzes, and communicating student test results to parents. Therefore, the results of this study may be used by education stakeholders to ensure that all instructors employ ICT for student assessment and teaching.

Scope of the study

This study examines the use of information and communication technology by chemistry and biology lecturers in the classroom. Therefore, it is not accurate to generalise that all Tanzanian teachers would use ICT in a uniform manner based on these results.

Conceptual Framework

This study focused on the use of technology by educators in the classroom and its influence on student success. The model, which serves as a compass, elucidates the causal relationship between actions and a series of events that together achieve the intended impact (Vogel & Zoe, 2012). The Model illustrates that successful investments result from well planned strategies aimed at accomplishing predefined goals. Consequently, it is necessary to provide schools with ICT equipment and facilities, as well as give training to instructors, to enable the utilisation of ICT for instructional purposes and evaluation. Figure 1 illustrates the model.



Conceptualization of ICT Integration in Education Source**:** Adapted from Vogel and Zoe (2012, p.5)

According to Alkahtani (2017), ICT implementation in education refers to the use of technology to improve instructors' teaching skills by incorporating it into the curriculum. Alkahtani contends that ICT revolutionises the delivery of education by making it easier to organise and implement high-quality assessment. According to Kirkland and Futurelab (2009), the use of information and communication technology (ICT) in the classroom is delivering value by transforming the social practice of teaching and assessment via the adoption of innovative approaches to questioning, digital tools, and physical environment. The concepts presented in this article were derived from these definitions.

Professional development for educators in using technology for assessment and instruction

According to the 2013–2014 Education for All Global Monitoring Report, the effectiveness of a school system relies solely on its teachers. According to Mishra and Koehler (2007) and Turunen and Tuovila (2012), instructors and assessors who use technology in the classroom must possess extensive knowledge in the subject matter and the skill to interpret information effectively. This is necessary to improve student learning. The requirement to

provide educators with the necessary skills to effectively use advancements in information and communication technology (ICT) in both classroom instruction and student evaluations has increased in parallel with the rapid pace of technological progress. SIPSE (2015) states that to provide an optimal environment for the utilisation of ICT, it is important to construct ICT infrastructures, provide training to teachers for their integration, and develop leaders who can supervise and support teachers in this process. One effective method to enhance teachers' training in using ICT is to establish professional learning communities, where instructors from the same school may collaborate and exchange information to enhance their professional skills (Talbert, 1991). An alternative approach is to establish a network of teachers, where educators from various schools may convene at a designated venue and undergo training provided by specialists (Lieberman & Wood, 2002).

The use of instructional technology in formative evaluation by teachers

ICT is an excellent tool for students to do research and complete class tasks. Furthermore, it offers educators the chance to establish connections with colleagues from other parts of the world and get fresh insights (Alkahtani, 2017). Research has shown that the use of different types of information and communication technology enhances training and makes the production of assessment instruments and analysis of test results more efficient (Mbodila & Muhandji, 2013). Agbobli (2002) contends that ICT is an excellent instrument for facilitating persons in achieving the evident objectives of education in human life. According to this notion, the educational system has the potential to progress and improve with appropriate investment in such technology.

According to Zhao, Pugh, Sheldon, and Byers (2002), in order to successfully implement information and communication technology (ICT) in a school, it is essential to have equipment, internet access, human resources (such as specialists) to support creative efforts, planning time, and physical resources (such as large classroom space). Innovations that need a greater amount of resources and a more significant deviation from instructors' current techniques in terms of both teaching and assessment are more likely to succeed. Similarly, innovations that require a lesser amount of both resources and deviation from current methods also have a higher chance of success.

Challenges in Implementing Information and Communication Technology (ICT) in the Classroom

Research conducted by Leung, Watters, and Ginns (2005) revealed that a significant number of schools in Hong Kong had challenges in terms of

insufficient computers, computer-based equipment, software, and classroom space. These constraints hindered the integration of information and communication technology (ICT) into the curriculum of secondary schools. In a similar vein, Alkahtani (2016, 2017) found that instructors' insufficient computer literacy poses a hindrance to the incorporation of ICT in classrooms in Saudi Arabia. Teachers with a low degree of computer proficiency need more time to organise classes that integrate information and communication technology (ICT) compared to those who are more proficient.

Alkahtani identifies several significant obstacles, such as maintaining the functionality of information and communication technology (ICT) equipment, enhancing the quantity and quality of school infrastructure, and offering comprehensive training to teachers that encompasses both the technical aspects of utilising the equipment and the content and delivery techniques of the curriculum. Mbodila, Jones, and Muhandji (2013) conducted a more extensive investigation and discovered that the United States does not possess the essential regional infrastructure required for the complete integration of ICTs into education. The authors stressed the importance of planners and policymakers evaluating the prevalence of different types of information and communication technology (ICT) in the country and educational system, as well as the accessibility of appropriate facilities, electricity, and telephones, prior to implementing any ICT in education. The European Commission (2013) identified issues such as insufficient information and communication technology (ICT) infrastructure, limited digital skills, inflexible curriculum, and insufficient support from colleagues. Using ICT in the classroom has both advantages and disadvantages. In order to ensure the proper utilisation of ICT, it is essential to have a robust policy, efficient strategic planning, competent instructors, and sufficient implementation.

Methodology

The researchers in this quantitative study used a survey approach to examine the teachers' sentiments about the training, their utilisation of technology in assessment, and the challenges they encountered. The study consisted of 179 randomly selected volunteers from 179 secondary schools. Of these individuals, 90 were biology instructors and 89 were chemistry teachers. A total of 179 instructors were surveyed using questionnaires as part of the 2023 grading process to collect the necessary data. We opted for questionnaires since they facilitated the efficient and effortless collection of data from a substantial number of instructors. Before processing, the replies

from the questionnaire were classified and numerical data was entered into Microsoft Excel. The findings were conveyed using tables that displayed both absolute numbers and percentages in numerical and percentage forms.

Findings

Teachers' use of ICT in Assessment of Learning

Table 1: Teachers' Utilisation of ICT in Supporting Teaching and Assessment (n = 179)

S/N	Teaching Aspects	% of Respondents	Assessment Aspects	% of Respondents
1.	Using computer for searching teaching materials	90	Using computer for typing examinations	81
2.	Using computer to preparing teaching notes	80	Using excel to process examination	59
3.	Preparing teaching notes on slides	67	Using computer for registering candidates	56
4.	Using projector for classroom instruction	56	Communicating examination results to parents using network	21
5.	Using e-book for searching notes	49	Using computer network for	00

Table 1 demonstrates that a significant number of educators use ICT for both teaching and assessing purposes. Most of these instructors depend on internet resources while searching for lesson ideas. However, no instructor takes use of internet tools to assess student development.

Challenges faced by Teachers in Implementing ICT in Teaching, Learning and Assessment

Table 2: Challenges faced by Teachers in Using ICT

SN	Challenge	Number of teachers	Percentage
	Major challenges		
	Lack of or insufficient	140	78

equipment		
Lack of or insufficient computer knowledge	105	59
Minor challenges		
Lack of internet	63	35
Erratic/unreliable electricity	61	34
Lack of maintenance and updating of computer software and hardware	22	12

Based on the data presented in Table 2, the majority of teachers identified the lack of adequate information and communication technology equipment as the main challenge. This indicates that the majority of educators have acquired the skills to effectively use information and communication technologies (ICTs) in the classroom. However, they are unable to use this knowledge because they do not have the necessary equipment. The second major impediment was identified as a deficient or non-existent comprehension of computers. Although most Biology and Chemistry teachers have some knowledge of using technology in the classroom, there are still a few who lack sufficient training, especially those who have only attended one capacity-building event.

Challenges that hinder the use of ICT in the classroom and assessing student development include poor or nonexistent internet connections and unstable or nonexistent power sources. As a result of these challenges, educators have restricted access to information sent by technology. In urban areas, there are schools that have frequent power outages. In contrast, in rural or remote locations, there are schools where pupils lack access to electricity, or where generators are not easily accessible. Both schools are now without power and internet, rendering them unable to use any sort of information and communication technology. A minor fraction of the educators who participated in the study indicated the frequency at which their schools' computer systems underwent maintenance and updates. These findings indicate that most schools have developed and continuously maintain well-equipped computer laboratories.

Discussion

The study revealed that chemistry and biology teachers in Tanzania's secondary school system use at least nine different strategies to include ICT

into their teachings, indicating a commendable utilisation of this technology. According to Yoo and Murithi (2021), using information and communication technology strategically may greatly enhance the evaluation and teaching processes. According to Kirkup and Kirkwood (2005), students have a more stimulating and favourable learning experience when instructors use ICTs cautiously. In addition, Senzige and Sarukesi (2003) and Yoo and Murithi (2021) both observe that the use of ICT in assessment simplifies the development of apparently intricate scientific concepts. Prior to using information and communication technologies (ICTs) in the classroom, it is essential to engage in thorough planning, get enough financing for computers and other technology, and ensure the presence of trained instructors.

Conclusion

Educators have been using their acquired knowledge in many aspects of education and assessment, such as lesson planning, exam preparation, and internet resource discovery. However, there are still those instructors who have not yet adopted the practice of assessing student progress using online means. Despite more than 50% of educators having received training in the use of information and communication technology (ICT) in the classroom, some individuals have been unable to implement this knowledge owing to problems such as power outages, unreliable internet connections, or inadequate equipment.

Recommendations

As to the researcher's findings, it is essential for all teachers to get training on effectively integrating Information and Communication Technology (ICT) into their teaching methods. This training should be provided by the government, training institutions, and schools. This will ensure that teachers use ICT in a suitable manner inside the classroom and for the purpose of assessment. In order for information and communication technology (ICT) to be effectively used in secondary schools, it is essential that certain facilities and equipment, such as internet connection, be also accessible. The main focus of this study was on how science instructors use technology in the classroom for teaching and assessment reasons. Consequently, teachers and students who were not part of the topic were excluded. Hence, it would be prudent to do more research to explore the viewpoints of students and instructors in non-science disciplines on the utilisation of information and communication technologies in the educational setting.

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