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Bayesian inference for evaluating and improving effectiveness of ict on students' academic performance and research Department of Statistics, Federal University of Lokoja

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Abstract
Information and Communication Technology (ICT) is an extension term for Information Technology (IT). This research uses Bayesian inference to investigate, evaluate and improve effectiveness of ICT on students' academic performance and research. Department of Statistics, Federal University of Lokoja. Existing literature suggests that robust ICT professional development is linked to improved student outcomes and increased lecturers/teachers retention rates. The research conclude that students largely depend on ICT for accessing academic materials. ICT variables collectively influence students' academic performance. Among the predictors, ICT_ACCESS has the strongest Resource allocation should emphasize high-impact ICT components, particularly access and research-support tools, to ensure efficient investment. Recommendation was put forward such as the continuous monitoring and evaluation of ICT initiatives should be implemented to measure effectiveness and guide future improvements, making it the most significant factor in improving academic outcomes.

Keywords: Information and communication technology, trend change**,** intellectual development, Bayesian multiple regression

Introduction

The ICT (Information and Communication Technology), Technology-Enhanced Learning in Research-Led Institutions (TELRI) project was established at the Universities of Warwick and Oxford, funded by a Teaching and Learning Technology Project (TLTP) award from the Higher Education Funding Council for England (HEFCE) [1]. This proposal sought to tackle three inter-related issues. The first is to study the impact of ICT on education and department of statistics students' and improving academic performance, intellectual development in research, department of statistics, Federal University of Lokoja. The second is that in many universities, the two main university objectives are "research and teaching" are not closely linked, and the former has higher status than the latter. The third is that the wider availability of powerful ICT tools brings both closer, this with it the need to make sure that the tools are used in ways that best support students' learning. This proposers aimed to tackle both of these issues by assisting students to build up academic confidence, develop research-based approaches to teaching, through the effective use of learning technologies [1, 4, 14].

The team founded by Hattie and Marsh, 2015 was aware of the intense debate about supposed links between ICT, research and teaching, and aware also that, despite the generally inconclusive research evidence (see Hattie and Marsh, 2015 for a meta-analysis of 58 studies), a belief that research with ICT informs teaching persists [2, 3]. The team believed that research and teaching could beneficially be linked, with one enriching the other, if this was planned for. The alternative situation, in which students receive no direct benefit from lecturers' research, whilst academics feel pulled between two competing demands for their time, is obviously undesirable. Although the improvements in students' learning that research is sought to bring about do not require a research-led environment, it was believed that certain environments, of which research-led institutions are an example, provide particular opportunities for bringing research and teaching together in a productive relationship. The point was trenchantly made in the USA by the Boyer Commission report that criticised research-led universities for failing to make use of their natural advantages and urging that research and teaching should be brought together [5, 15].

Several possible forms of linkage between ICT, research and teaching were identified. The content argument supposes that students training on ICT can help researchers bring their own leading edge research into their teaching curriculum, although it is also widely suggested that this can be problematic, particularly in the sciences (Feldman, 1987). Others, more pragmatically, focus on a resourcing approach, pointing out that research brings better libraries, better research tools and higher levels of resourcing generally. A third main area is in learning processes, since undergraduates and researchers are both engaged in learning [3, 6]. In considering the potential value of ICT in these forms of linkage, the project proposers could see the usefulness of supporting students, staff to make more and earlier use of research tools, many of which are, of course, technology-based [2, 10].

Introduction of research tools – for simulations and textual analysis for example – offers another large area for development. However, the area of learning processes was thought to be a much more valuable – and challenging – area to work in, since it addresses such a central educational issue [7, 13]. It is reasonable to suppose that experienced researchers and others who apply a discipline professionally will have developed a range of higher-level cognitive skills. Their intellectual processes and methods of working provide a useful model for their students in department of statistics' own learning through ICT. It would be of immense benefit

to students of statistics if they could be helped to develop those skills through an appropriately [2, 9, 12].

Researchers characteristically deal with large amounts of students, complex information and require the skills of analysis, the ability to make and discern structure. Therefore, ICT tools that require learners to give meaning and value to information are particularly useful. Research requires considerable precision. ICT tools that demand a high degree of focus, particularly on meaning, are therefore valuable. Finally, the ability critically to reflect on working processes is vital, and so tools that make apparent the processes of learning are useful. All of these tools are more effective when they offer immediate feedback to the learner. These links may be summarized but the society, department of statistics has no option that to try use ICT to improve academic performance at department of statistics Federal University Lokoja [8, 9].

Literature Review

Attempting to link ICT, research and teaching immediately suggests problems of the definition of those terms (Elton, 1986) and these may be discipline-related (Hattie and Marsh, 1996). However, across all disciplines, one would expect a number of broad capabilities of a proficient researcher, including: Whats ICT? being innovative, working independently, setting and solving problems, analyzing critically, handling large quantities of information in a wide range of media. What these might mean in practice would clearly be very different from one discipline to another. Nevertheless, they seem to be a reasonably robust set of terms which academic staff in any discipline would agree were desirable attributes, and this probably explains their repeated appearance in published lists of skills from many sources [8, 11].

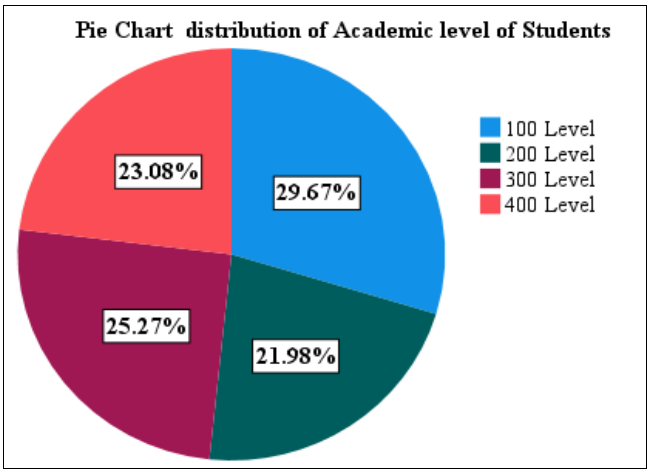
These capabilities require the presence of body of useful ICT expatriate, body of disciplinary knowledge, techniques used within the discipline, higher order cognitive skills learning technologies can contribute a lot to ICT development, TELRI approach is believed to be that it bases its work on the research expertise of academics and that it encourages a more thoughtful use of ICT tools within that context. It is easy to find examples of the use of learning technologies to make research tools, data and information available, thus contributing to students' disciplinary knowledge and techniques. However, learning technologies are less often used deliberately to develop higher cognitive skills, although they have considerable potential to do so. The Boyer Commission report makes this point strongly, asking for ICT that "enriches teaching rather than substitutes for it", and wanting students to have tools "with which they can discriminate, analyse and create rather than simply accumulate" [10, 11].

There are many possible contributions. Creativity and originality are highly valued in researchers. Both are difficult to define, but it can safely be said that those who work in open situations, with the greatest autonomy, who are required to identify and set as well as solve problems, are most likely to be encouraged to be creative because of what they are required to bring to the situation themselves. Therefore TELRI was concerned with the integration of C&IT tools to support learning that takes place in "open" Researchers characteristically deal with large amounts of students, complex information and require the skills of analysis, the ability to make and discern structure. Therefore, ICT tools that require learners to give meaning and value to information are particularly useful. Research requires considerable precision. ICT tools that demand a high degree of focus, particularly on meaning, are therefore valuable. Finally, the ability critically to reflect on working processes is vital, and so tools that make apparent the processes of learning are useful. All of these tools are more effective when they offer immediate feedback to the learner. These links may be summarized but the society, department of statistics has no option rather than to try use ICT to improve academic performance at department of statistics Federal University Lokoja. Settings [1, 15]

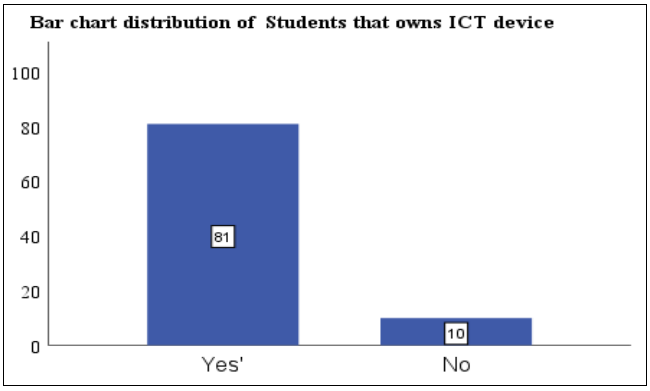
Methodology

To investigate the impact of ICT on education in department of statistics students' academic performance, intellectual development in research, Federal University of Lokoja. Qualitative approach would be used in the paper. Data would be collected. Survey Research Study using questionnaires as the instrument of drawing information from the respondents. The population of this study 100, comprised the part department of statistics, Federal University Lokoja. This research assess various approaches, including ICT knowledge, mentorship initiatives, and access to online resources, to foster a culture of continuous ICT learning among educators. The findings are expected to contribute to creating a more effective and supportive ICT educational environment for both teachers and students, hence the study analyzes the effect of Information and Communication Technology (ICT) on students' academic performance in the Department of Statistics, Federal University of Lokoja. Using descriptive statistics and a Bayesian multiple regression model, the analysis evaluates how ICT access, research usage, and training influence academic outcomes, with the aim of providing evidence-based recommendations for improvement.

Analysis/Material
Demography



The pie chart shows that respondents are fairly distributed across all academic levels in the Department of Statistics. 100 Level students recorded the highest participation (29.7%), followed by 300 Level (25.3%) and 400 Level (23.1%), while 200 Level had the lowest (22.0%). The data reflects balanced representation across all levels.



The bar chart indicates that a significant majority of respondents (89.01%) own a personal ICT device, while only (10.9%) do not. This high level of device ownership suggests strong access to ICT tools for academic and research purposes, although the small proportion without devices may face limitations in fully benefiting from ICT-based learning.

Objectives 1

To study the impact of ICT on students' academic performance, department of statistics, Federal University of Lokoja

Regular access to ICT facilities for academic purposes								
Levels	**Strongly Agreed**		**Agreed**		**Disagreed**		**Strongly Disagreed**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**
100 Level	12	44.44	9	33.3	3	11.11	3	11.11
200 Level	10	50	5	25	3	15	2	10
300 Level	9	39.1	8	34.7	4	17.4	2	8.7
400 Level	10	45.1	28	30.8	11	12.1	11	12.1

The cross-tabulation results show that 79% of students use ICT tools for academic purposes, while 21% do not use them regularly. This indicates a high level of ICT engagement and suggests that ICT is well integrated into students' academic activities across all levels.

Regular access to ICT facilities for academic purposes								
Levels	**Strongly Agreed**		**Agreed**		**Disagreed**		**Strongly Disagreed**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**
100 Level	12	44.44	9	33.3	1	3.70	5	18.51
200 Level	8	40	3	15	1	5	5	25
300 Level	12	52.17	6	26.09	2	8.70	3	13.05
400 Level	9	42.86	25	27.47	7	7.69	15	16.48

The table indicates that 75.82% of students use ICT tools to access online academic resources, while 24.18% do not. Usage is consistently high across all levels, with 400 Level students showing the highest proportion. This suggests that students largely depend on ICT for accessing academic materials.

Objective 2

To create a Bayesian model through knowledge of ICT to improve academic performance of students of department of statistics, Federal University Lokoja:

Bayesian Estimates of Coefficients

Parameter	**Posterior**		
	Mode	**Mean**	**Variance**
(Intercept)	1.514	1.514	.068
ICTRESEACRH	.040	.040	.008
ICT_Training	-.012	-.012	.004
ICT_ACESS	.177	.177	.015

Hypothesis Testing and Model Interpretation

Hypotheses

H_0: ICT variables have no effect on academic performance.

H_1: ICT variables have an effect on academic performance.

Posterior Mean Estimates (Bayesian Regression)

Intercept = 1.514

ICT_RESEARCH = 0.040 (Variance = 0.008)

ICT_TRAINING = -0.012 (Variance = 0.004)

ICT_ACCESS = 0.177 (Variance = 0.015)

Decision Rule

If the posterior mean > 0, the variable has a positive effect. If the posterior mean < 0, the variable has a negative effect.

Conclusion

The results indicate that ICT variables collectively influence students' academic performance. Among the predictors, ICT_ACCESS has the strongest positive effect, making it the most significant factor in improving academic outcomes.

Objectives 3

To propose actionable recommendations for enhancing the use of ICT and training for professional development:

- Priority should be given to improving ICT infrastructure and accessibility within the department, as ICT_ACCESS (0.177) shows the strongest positive influence on academic performance.
- The use of ICT for academic research should be strengthened, since ICT_RESEARCH (0.040) demonstrates a positive contribution to students' performance.
- Existing ICT training programs should be reviewed and redesigned to focus on practical and professional competencies, given the minimal effect observed (−0.012).
- ICT tools should be more practically integrated into coursework and academic activities to maximize their impact on learning outcomes.
- Resource allocation should emphasize high-impact ICT components, particularly access and research-support tools, to ensure efficient investment.

- Continuous monitoring and evaluation of ICT initiatives should be implemented to measure effectiveness and guide future improvements.

Discussion

Survey research study using questionnaires as the instrument of drawing information from the respondents. The population of this study 100, comprised the part of department of statistics, Federal University Lokoja. The pie chat shows 100 Level students recorded the highest participation (29.7%), followed by 300 Level (25.3%) and 400 Level (23.1%), while 200 Level had the lowest (22.0%). The data reflects balanced representation across all levels. The bar chart indicates that a significant majority of respondents (89.01%) own a personal ICT device, while only (10.9%) do not. This high level of device ownership suggests strong access to ICT tools for academic and research purposes, although the small proportion without devices may face limitations in fully benefiting from ICT-based learning. The table earlier indicates that 75.82% of students use ICT tools to access online academic resources, while 24.18% do not. Usage is consistently high across all levels, with 400 Level students showing the highest proportion. This suggests that students largely depend on ICT for accessing academic materials. The results indicate that ICT variables collectively influence students' academic performance. Among the predictors, ICT_ACCESS has the strongest positive effect, making it the most significant factor in improving academic outcomes and recommendations are put forward to be considered.

Conclusion

In conclusion, students largely depend on ICT for accessing academic materials. ICT is well integrated into students' academic activities across all levels. ICT variables collectively influence students' academic performance. Hence Resource allocation should emphasize high-impact ICT components, particularly access and research-support tools, to ensure efficient investment. Continuous monitoring and evaluation of ICT initiatives should be implemented to measure effectiveness and guide future improvements.

Weakness and Future Research

This study is restricted to department of statistics Federal University Lokoja. Increasing the scope and frame to extend to other instituions in Nigeria can be a full study.

Authors Contributions

All authors contributed immensely in the aspect of technical writing.

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Ethics

This is the original manuscript; there will be no expectation of any ethical problems.

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