Availability and Utilization of Information and Communication Technology in Data Analysis: The University Experience

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Abstract- *The study sought to examine the availability and utilization of information and communication technology in data analysis: The university experience. For the study, two objectives and research questions were posited to guide the study and the study adopted the descriptive survey design of the ex-post facto type and the population comprised 3, 217 respondents drawn from two universities (the University of Calabar and Cross River University of Technology) and a sample of 322 respondents which depict 10% of the population. For ease of data collection, a structured questionnaire titled Availability and Utilization of Information and Communication Technology and Data Analysis Questionnaire (AUICTDAQ). The instrument was subject to expert corrections in the field of Educational measurement and evaluation and library and information sciences respectively and the inputs, corrections and modification of the instrument were done before data collection. The instrument was trial tested using split-half reliability and the coefficient of internal consistency ranged from .87 to .93 accordingly indicating that the instrument was valid and reliable for data collection. The statistical analysis used for data analysis are the simple percentage and bar charts. From the data analysis, it was found that for the availability of ICT facilities in data analysis majority of the respondents 312 (98.42%), 310 (97.79 %) and 274 85.80% agreed that Statistical Analysis Software (SAS), Microsoft Excel and Statistical package for social sciences are available to them when analyzing data however, 309 (97.48%), 305, 96.21 and 269 84.86% dominated the study Python, R and Tableau ICT facilities are not available to the in data analysis. Also, the finding of how are ICT facilities utilised in data analysis among graduate students as shown in Table 2. 305 (96.21), 297 (93.69%) and 293 (92.43%) strongly said that they utilized Microsoft Excel, Statistical Analysis Software (SAS) and Statistical Package for Social Sciences in data analysis while 309 (97.48%), 298 (94.01%) and 275 (86.75%) said that they do not utilised R, Tableau and Python ICT software in data analysis. It was concluded that as university teachers, the availability and utilization of information and communication technology can foster teachers/students' quest for knowledge advancement in all ramifications there is a need for skillful practices in data analysis which can maximally be achieved through quality ICT skills. It was however recommended that the government should provide ICT facilities (software) to all tertiary institutions at affordable prices for students to be well equipped with the training skills rudiment for enhance skills in data analysis.*

Indexed Terms- Availability and Utilization, Information and Communication, Data Analysis & University Experience

I. INTRODUCTION

In this global era where education has been digitalized to accommodate modern trends in teaching and learning. This underscores why education is regarded as the foundation for societal growth and economic development. Countries with high levels of education are said to have embraced digitalization (Information

and communication). Equipping learners with information is a sin-qua-non to economic growth and societal development. Information is the process of passing messages of fact or knowledge about a particular topic or event. In light of this, the researchers defined information as knowledge or ideas received concerning a particular fact or circumstance. This underscores why education is incomplete without the right information. Not getting the right information can lead to communication breaches of the aims and objectives of education.

The National Information Technology Policy was initiated in 2001 to guide the IT industry in Nigeria and was followed by the enactment of the National Information Technology Development Agency Act 2007 which became the legal platform for the creation of the National Information Technology Development. The basic objectives of the National ICT Policy are to create a conducive environment for the rapid expansion of ICT networks and services that are accessible to all at reasonable costs; and that contribute to the development of the various socio-economic sectors. Therefore, the specific objectives of this National ICT Policy are:

  i. To facilitate the development of an appropriate legal framework for effective implementation of ICT policies;
 ii. To promote universal access to high-quality and advanced ICT and services;
iii. To develop and enhance indigenous capacity in ICT technologies and software development;
 iv. To ensure the country's effective participation in regional and international ICT fora to promote ICT development in Nigeria, meet the country's international obligations, and derive maximum benefit from international cooperation in these areas;

Most nations of the world give education a high priority in their developmental effort. With the emergencies of information and communication technology, data analysis has been made easily through a radical transformation of research data from the primitive (traditional and manual) method of analyzing raw scores (Nwosu, 2003).

Information and communication technology has been a force that has changed many aspects of the ways we live. If one were to compare such fields as Medicine, Tourism, Business, Law, Banking, Engineering and Architecture, the impact of ICT across the past two or three decades has been enormous (Ademulegun, 2006). The ways these fields operate today are vastly different from the way they operated in the past, but when one looks at vocational education, there seems to have been an uncanny lack of influence and far less change than other fieldshave experienced. The rapid advancement in information and communication technology is offering new potential for producing and distributing knowledge. These technologies are fundamentally altering how we live and work as well as how we learn and have transformed into a global community. This is in line with the view of Ononogibo (1990). Information and communication technology is a revolution, that has penetrated almost all fields of human activities, transforming our economic and social lives

Barac and Akbay (2011) stated that in learning, learners' behaviour can be modified through organized experience provided in the learning process. The authors identified and explained some modern ICT software to include:

Firstly, Microsoft Excel is one of the most common software used for data analysis. In addition to offering spreadsheet functions capable of managing and organizing large data sets, Excel also includes graphing tools and computing capabilities like automated summation or "AutoSum." Excel also includes Analysis ToolPak, which features data analysis tools capable of performing variance, regression, and statistical analysis. Excel's simplicity and versatility make it a powerful data analysis tool suitable for managing, sorting, filtering, cleaning, analyzing, and visualizing data. If you're just starting in data science, you should consider learning more about Excel to prepare for your future career.

Secondly, Python is routinely ranked as the most popular programming language in the world today. Unlike other programming languages, Python is relatively easy to learn and can be used for a wide range of tasks, including software and web development, and data analysis. In the world of data, Python is used to streamline, model, visualize, and analyze data using its built-in data analytics tools.

Thirdly theR is an open-source programming language used for statistical computing and graphics. Like Python, R is considered a relatively easy-to-learn programming language. Typically, it's used for statistical analysis, data visualization, and data manipulation. The statistical focus of R means that it's well-suited to statistical calculations, while the visualization tools included within R make it a great language for creating compelling graphics like scatter plots and graphs.

More so, is Python, which is one of the most important programming languages used in data analysis. If you're considering a career in data, then you might want to spend time learning R. Also, Tableau is undoubtedly one of the most popular data visualization platforms in the world of business, particularly because it features an easily understood user interface and seamlessly turns data sets into comprehensible graphics. While business users enjoy it because of its ease of use, data analysts like it because it packs powerful tools that can perform advanced analytics functions like segmentation, cohort analysis, and predictive analysis. Data visualization is important because it allows data analysts to convey their findings to colleagues and stakeholders who might not otherwise understand them. If you're considering a future in either business analytics or intelligence, then you might consider learning Tableau to prepare for the professional workplace. Application data, particularly web-based ones. Popular among websites, MySQL has been used by such popular websites as Facebook, Twitter, and YouTube. In data, a Structured Query Language (SQL) is used for managing relational database management systems, which use relational databases usually structured into tables. As a result, data professionals use MySQL to store data securely and perform routine data analysis. While the program has some limitations, MySQL typically fits well within many businesses' existing data systems.

Jupyter Notebook is a web-based interactive environment used to share computational documents or "notebooks." Data analysts use Jupyter Notebooks to write and run code, clean data, data visualization, machine learning, statistical analysis, and many other forms of data analysis. Furthermore, Juypter Notebook allows users to combine data visualizations, code, comments, and numerous different programming languages in one place, allowing for an improved space to document a data analysis process and share them with others. Whatever your professional data goals, you will likely benefit from using a tool like Jupyter Notebook to work through data problems and share your work with others.

Minitab is a data analysis software package that is used for data analysis. It is widely used in a variety of industries, including healthcare, manufacturing, and education. Minitab provides users with tools to perform statistical analysis, including hypothesis testing, regression analysis, and ANOVA.

Finally, SAS is a well-known suite of statistical analysis software developed by the SAS Institute for various analytical purposes, including business intelligence, advanced analytics, and predictive analytics. Analysts use SAS to retrieve, report, analyze, and visualize data. Business intelligence analysts and data analysts more broadly like SAS because it brings together a variety of powerful analytic tools in one place and has an intuitive graphical user interface (GUI) that makes it easy to use. Furthermore, SAS is a reliable software suite that allows data analysts to perform much of their work – from managing data to cleaning and modeling it. Learn SAS to prepare for positions focused particularly on business intelligence and analytics or if you want to become familiar with a software suite that can handle most of what a data analyst might need to do. Statistical Analysis Software (SAS) is a statistical software suite developed by SAS Institute for data management, advanced analytics, multivariate analysis, business intelligence, criminal investigation, and predictive analytics. SAS was developed at North Carolina State University from 1966 until 1976 when SAS Institute was incorporated

- Concept review of information and communication technology

Nwosu (1999) describes information and communication technology as the convergence of tools of micro-electronics telecommunication and computers while Akinde and Adagunodo (2000) stated that information and communication technology are mechanisms by which a wide variety of audiences can be reached especially with information that can make a meaningful contribution for informed decision making in government, banking, oil industry,

manufacturing commerce and education sectors. Butcher (2003) views information and communication technology as electronic technology for collecting, storing, processing and communicating information. This is in line with Ademulegun (2006) who explained information and communication technology as the item of equipment (hardware) and computer programme (software) that allow us to access, retrieve, store, organize and manipulate information. Ohunba (2006) stated that information and communication technology is an umbrella term for acquiring, processing, storing and disseminating information either in textual, vocal, numerical, pictorial, graphical, etc. forms using computer and telecommunication. Neukar, (2006) views information technology (IT) as the technology that merges computing with high-speed communication linking camping data, sound and video. It is a communication process in which information (input) is recorded, stored and retrieved process for decision making (output) on planning operation and controlling.

Ikelegba (2007) categorized the different kinds of information and communication technologies into five basic types:

1) Sensing technology: These are devices that help us gather information from the environment and translate the information into a form that can be understood by computer and mouse. These are technologies that tie together and communicate between the various kinds of technologies Examples include fax (screen etc.).

2) Communication technologies: Facsimile machines landed cellular telephone, computer networks. A network is a group of devices that are linked together. An example is the private branch exchange (PBXB) which is a local area network (LAN) that covers several floors or over a campus in case of the school environments. The wide area network (WAN) cover larger geographical areas and uses telephone line microwave and satellite communication network.

3) Analyzing technologies: The computer hardware and software come with this category computer takes information from sensing and communication devices and they store and process the information.

4) Display technologies: These are essential output devices. They make processed data available to humans for use either through loudspeakers, printers,or display screens like photocopying machines.

5) Storage technologies: This is another important category of ICT. They help us to store large quantities of information in a form that can be easily accessed. This is made up of secondary storage devices such as magnetic tape, magnetic disc, and optimal disc (CD ROMs, Only Memory, VCDs and Video Compact Disc etc.).

In recent years therehas been increased emphasis on individualized programs instruction and information and communication technology to facilitate learning at all levels of education and training. The feasible application of microcomputers in the Nigerian classroom for teaching and learning is gradually gaining recognition as a result of the great importance and educational appropriateness it offers. The following includes some of how information and communication technology canbe used for instructional delivery (Lemke, 1999).

1. Computer Assisted Instruction (CAI): This is the term used to describe the use of computers to provide instruction to students by stimulating teaching and learning. Opportunities in the classroom are in the area of drift and practice, tutorial, simulation demonstration designing, data collection, analysis and games. Computer management is for managing instruction. In the case of CMI, Abimbola (1998) observed that students do not receive any instruction from the computer rather students' instructions are managed using computer. Harold (1999) classified the functions performed by CMI into two; Instruction management and function support. The support for a basic group of users including students and evaluators. The instructional management-related functions as discussed by Harold (1999) include the following:

a. Diagnosis: This is the process by which ranges of instructional alternatives are suggested based on diagnosis to either the students or the teacher.

b. Performance monitoring: This involves the process by which an individual and group's rate of progress is watched and supervised closely. Both students' and teachers' performance are monitored and this supports evaluation and planning.

c. Resource allocation/scheduling: This is the process for allocation of instructional resources specified by the prescriptive process within a particular time from to make the most effective use of the available resource.

d. Reporting: This involves a process by which one retrieves and updates information used on characteristics of the information via a data system and by which information is tabulated and formulated in a form interpretable by human beings.

e. Database use: Students and teachers can use computers to keep and produce records (i.e. information storage and retrievable about current events and other disciplines).

2. Computer-Aided Design (CAD): Another dramatic use of computers in the classroom is through computer-aided design. CAD offers a variety of 3 – dimensional and modeling and visualization features. CAD is also successful in instructional applications because teachers designers and students have unlimited access to a wide range of vital design materials and construction techniques that make it possible to explore more advanced technical designs.

3. Programming: Computer programming is the art of conceiving a problem in terms of the steps to its solution and expressing those steps as instructions for the computer to follow. Bright man programming language is a collection of commands that directs the control of a computer programmes and run the same on the computer. Students and teachers can develop their programmes using special computer languages like BASIC (Beginner's all-purpose Symbolic Instruction Code), PASCAL RGP (Report Program Generator) FORTRAN, and COBOL. Students will find it interesting to convert their ideas into executed programmes.

4. Problem-solving: The computer is invading the educational system in a way unparalleled in previous education history. The computer permits students to develop programmes and to suit the programmes to solve numerous problems.

Information and communication technology are generally accepted as a modern instrumental tool that enables educators to modify the teaching methods they use to increase student's interest and facilitate learning. According to Ohomba (2006) some of the tools used in the path of information and communication technology among others include:

a. E-learning: This is the main information and communication technology new education tool for teaching and learning. E-learning usually refers to structured and managed learning experiences and may be provided partially or wholly via a web browser or through the internet or an intranet or multimedia platform such as CD-ROM DVDs, or other media and communications.

b. Video lecture: These are specially prepared lectures that are transmitted live on the internet or can be accessed from a website at any time Charts and diagrams etc. can be accessed separately.

c. E-library: There are thousands of books that a person can access via the internet. This is very good for research and it's used to increase knowledge.

d. Internet: This is a global collection of many types of computers and computer networks that are linked together.

e. Distance learning: Also known as tele-learning is a form of study in which students and teachers are at different locations.

• Statement of the Problem

The issue of faulty data output among research scholars has generated mixed reactions nationally and internationally. A lot of reasons were advanced by lecturers and students for poor ICT skills in data analysis in teaching and learning. Based on the researcher's interaction with some lecturers from the department studied, which are Business Education, Home Economics, Agric. Education and Technical Education. It was observed that the use of manual methods of ICT in data analysis has not made any much impact due to the unavailability of the relevant ICT facilities for teaching purposes. Similarly, the students interviewed complained that most data analyzed using the manual method are saturated with errors (type I and type II errors). This crude method has affected the credibility, validity and reliability of raw data generated from the field by most researchers. Also, overutilization of manual methods of data analysis instead of ICT facilities in data analysis such as statistical packages causes students to be deficient in using the new technology. Lack of adequate ICT

facilities tends to hamper the effective teaching of vocational education courses. Some other students, the researcher interacted with complained that some lecturers are not skilled in using ICT in data analysis and teaching research-oriented courses. This is why such lecturers prefer to stick to the traditional method of teaching. This can be supposed to be the view of Adeshina (2007) who stated that for lecturers and students to grow professionally and remain relevant, especially in their quest for research undertakings, they must possess ICT skills. Based on the foregoing, the researcher posts the questions; How are information and communication technology facilities available and utilize in data analysis: the university experience? Seeking answers to this question constitutes the central problem for this research undertaking.

- Purpose of the Study

The main purpose of this study was to examine the availability and utilization of information and communication technology in data analysis: The university experience. The specific objectives are;
1. To determine the extent to which available ICT facilities have helped students in data analysis among students.
2. To ascertain the extent of utilization of ICT facilities has promoted quality data analysis among students.

- Research questions
For this research work, the following research questions were posed;
1. To what extent are ICT facilities available for data analysis among graduate students?
2. How are ICT facilities utilised for data analysis among graduate students?

II. METHODOLOGY

The researchers adopted a descriptive survey design of the ex-post facto type and the population comprised of 3, 217 respondents drawn from two universities (University of Calabar and Cross River University of Technology) and a sample of 322 respondents which depicts 10% of the population. For ease of data collection, a structured questionnaire titled Availability and Utilization of Information and

Communication Technology and Data Analysis Questionnaire (AUICTDAQ). The instrument was subject to expert corrections in the field of educational measurement and evaluation and library and information sciences respectively and the inputs, corrections and modification of the instrument were done before data collection. The instrument was trial tested using split-half reliability and the coefficient of internal consistency ranged from .87 to .93 accordingly indicating that the instrument was valid and reliable for data collection. This supported the view of Berge (1995) who stated that any research instrument, to ascertain its validity, should be given a panel of experts to determine whether it's (contents) can elicit the desired data they are intended to elicit and this in essence is to ensure its content validity and necessary adjustment made. The researcher collected data through the administration of questionnaires from the students. The collection of data was done through personal administration and the employment of research assistants in each respective department. The researchers used an interval of three (3) days for collecting the data from respective departments. The statistical analysis used for data analysis are the simple percentage and bar charts.

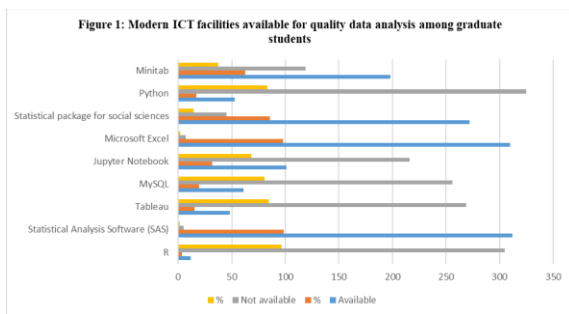## III. RESULTS

- Research question one
To what extent are modern ICT facilities available for quality data analysis among graduate students? To answer this research question, items 1-9 were employed using simple percentages and bar charts as shown in Table 1.

Table 1: Modern ICT facilities available for quality data analysis among graduate students (n=317)

S/n	Items	Available	%	Not available	%
1	R	12	3.79	305	96.21
2.	Statistical Analysis Software (SAS)	312	98.42	5	1.58

3.	Tableau	48	15.14	269	84.86
4.	MySQL	61	19.24	256	80.76
5	Jupyter Notebook	101	31.86	216	68.14
6	Microsoft Excel	310	97.79	7	2.21
7	Statistical package for social sciences	272	85.80	45	14.2
8	Python	8	2.52	309	97.48
9	Minitab	198	62.46	119	37.54

Table 1 revealed that for the availability of ICT facilities in data analysis majority of the respondents 312 (98.42%), 310 (97.79 %), and 274 85.80% agreed that Statistical Analysis Software (SAS), Microsoft Excel and Statistical package for social sciences are available to them when analyzing data however, 309 (97.48%), 305, 96.21 and 269 84.86% dominated the study Python, R and Tableau ICT facilities are not available to the in data analysis. See the results as displayed in the bar chart in Figure 1.


Figure 1: Modern ICT facilities available for quality data analysis among graduate students

- Research question two

How are ICT facilities utilised in data analysis among graduate students? To answer this research question, items 10-18 were employed using simple percentages and bar charts as shown in Table 2

Table 1: Modern ICT facilities utilisation in data analysis among graduate students (n=317)

S/n	Items	Utilized	%	Not utilised	%
10	R	8	2.52	309	97.48
11	Statistical Analysis Software (SAS)	297	93.69	20	6.31
12	Tableau	19	5.99	298	94.01
13	MySQL	55	17.35	262	82.65
14	Jupyter Notebook	84	26.50	233	73.50
15	Microsoft Excel	305	96.21	2	3.79
16	Statistical package for social sciences	293	92.43	24	7.57
17	Python	42	13.25	275	86.75
18	Minitab	204	64.35	113	35.65

Also, the finding of how are ICT facilities utilised in data analysis among graduate students as shown in Table 2, revealed that 305 (96.21), 297 (93.69%), and 293 (92.43%) strongly said that they utilized Microsoft Excel, Statistical Analysis Software (SAS) and Statistical Package for Social Sciences in data analysis while 309 (97.48%), 298 (94.01%) and 275 (86.75%) said that they do not utilised R, Tableau and Python ICT software in data analysis.

Figure 2: Modern ICT facilities utilisation in data analysis among graduate students
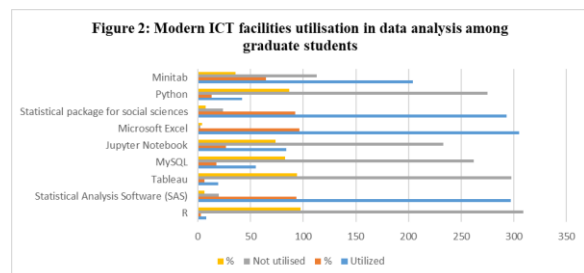
CONCLUSION

From the researchers experience as university teachers, well-equipped knowledge of data analysis plays a crucial role in ICT (Information and Communication Technology) across various levels of education. This is because ICT and data analysis involve the process of examining large sets of data to uncover meaningful insights, patterns, and trends that can be used to make informed decisions and improve organizational performance. As ICT in education advances literacy and information will also be enhanced, not only teachers who support learning but also students will be able to acquire knowledge and skills of IT devices. Literacy will help students to select and use necessary information and to develop the ability to think for themselves. The ICT components used in libraries and other fields of knowledge include hardware, software, networking, and digital resources. These components have revolutionized how libraries acquire, organize, store, and provide access to information, enabling them to meet the changing needs of library users in the digital age

RECOMMENDATIONS

The researcher made the following recommendations:
1. The government should provide ICT facilities (software) to all tertiary institutions at affordable prices so students are well equipped with the training skills rudiment for enhanced skills in data analysis.
2. Most school management should give students scholarship training on modern trends in ICT. This will help to facilitate their skills and practices in modern techniques in ICT and data analysis skills.

- Implication of the study to educational stakeholders

The significance of the study will be of great benefit to federal and state governments.

The result of the study will be beneficial to the federal and state government as an employer of labour in that, it will tackle the problem of obsolete office equipment, poor working conditions poor infrastructure, and inadequate networks. It will assist the commission in evaluating the implementation of ICT in teaching and learning in Cross River State and make necessary recommendations to the federal ministry of education. The outcome of the study will encourage vocational education courses in Cross River State to acquire information and communication technology skills relevant to teaching vocational education courses and the need for the lecturer to attend conference seminars and workshops to update their knowledge. Also, the outcome of the study willbe beneficial to students of Nigeria. The result will provide, guide, and direct the students to acquire saleable skills that will give them a competitive advantage in the work environment.

In addition, intending researchers will find the work useful for further studies in the area, Also management of different colleges of education can use the result of this research to provide adequate information and communication technology facilities for teaching and learning vocational education in their various institutions.

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