Assessment of the Perceived Impact of Information Technology on Teaching and Learning in Secondary Education

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

The current study assessed the impact of Information Technology (IT) on teaching and learning in some Nigerian secondary schools based on students' perception. The Awka Education Zone of Anambra State was the geographical area of coverage. The objective of the research was to assess students' perception of the impact of IT in teaching and learning in secondary schools. A sample size of 600 respondents was used. A 15 item structured questionnaire developed within the study was used for data collection. Three research questions were posed and two hypotheses were formulated to guide the study. The study showed that students performed better when exposed to IT methods in teaching and learning than when exposed to traditional methods. The z-test analysis showed that there was significant difference in mean interest of male students and female students towards IT integration in teaching and learning. A significant difference was equally observed in the mean perception of junior and senior students toward IT integration in teaching and learning.

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1. INTRODUCTION

Development often requires the synergistic interaction between human values and technological innovation. The monumental development experienced in Information Technology (IT) over the last three decades has made IT pivotal in development and globalization. IT encompasses all the technologies including hardware, software and system networks necessary for acquiring, processing, securing, transmitting, presentation and storing of information. It significantly affects every spheres of human endeavors, including education [1-5]. The current role of IT in education cannot be overemphasized. Many of the teaching, learning and examination platforms globally are mainly electronic. IT has gained prominence and as a major competence required for survival in our current world, it is a core component in educational systems. Many governmental and private initiatives have attempted to address the issue of IT integration in the secondary school system by carving out policies and strategies, providing computers and internet facilities, giving training to teachers and adopting an IT based curriculum. Provision of these facilities and more has become a major publicity campaign by many private institutions [6]. However, not many studies have focused on assessing the impact of IT on teaching and learning in the educational system. The current study therefore focused on assessing the impact of the integration of IT in secondary school education, based on students' perception.

Many school teachers are not IT savvy, still holding on to the old traditional non-IT compliant method of teaching and learning. Available resources including infrastructure, curricula and trained manpower are still inadequate. Most of the failures encountered while attempting to solve these problems occur at the implementation level. Whereas computers are available in some schools, they are often mainly on display only while teaching computer studies and not applied in other areas. In some cases, they were acquired solely for compliance purposes. In many of these secondary schools, IT was scarcely used to facilitate the smooth running of the schools' operations. If significant improvement is to be recorded in the Nigerian educational system however, it is imperative that there should be effective and efficient integration of IT into the teaching and learning processes of the system.

1.1 Research Questions

In order to obtain precise results from this study, the following research questions were used as guide for determining the impact of IT on teaching and learning in secondary education:

1. What are students' perceptions of their own performances when exposed to the use of IT-based methods as against the use of traditional methods for teaching and learning?
2. What are students' perceptions of teachers' conversance with the use of IT based tools?
3. What are students' perceptions of the integration of IT in teaching and learning?

1.2 Aim and Objectives

The main aim of the current study was to evaluate students' perception of the impact of IT on teaching and learning.

The specific objectives of the study were:

1. To assess students' perception of their own performances when exposed to the use of IT-based methods as against when exposed to traditional methods of teaching and learning.
2. To assess students' perception of teachers' conversance with the use of IT based tools; and
3. To assess students' perception of the integration of IT in teaching and learning;

1.3 Hypotheses

At a 0.05 level of significance, the following null hypotheses were formulated:

1. There is no significant difference in student's perception of their own performance when exposed to IT-based methods as against when exposed to traditional methods of teaching and learning.
2. There is no significant difference in the mean interest of male and female students towards IT integration in teaching and learning of concepts in secondary schools.

3. There is no significant difference in the mean perception of junior and senior students towards IT integration in teaching and learning.

1.4 Significance of the Study

This study is significant to the extent that educational systems globally are drifting in the direction of extensive application of IT-driven approaches in teaching and learning. As a part of the global community therefore, the Nigerian educational system needs not only to be kept abreast of the changing trends, but must also be evaluated to ascertain students' perception of the integration of these trends in teaching and learning.

1.5 Scope of Study

Teaching and learning was evaluated based on two subject areas, Integrated Science and Biology. While Integrated Science was employed for evaluating the Junior Secondary student, Biology was employed for evaluating the Senior Secondary students.

2. INFORMATION TECHNOLOGY IN THE NIGERIAN EDUCATION SYSTEM

IT encompasses all the technologies that facilitate communication processing and transmission via electronic medium [7]. IT facilitates the creation, storage, management and dissemination of information by electronic means. IT is a term used to describe the tools and processes used in accessing, retrieving, storing, organizing, manipulating, producing, presenting and exchanging information by electronic and other automated means [8]. Among the tools being referred to here are computer software and hardware including telecommunication devices such as personal computers, scanners, digital cameras, hand-held devices, personal digital assistants (PDAs), phones, fax machines, modems, CD & DVD players and recorders, multimedia applications, database systems, digitized video, radio, and television systems. Leach et al. [9] advocated for an integrated view of IT in which one emphasizes the intersection of Information technology, information content and telecommunications enabling new forms of knowledge production and interactivity. This view captured in Fig. 1 argued that IT should be underpinned by the ability to facilitate interactivity.

For there to be effective human capital development in any nation, the educational system plays a major role [10,11]. IT is now an essential part of everyday life in all organizations including educational institutions. The relevance of IT in the educational system in general cannot be overemphasized. In Nigeria in particular, as in many developing countries, the need for IT and its inculcation in the educational system is of utmost importance. The value and skill-sets acquired by students as a result of teaching and learning using IT tools cannot be overemphasized. In the current technology-driven age, IT competence has become an essential tool for survival. This has led organizations to spend a lot of money in training and re-training of their employees on the use of IT tools, including computer and software programs [12-14]. Thus, employers always prefer employees with high levels of IT appreciation. This therefore calls for early acquisition of IT skills by students.

The use of IT in teaching and learning allows for increased individualization. Many of the IT based teaching and learning tools actually adjust to the attention span of the student and provide
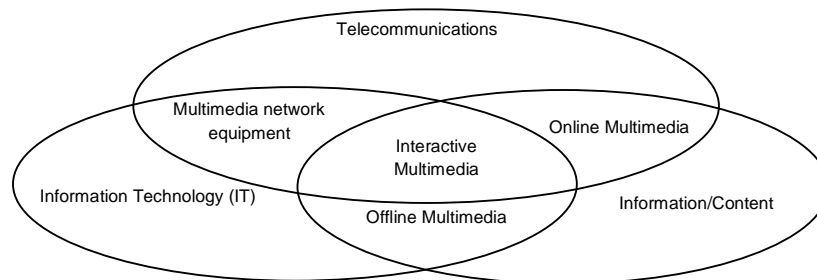

Fig. 1. Information technologies
Adapted from Leach et al. [9]

valuable and immediate feedback. Such feedback is very valuable for literacy enhancement [15,16]. Tools of this nature need to be implemented in the Nigerian school system. The application and use of IT in the Nigerian educational system will prove to be immensely beneficial at giving students a better education. The country is in grave need of a technologically advanced workforce with the capacity to solve longstanding problems using existing technologies, and the ability to reformulate new technologies when the need arises [17]. The integration of IT into teaching and learning has arguably experienced one of the most technological advancements since late 20th century. The current study is thus focused on assessing its impact so far on the Nigerian education system, using the secondary school system as a case study.

A number of research works have focused on the benefits of IT to the quality of teaching and learning that take place in educational systems [18]. IT has been proven to have the potential for accelerating, enriching and deepening skills [19]. IT tools often help in engaging and motivating students at a higher level than other mediums of teaching and learning. These tools equally help relate school experience to work practice as well as create economic viability for tomorrow's workers [20].

In a rapidly changing world (global village) where basic education is essential for an individual to be able to access and apply information, IT skills are nonnegotiable. It is now general knowledge that the ability to access and use information is no longer luxury, but a necessity for development. Unfortunately however, many developing countries especially in Africa, are still struggling with the development of these competences [21]. Studies by the Africa Health, Human & Social Development Information Service Afri-Dev.Info [22] also showed that investment in the Nigerian education system is not keeping up with population growth. This is not unconnected with the challenges Nigeria has encountered in trying to reach the Millennium Development Goals MDGs, chances of which seem very bleak [23].

The Nigerian secondary education system is experiencing some measures of growth and development with regards to the deployment and use of IT in teaching and learning. The Federal Government of Nigeria in the National Policy on Education (NPE) recognized the prominent role of IT in the educational system [24-26]. In the bid to actualize this goal, the NPE states that government will provide basic infrastructure and training at the primary school. Also, computer education has been made a pre-vocational elective at the Junior Secondary School (JSS) and is a vocational elective at the Senior Secondary School (SSS). Government is equally working towards providing necessary infrastructure and training to facilitate the integration of IT into the educational system. Although a number of earlier attempts at achieving these goals had not been too successful beyond the distribution and installation of personal computers [27], more progress is being recorded in recent years. Several organization, associations and agencies from around the world have developed different initiatives aimed at imparting IT skills to young Africans in primary and secondary schools [28]. The Nigerian National Information Technology Development Agency (NITDA) and other relevant organizations have equally paid a lot of attention to the provision of internet access to schools [29,30].

3. RESEARCH METHODOLOGY

3.1 Research Design

The current study adopted the survey research methodology in acquiring its facts and figures. As a survey study, it took into consideration both large and small populations. Purposive samples from the population were chosen and studied to discover the relationship between interacting variables. With a nondisclosure statement in the employed research instrument, the aim was to solicit the candid opinion of respondents on the use of IT in teaching and learning in some Nigerian secondary schools.

3.2 Area of the Study

The current study covered all the Public Secondary Schools in Awka Educational Zone of Anambra State. Awka Educational Zone was in the state capital and was considered the educational nerve center of Anambra State, which made it very suitable for the study. The population studied covered students of the secondary schools in Awka Educational Zone. This zone was made up of five Local Government Areas (LGA) namely Awka North, Awka South, Anaocha, Dunukofia and Njikoka. It was a relatively large population to work with, so random samples of schools were therefore selected from each LGA for the study.

3.3 Sample and Sampling Technique

The researchers used purposive sampling technique to pick the respondents from the schools in the five Local Government Areas. The purposive sample for the current study was made up of 600 students chosen from the five LGAs. This number comprised of 30 students from both JSS and SSS for each of the 20 schools in the zone. This gave a total sample size of 600 respondents selected across the population. The purposive sampling technique was used to account for balanced representation of gender (male and female) and class group (JSS and SSS). Except for the equal representation (in population size) of gender and class group, the sample population used for the current study was a true representative of the whole population under study.

3.4 Instruments Used for Data Collection

The instrument employed for data collection in the current study was a validated questionnaire. Questionnaires are suitable for collection of information about attitudes, perceptions, interest and social habits of individuals, hence the justification for its use in this study. The questionnaire was divided into four sections. Section A comprised the socio-demographic characteristics of respondents. Section B, C and D consisted of 5 items each on:

i. Students' perception of their own performance when exposed to IT method as against when exposed to traditional method;
ii. Students' perception regarding how conversant teachers are with IT usage; and
iii. Students' perception towards IT integration in teaching and learning respectively.

This gave a total of 15 items scored on a 5-point Likert scale as follows:

Strongly Agree (SA) - 5
Agree (A) - 4
Undecided (U) - 3
Disagree (D) - 2
Strongly Disagree (StD)- 1

This yields a cut-off point of 3.0

3.5 Validity and Reliability of the Instrument

To ensure the validity of the instrument, the face and content validity were established by relating the content of each item to the literature.

A pilot survey was conducted using thirty students in JSS 3 and SS 3 from two (2) Secondary Schools in Anaocha Local Government Area. The reliability coefficient of 0.76 was established using split-halt and was considered high enough for the test instrument.

3.6 Method of Data Collection

The method of data collection was through the use of questionnaires. An on-the-spot administration ensured necessary guidance within the cause of completing the questionnaire. It also ensured maximum return of the instrument, yielding a hundred percent retrieval of successfully administered questionnaires.

3.7 Method of Data Analysis

Data collected were analyzed using mean, standard deviation and z-test. Mean and standard deviations were used to answer the research questions while the z-test statistic was employed to test the hypotheses.

4. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

4.1 Research Questions

This section presents and analyses the results that address the research questions and hypotheses of the current study.

4.1.1 Results for research question 1

To what extent are there differences in the perceptions of students on their own performances based on the use of traditional method as against the use of IT based methods for teaching and learning? Table 1 shows the Mean (M) and Standard Deviation (SD) of students' perception on their own performance based on what method of teaching and learning they were exposed to.

4.1.2 Research question 2

To what extent are there differences in the perceptions of students regarding how conversant teachers are with IT usage? The results for this are shown in Table 2.

4.1.3 Research question 3

What are students' perception towards the integration of IT in teaching and learning? The results for this are shown in Table 3.

4.2 Hypothesis

4.2.1 Null hypothesis 1

The first null hypothesis is that there is no significant difference in student's perceived performance when exposed to traditional methods as against when exposed to IT based methods of teaching and learning. Table 4 shows the two-tailed z-test analysis of perceived performance when IT-based approach and Traditional to teaching and learning was employed. The proportions were derived from Table 1 (ignoring the Likert scale) where the SA and A columns were in favor of the IT-based approach, while columns D and StD were in favor of the traditional approach.

From Table 4, the proportion of students' perception that indicated improved performance

resulting from IT-based approach was 0.7347 while the proportion of students' perception that indicated improved performance resulting from the traditional approach was 0.1840. The combined standard deviation was computed to arrive at 0.024. The z-test was calculated and found to be 561.04 which is greater than z-critical (1.96). Therefore, the first null hypothesis which stated that there was no significant difference in student's perceived performance when exposed to traditional methods as against when exposed to IT-based methods of teaching and learning was rejected.

4.2.2 Null hypothesis 2

The second null hypothesis is that there is no significant difference in the mean interest of male and female students towards IT integration in teaching and learning of concepts in secondary schools. Table 5 shows a two-tailed z-test of difference between mean interest of male and female students towards IT integration in secondary schools.

Table 1. Students perception of own performance

S/N	Item	SA	A	UD	D	StD	F	FX	M	SD	Remark
1	Students taught with IT method perform better than students taught with traditional method in the class exercise.	350 (1750)	107 (428)	23 (69)	65 (130)	55 (55)	600	2432	4.05	1.37	Accepted
2	Students understand better when the teacher teaches with IT method.	250 (1250)	150 (600)	70 (210)	100 (200)	30 (30)	600	2290	3.82	1.27	Accepted
3	Students perform better in the exam when the teacher uses IT method to teach.	246 (1230)	183 (732)	66 (198)	55 (110)	50 (50)	600	2320	3.87	1.27	Accepted
4	Students perform better in drill and practice when the teacher uses IT to teach.	280 (1400)	200 (800)	26 (78)	58 (116)	36 (36)	600	2430	4.05	1.20	Accepted
5	Students perform better in their assignment when the teacher uses IT method to teach.	244 (1220)	191 (764)	62 (186)	70 (140)	33 (33)	600	2343	3.91	1.21	Accepted

Average Mean = 3.94; Average Standard Deviation = 1.27; SA = Strongly Agree; A = Agree; UD = Undecided D = Disagree; StD = Strongly Disagree; M = Mean; SD = Standard Deviation

Table 2. Students' perception of teachers' conversance with IT Usage

S/N	Item	SA	A	UD	D	StD	F	FX	M	SD	Remark
1	Teachers in the secondary schools own laptops computers.	78 (390)	80 (320)	50 (150)	205 (410)	187 187	600	1457	2.43	1.38	Rejected
2	When teaching, teachers expose students to internet forum for group discussion.	70 (350)	86 (344)	20 (60)	209 (418)	215 (215)	600	1387	2.31	1.39	Rejected
3	When teaching, teachers use multimedia projectors to project their lessons.	124 (620)	120 (480)	20 (60)	186 (372)	150 (150)	600	1682	2.80	1.52	Rejected
4	Teachers make use of PowerPoint presentation while teaching.	118 (590)	102 (408)	22 (66)	190 (380)	168 (168)	600	1612	2.69	1.52	Rejected
5	Teachers make use of Computer Assisted Instruction software while delivering their lessons.	70 (350)	86 (344)	20 (60)	209 (418)	215 (215)	600	1387	2.31	1.39	Rejected

Average Mean = 2.51
Average Standard Deviation = 1.44

Table 3. Students perception of IT integration in education

S/N	Item	SA	A	UD	D	SD	F	FX	M	SD	Remark
1	Students embrace IT in teaching and learning.	225 1125	206 824	31 93	78 156	60 60	600	2258	3.76	1.34	Accepted
2	IT integration makes teaching and learning more interesting to the students.	252 1260	207 828	23 69	65 130	53 53	600	2340	3.90	1.30	Accepted
3	IT integration makes students to shy away from classes.	106 530	102 408	40 120	168 336	184 184	600	1578	2.63	1.50	Rejected
4	Teachers are lazy when they teach with IT method.	107 535	110 440	40 120	170 340	173 173	600	1608	2.68	1.49	Rejected
5	IT education should be included in the national curriculum.	210 1050	202 808	35 105	87 174	66 66	600	2203	3.67	1.37	Accepted

Average Mean = 3.33
Average Standard Deviation = 1.40

Table 4. Test for performance difference in IT-based and traditional approach

Source of variation	Proportion	Standard deviation	N	Level of sig.	z-cal	z-critical	Decision
IT-Based Traditional	0.7347 0.1840	0.024	600	0.05	561.04	1.96	Reject null Hypothesis 1

From Table 5, the mean score and standard deviation of male students were 66.98 and 12.34 respectively while the mean score and standard deviation of female students were 47.60 and 8.60 respectively. The z-test was calculated and found to be 21.87 which is greater

Table 5. Test for difference in male and female students' interest in IT integration

Source of variation	Mean	Standard deviation	N	Level of sig.	z-cal	z-critical	Decision
Male	66.98	12.34	300	0.05	21.87	1.96	Reject null Hypothesis 2
Female	47.60	8.60	300				

Table 6. Test for difference in junior and senior students' interest in integration

Source of variation	Mean	Standard deviation	N	Level of sig.	z-cal	z-critical	Decision
Senior	1.40	0.49	300	0.05	4.25	1.96	Reject null Hypothesis 3
Junior	1.24	0.43	300				

than the value of z-critical (1.96). Therefore, the second null hypothesis which stated that there was no significant difference in the mean interest of male and female students towards IT integration in teaching and learning was rejected.

4.2.3 Null hypothesis 3

The third null hypothesis is that there is no significant difference in the mean perception of junior and senior students towards IT integration in teaching and learning. Table 6 shows the two-tailed z-test analysis of junior and senior students' perception towards IT integration in teaching and learning.

From Table 6, mean and standard deviation of senior students' responses were 1.40 and 0.49 respectively while the mean and standard deviation of junior students' responses were 1.24 and 0.43 respectively. The z-test was calculated and found to be 4.25 which is greater than z-critical (1.96). Therefore, the third null hypothesis which stated that there was no significant difference in the mean perception of junior and senior students towards IT integration in teaching and learning was also rejected.

5. DISCUSSION

The study reveals that the following factors affect IT integration in classroom: Gender differential in IT integration, Class level differential in IT integration; Perception of students on their own performances when exposed to IT methods as against when exposed to traditional methods; Perception of students on how conversant teachers are with IT usage; and Perception of students toward IT integration in teaching and learning in secondary schools. Although this study was limited to the Awka Educational Zone

of Anambra State in Nigeria, studies suggest that similar results are equally obtainable in other parts of the country.

6. CONCLUSION

The study has shown that students have a better perception about their performance when exposed to IT-based methods as against when exposed to the traditional methods of teaching and learning. The influence of gender in IT integration was significant. Male students were more favorable towards IT integration, expressing higher interest towards IT integration in teaching and learning than their female counterparts. Teachers were perceived not to be conversant with IT usage. The students' perception of teachers not being conversant with IT usage was based on the teachers not using PowerPoint presentations, Computer Assisted Instruction software, multimedia projectors, and other IT tools (where they are available) for lesson delivery. The influence of class level on IT integration is significant. As indicated by the study, senior students demonstrated a higher level of interest towards IT integration in teaching and learning than junior students. The study has experimentally revealed among other things, that irrespective of the perspective from which impacts were assessed, the application of IT-based tools and techniques in teaching and learning is very beneficial to the secondary school education system.

7. RECOMMENDATIONS

Considering the enormous benefits that the integration of IT in teaching and learning portends for the education system, it is recommended that more efforts be made at implementing the National Education Policies that encourage IT integration in the system.

Special attention should be given to those aspects of the policy that recognize the role of IT in teaching and learning. Furthermore, to solve the financial challenges facing IT integration in education, policies should be established that mandates a co-reliance between the industry and the academia. This would avail researchers the opportunity to work on cogent industry-needs, while the industry funds the research. Such symbiotic relationships will release extra funds into the education sector of the country, thereby fostering higher levels of growth and development.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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