

INFLUENCE OF INFORMATION AND COMMUNICATION TECHNOLOGY AND TEACHERS' COMPETENCIES ON SENIOR SECONDARY SCHOOLS STUDENTS' LEARNING OUTCOMES IN BASIC SCIENCE AND TECHNOLOGY IN SOUTHWEST, NIGERIA.

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Abstract

The study investigated the influence of Information and Communication Technology and teachers' competences on learning outcomes of senior secondary school students in Basic Science and Technology in Southwest, Nigeria. The study adopted the descriptive survey research design. The population comprised 166,716 Junior Secondary School Three (JSS3) students and 1,124 teachers of Basic Science and technology in southwest, Nigeria. The sample consisted of 720 junior secondary school students selected from eighteen public secondary schools in Southwest, Nigeria using multistage sampling procedure and 72 teachers of Basic Science and Technology from eighteen public secondary schools in Southwest, Nigeria using purposive sampling. The instruments used to collect data for the study are 'Teachers' Competency and Assessment Questionnaire (TECAQ)' and 'Students' Attitude and Interest in the Learning of Basic Science and Technology (SAILBAST)'. The instruments were subjected to scrutiny by experts and researcher's supervisor to ascertain its face and content validity. Reliability coefficients of 0.68 and 0.74 were obtained respectively for TECAQ and SAILBAST using Cronbach Alpha's reliability analysis. The research questions raised were analyzed using frequency counts, percentage and mean. The hypotheses were tested using linear regression analysis at 0.05 level of significance. The results of the study showed that ICT utilization has a positive influence on students' learning outcomes and teachers' pedagogical knowledge competency has a positive influence on students' learning outcomes. It was concluded that ICT utilization and Teachers' pedagogical knowledge competency have a positive influence on students' learning outcomes in Basic Science and Technology. Based on the findings of the study, it was recommended that teachers should utilize ICT in the teaching of students in Basic Science and technology. Also, teachers of Basic Science and Technology should be exposed to, encouraged to apply and adopt diverse pedagogical approaches which can stimulate learning while teaching.

Keywords: ICT utilization, teachers' competencies, pedagogical knowledge competency, learning outcomes.

Introduction

ICT is a major tool being currently used for knowledge advancement in many schools globally. The concept, Information and Communication Technology (ICT) is quite wide and variously explained by different authors. Ejechi (2013) explained that ICT refers to the use of computer technology and its associated software, audio, visual and telecommunication equipment (including mobile phones) to send, receive, store and even manipulate information for objectives. These objectives include, but not limited to business, government services, organizations, school and research. It also includes the worldwide network of computers otherwise called internet. This technology has turned the world into what is now called global village. The use of ICT for learning is increasingly becoming the order of the day.

The ICT is a science of information which uses the computer and multi-electronic resources to collect, process, store, retrieve and transmit or disseminate information to various parts of the world. ICT has permeated virtually all aspects of human endeavor. It has crept into the educational system and has had obvious impact in the curriculum. Adeyemo (2010) described ICT as consisting of computer hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information. It includes computer sets, computer and application software (i.e. Spreadsheet, word processing, excel), disc and storage media (i.e. memory cards, flash drives, CD-Rom, audio and video cassettes, films, pictures, e-books, e-magazine,) telecommunication gadget and services such as internet, internet browsing, electronic mail services,

cyber café, scanner, browsers, internet services provider which are used in the secondary schools for processing, storage, presentation, communication and exchange of data and information in the teaching and learning processes.

Akudolu, Aremu and Lanre (2011) posited that ICT comprise the tools used basically for collaboration, searching and exploring information, processing and storing of data. ICTs therefore imply the unification and application of technological devices/tools and resources used to process, store, receive and disseminate information electronically anywhere to aid learning. ICT tools and resources aid students' learning by presenting materials in electronic form through on-line digital libraries, video projection screen, CR-Roms, internet facilities and mobile technologies such as i-pod, smart phones, MP player and book readers. ICT is considered an indispensable tool for globalization.

There are many contents in ICT. Ibezim and Igwe (2016) noted that the term ICT could include computer hardware and software, digital cameras, video cameras, the internet, telecommunication tools, programmable toys and many other related devices and resources. The computer which is an electronic machine for receiving, manipulating, storing and retrieving information, can aid teaching and learning in several ways. Information that is saved in any storage device of the computer such as flash drive, floppy diskette or in the Central Processing Unit (CPU) can be retrieved at a tremendous speed in the computer. It is a matter of calling up the information through the input hardware such as the keyboard and mouse, in the file or web address it was saved. Other ICT devices relevant in teaching include television, radio and cassette player. Recent and updated global information from several people

can easily be accessed through the internet using the computer.

From the fore-going, it is clear that ICT is concerned with information sourcing, sharing, storing, manipulation, sending using certain electrical hardware and software; it aims at increasing human knowledge. Prior to the era of Information and Communication Technology, teachers and instructors in schools relied primarily and predominantly on educational materials in form of textbooks, journals and publications that are available on the shelves of libraries and bookshops. Not only this, there is a dearth of current, up-to-date academic materials. In addition, students relied only on teachers and a few available textbooks. Learning only appeared to take place in the school and in the presence of teachers. However, with the discovery and introduction of ICT, these trends have changed.

Furthermore, ICT have turned the world into a global village. Through various ICT channels and outlets such as internet, computers (laptops and desktop), projectors, digital cameras, radio sets, television sets, virtual libraries, mobile telephones as well as various packages/software on audio and video compact disc, it seems teacher can teach their students better for goal attainment. Also students are likely to carry out assignments, study and learn independently at home or elsewhere. Online teaching and learning seems possible as learners are likely to receive instructions and learn via various software in CDs, DVDs and computer.

Teachers' competencies in the areas of ICT utilization and pedagogical knowledge competency are likely to influence students' learning outcomes in Basic Science and Technology. Teachers who possess ICT utilization skills will likely possess

the capability and capacity to use it for instructional purposes (Arkoful & Abaidoo, 2014). Likewise, teachers' pedagogical knowledge competency plays in a central role in students' learning outcomes. Teachers who are pedagogically competent have the ability to adopt, adapt and utilize various methods of teaching for effective teaching (Ikwuka et al, 2021).

Students' interest in Basic Science and Technology may be influenced by utilization of ICT. Onwunara (2020) observed that ICT utilization enhances students' interest in learning Basic Science and Technology. Adegbola (2019), Afuwape and Adeyi (2019) asserted that teachers' pedagogical knowledge competency positively influences students' attitude to the learning of Basic Science and Technology. Obodo, Animercy and Okolo (2021), Amalu and Ntamu (2021) as well as Iguisi and Edomsowan (2022) all submitted that teachers' pedagogical knowledge competency has a positive influence on students' interest in Basic Science and Technology.

Statement of the Problem

It has been observed that there is a declining interest, enrolment and apathy to science subjects in Senior Secondary Schools. From observation, the current number of students studying sciences in SSS classes in public secondary schools in Southwest, Nigeria is considered too low. This study seeks to investigate if certain teacher competencies could be responsible for this.

Purpose of the Study

The study investigated the influence of ICT and teachers' competencies on students' learning outcomes in Basic Science and Technology in Southwest, Nigeria. It also examined the influence of ICT utilization on students' learning

outcomes in Basic Science and Technology. The research assessed the influence of teachers' pedagogical knowledge competency on students' learning outcomes in Basic Science and Technology.

Research Questions

1. What is the influence of ICT utilization on students' learning outcomes (interest and attitude) in Basic Science and Technology?
2. What is the influence of teachers' pedagogical knowledge competency on students' learning outcomes (interest and attitude) in Basic Science and Technology?

Research Hypotheses

The following null hypotheses were used for this study:

1. There is no significant influence of ICT utilization on students' learning outcomes (interest) in Basic Science and Technology.
2. There is no significant influence of utilization of ICT on students' learning outcomes (attitude) to Basic Science and Technology.
3. There is no significant influence of teachers' pedagogical knowledge competency on students' learning outcomes (interest) in Basic Science and Technology.
4. There is no significant influence of teachers' pedagogical knowledge competency on students' learning outcomes (attitude) to Basic Science and Technology.

Methodology

This study adopted the descriptive survey research design. The population for the study consisted of 116716 Junior Secondary School III (JSS 3) students and 1124 teachers of Basic Science and Technology in public secondary schools in Southwest,

Nigeria. The sample for the study consisted of 720 JSS III students selected from eighteen public secondary schools using the multistage sampling procedure. One Local Government Area (LGA) making a total of nine LGAs that were used for this study. Two secondary schools were randomly selected from each of the selected LGAs making a total of eighteen public secondary schools. Two research instruments were used for data collection. They are 'Teacher' Assessment and Competency Questionnaire (TECAQ)' and 'Students' Attitude and Interest to the Study of Basic Science and Technology (SAILBAST). After the collection of data, they were analyzed using frequency counts, means, percentage and linear regression.

Validity of the instruments

The face, content and construct validity of the instruments were carried out by experts in Educational Technology as well as Test, Measurement and Evaluation in Ekiti State University, Ado Ekiti.

Reliability of the Instruments

The reliability of TECAQ and SAILBAST was done using Cronbach Alpha's reliability analysis. Reliability coefficients of 0.68 and 0.74 were respectively obtained for the two instruments. These values were considered adequate for the instruments to be considered reliable for data collection.

Results

Question 1: What is the influence of ICT utilization on students' learning outcomes in Basic Science and Technology?

In analyzing the question, teachers' responses relating to the influence of ICT utilization on students' learning outcomes in Basic

Science and Technology were obtained using “Teachers’ Competency and Assessment Questionnaire (TECAQ)” and subjected to statistical analysis

involving frequency counts, percentages and mean. The result is presented in Table 1.

Table 1: Influence of ICT utilization on students’ learning outcomes in Basic Science and Technology

S/N	ITEMS	SA	A	D	SD	MEAN
1.	The use of ICT for instructional purposes is a difficult endeavor	9 (12.5)	16 (22.2)	34 (47.2)	13 (18.1)	2.29
2.	The use of ICT in teaching Basic Science and Technology is relevant	31 (43.1)	34 (47.2)	5 (6.9)	2 (2.8)	3.31
3.	Teachers do not use ICT for instructional purposes because they are not computer literate	9 (12.5)	34 (47.2)	22 (30.6)	7 (9.7)	2.62
4.	The use of ICT in teaching Basic Science and Technology produces the best results.	27 (37.5)	34 (47.2)	9 (12.5)	2 (2.8)	3.19
Criterion mean = 2.50						

Table 1 presents the influence of ICT utilization on students’ learning outcomes in Basic Science and Technology. The result shows that, using a criterion mean score of 2.50 for the affirmative of the statements, all the items had mean scores above the cut-off point. This implies that the influence of ICT utilization on students’ learning outcomes in Basic Science and Technology is positive. There will be no significant influence of teachers’ pedagogical knowledge competency on students’ interest in Basic Science and Technology.

Questions 2: What is the influence of teachers’ pedagogical knowledge

competency on students’ learning outcomes in Basic Science and Technology?

In analyzing the question, teachers’ responses relating to the influence of teachers’ pedagogical knowledge competency on students’ learning outcomes in Basic Science and Technology were obtained using “Teachers’ Competency and Assessment Questionnaire (TECAQ)” and subjected to statistical analysis involving frequency counts, percentages and mean. The result is presented in Table 2.

Table 2: Influence of teachers' pedagogical knowledge competency on students' learning outcomes in Basic Science and Technology.

S/N	ITEMS	SA	A	D	SD	MEAN
1.	Instructional methodology used in teaching affects students' learning outcomes in Basic Science and Technology	32 (44.4)	21 (29.2)	10 (13.9)	9 (12.5)	3.06
2.	Instructional Methodology is the most important factor that dictates students' learning outcomes in Basic Science and Technology	33 (45.8)	33 (45.8)	4 (5.6)	2 (2.8)	3.35
3.	The instructional method used in teaching depends on the topic	34 (47.2)	35 (48.6)	3 (4.2)		3.43
4.	Teachers of Basic Science and Technology are used to various methods of teaching	27 (37.5)	38 (52.8)	6 (8.3)	1 (1.4)	3.26
5.	All instructional methods are equally effective in teaching Basic Science and Technology	24 (33.3)	38 (52.8)	8 (11.1)	2 (2.8)	3.17
6.	Teachers of Basic Science and Technology subjects usually teach with instructional materials	23 (31.9)	40 (55.6)	9 (12.5)		3.19
7.	Behavioural objectives dictates the instructional method to be used in teaching Basic Science and Technology.	27 (37.5)	37 (51.4)	7 (9.7)	1 (1.4)	3.25
Criterion mean = 2.50						

Table 2 presents the influence of teachers' pedagogical competency on students' learning outcomes in Basic Science and Technology. The result shows that, using a criterion mean score of 2.50 for the affirmative of the statements, all the items had mean scores above the cut-off point. This implies that the influence of teachers' pedagogical competency on students' learning outcomes in Basic Science and Technology is positive.

Testing of Hypotheses

Table 3: Regression of ICT utilization and students' interest in Basic Science and Technology

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta (β)		
(Constant)	3.107	5.200		.597	.559
Teachers' utilization of ICT	.971	.360	.560	2.700	.016

Multiple R = 0.560, Multiple R² = 0.313, Adjusted R² = 0.270

*p<0.05

Hypothesis 1: There will be no significant influence of ICT utilization on students' interest in Basic Science and Technology.

In order to test the hypothesis, scores relating to ICT utilization and students' interest in Basic Science and Technology were obtained and subjected to statistical analysis involving Regression statistics at 0.05 level of significance. The result is presented in Table 3

Table 3 presents the predictive influence of ICT utilization on students' interest in Basic Science and Technology. A simple linear regression analysis was carried out to assess the influence of ICT utilization on students' interest in Basic Science and Technology. The result shows that there is significant influence of ICT utilization on students' interest in Basic Science and Technology ($F_{1,16} = 7.292$, $p < .05$). The null hypothesis is hereby rejected. The result shows that the composite correlation coefficient of 0.56-0 indicating that there is a positive moderate relationship between ICT utilization and students' interest in Basic Science and Technology ($R = 0.560$, $p < 0.05$). The

coefficient of multiple determination (0.313) shows that 31.3 percent of the observed variance in students' interest in Basic Science and Technology can be attributed largely to ICT utilization

Hypothesis 2: There will be no significant influence of utilization of ICT on students' attitude to Basic Science and Technology.

In order to test the hypothesis, scores relating to ICT utilization and students' attitude to Basic Science and Technology were obtained and subjected to statistical analysis involving Regression statistics at 0.05 level of significance. The result is presented in Table 4.

Table 4: Regression of ICT utilization and students' attitude to Basic Science and Technology.

Model	Unstandardized Coefficients		Standardized Coefficients Beta (β)	T	Sig.
	B	Std. Error			
(Constant)	24.539	2.327		10.547	.000
Teachers' utilization of ICT	.195	.080	.521	2.439	.027
Multiple R = 0.521, Multiple R ² = 0.271, Adjusted R ² = 0.225, $F_{1,16} = 5.949$					

* $p < 0.05$

Table 4 presents the predictive influence of ICT utilization on students' attitude to Basic Science and Technology. A simple linear regression analysis was carried out to assess the influence of ICT utilization on students' attitude to Basic Science and Technology. The result shows that there is significant influence of ICT utilization on students' attitude to Basic Science and Technology ($F_{1,16} = 5.949$, $p < .01$). The null hypothesis is hereby rejected. The result shows that the composite correlation coefficient of 0.521 indicating that there is a positive moderate relationship between ICT utilization and students' attitude to Basic Science and Technology ($R =$

0.521, $p < 0.05$). The coefficient of multiple determination (0.271) shows that 27.1 percent of the observed variance in students' attitude to Basic Science and Technology can be attributed largely to ICT utilization while 72.9 percent unexplained variance is due to other variables not investigated in the study.

Hypothesis 3: There will be no significant influence of teachers' pedagogical knowledge competency on students' interest in Basic Science and Technology. In order to test the hypothesis, scores relating to teachers' pedagogical competency and students' interest in Basic Science and

Technology. In order to test the hypothesis, scores relating to teachers' pedagogical competency and students' interest in Basic Science and Technology were obtained and

subjected to statistical analysis involving Regression statistics at 0.05 level of significance. The result is presented in Table 5.

Table 5: Regression of teachers' pedagogical competency and students' interest in Basic Science and Technology

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta (β)		
(Constant)	8.850	3.139		2.819	.012
Teachers' utilization of ICT	.471	.178	.552	2.651	.017
Multiple R = 0.552, Multiple R ² = 0.305, Adjusted R ² = 0.262, F _{1,16} = 7.028					

***p<0.05**

Table 6 presents the predictive influence of teachers' pedagogical competency on students' interest in Basic Science and Technology. A simple linear regression analysis was carried out to assess the influence of teachers' pedagogical competency on students' interest in Basic Science and Technology. The result shows that there is significant influence of teachers' pedagogical knowledge competency on students' attitude to Basic Science and Technology ($F_{1,16} = 5.118$, $p < 0.05$). The null hypothesis is hereby rejected. The result shows that the composite correlation coefficient of 0.492 indicating that there is a positive moderate relationship between teachers' pedagogical competency and students' attitude to Basic Science and Technology ($R = 0.492$, $p < 0.05$) the coefficient of multiple determination (0.242) shows that 24.2 percent of the observed variance in students' attitude to Basic Science and Technology is explained by teachers' pedagogical competency while the remaining 75.8 percent unexplained variation is due to other variables not investigated in the study.

Findings and Discussion

This study determined the influence of ICT and teachers' competencies on students' learning

outcomes in Basic Science and Technology in Southwest, Nigeria. The finding of this study showed that ICT utilization has a positive influence on students' interest in Basic Science and Technology. This is in agreement with the findings of Onwunara (2020) that ICT utilization enhanced students' interest, reinforced their understanding of the subject and facilitate the acquisition of digital skills. The findings of this study revealed that teachers' pedagogical knowledge competency has a positive influence on students' attitude in Basic Science and technology. This is in consonance with the findings of Adegbola (2019) that teachers' pedagogical knowledge competency has a significant positive influence on students' attitude towards Basic Science and Technology. This is particularly applicable to teachers' use of relevant instructional materials. Likewise, Afuwape and Adeyi (2019) corroborated this assertion that teachers' methodology and participation in training programmes on pedagogy have significant influence on the attitude of students to Basic Science and Technology.

Findings of this study revealed that teachers' pedagogical knowledge competency has a positive influence on students' interest in Basic Science and

technology. This concurs with the findings of Obodo, Animercy and Okolo (2021); Iguisi & Edomsowan (2022) that teachers' pedagogy knowledge competency has a positive influence on students' interest in Basic Science and Technology. Also, Amalu and Ntamu (2021) found that teachers' pedagogical knowledge competency led to an increase in the interest of students in Basic Science and Technology.

Conclusion

Based on the findings of the study, it was concluded that ICT utilization and teachers' competencies have a positive influence on students' learning outcomes (interest and attitude) in Basic Science and Technology.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Teachers of Basic Science and Technology should be motivated to use ICT for teaching and learning.
2. Regular training programmes should be organized for teachers on the relevance of ICT as a pedagogical tool.
3. Teachers' should be exposed to various teaching pedagogy through regular training programmes.
4. Teachers should be given orientation on diverse pedagogical approaches in teaching and motivated to apply them in classroom instruction.

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