



Senior School Mathematics Teachers' Awareness and Perceptions of ICT Resources for Teaching and Learning

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Received: 15 Dec, 2022 | Revised: 11 Mar, 2023 | Accepted: 28 Apr, 2023 | Published Online: 30 Apr, 2023

Abstract

This study therefore investigated senior school Mathematics teachers' awareness and perceptions of ICT resources for teaching and learning of Mathematics: a case of Nigeria. A descriptive research of the survey type was employed. The population for the study consisted of all Senior Secondary School Mathematics teachers in Kwara-Central, Kwara State, Nigeria where two hundred and fifty five Mathematics (255) teachers were involved in the study. Public and private school Mathematics teachers were selected using simple random sampling technique. The research instrument used in the study was "Mathematics Teachers' Awareness and Perceptions of ICT Resources Questionnaire" (MTAPIRQ). A reliability value of 0.83 was determined using Cronbach alpha in the SPSS version 22. Data were analyzed using percentage and chi-square statistical tools at 0.05 significant level. The result revealed that Mathematics teachers are aware and have positive perceptions of ICT resources for teaching and learning. The result finally revealed that teachers' perceptions are not dependent on their years of teaching experience. Recommendations were therefore made.

Keywords: awareness; ease-of-use; experience perceptions; ICT; usefulness

Abstrak

Penelitian ini bertujuan untuk menyelidiki kesadaran guru Matematika Sekolah Menengah Atas dan persepsi terhadap sumber daya TIK untuk pengajaran dan pembelajaran Matematika: kasus di Nigeria. Penelitian ini merupakan penelitian deskriptif dengan jenis survei. Populasi penelitian terdiri dari semua guru Matematika Sekolah Menengah Atas di Kwara-Central, Negara Bagian Kwara, Nigeria di mana 255 guru Matematika terlibat dalam penelitian ini. Guru Matematika sekolah negeri dan swasta dipilih dengan menggunakan teknik simple random sampling. Instrumen penelitian yang digunakan dalam penelitian ini adalah Mathematics Teachers' Awareness and Perceptions of ICT Resources Questionnaire (MTAPIRQ). Nilai reliabilitas sebesar 0,83 diperoleh berdasarkan rumus Cronbach alpha pada SPSS versi 22. Data dianalisis dengan menggunakan alat statistik persentase dan chi-square pada taraf signifikan 0,05. Hasilnya mengungkapkan bahwa guru Matematika memiliki kesadaran dan persepsi positif tentang sumber daya TIK untuk pengajaran dan pembelajaran. Hasilnya akhir dalam penelitian ini mengungkapkan bahwa persepsi guru tidak tergantung pada pengalaman mengajar mereka selama bertahun-tahun. Oleh karena itu, rekomendasi dibuat.

Kata Kunci: ease-of-use; ICT; kegunaan; kesadaran; persepsi

INTRODUCTION

The progress of any country depends greatly on how her educational system responds to development in a sustainable pattern. Mathematics education is a discipline which is vital to the sustainability of a nation's development, particularly due to its contributions to the training of manpower in the fundamental basics of science and technology as vital tools useful in every sphere of life. Mathematics education is the foundation of science and technology without which a nation can never become prosperous and economically independent (Anumudu, n.d.). This implies that the level of social and economic development is closely connected with the level of development in the Mathematics education. No society can develop without the effective teaching and learning of Mathematics in schools (Azuka, 2015).

"Most advances in science and technology owe their origin to Mathematics which is often referred to as the language of science and technology. For example, the computer which is the greatest discovery of the last century owes its origin to Mathematics theories. Whatever problem is solved today by applying computer technology has been solved by Mathematics in the past. No wonder, the place of Mathematics amongst the subjects taught in Nigerian schools is well recognized (Adenegan, 2007)".

Mathematics is a vital tool used by scientists in their quest for understanding of the physical world. It can be defined as the science of structure, order and relation that has evolved from elemental practices of counting, measuring and describing the shapes of objects (Anumudu, n.d.). Mathematics is much more than just the study of numbers; it is also the study of ideas. It has significance and contributes immeasurably to the established order of the world (Iyanda, 2017).

The current need for science and technology in most of the developing countries has necessitated improvement in Mathematics Education. The developing nations cannot afford to lag behind in the scheme of development. Hence, the need to update ourselves on Information Communication Technology (ICT) resources for teaching and learning of Mathematics so as to bridge up with the trend of development as it obtains in the other parts of the world (Olagunju, et al., 2015).

According to Nwangwu, et al., (2014), ICT can be conceptualized to mean information processing tools that are used to produce, store and process, distribute and exchange information. The ICT resources include projectors, computers, television, radio, storage devices, display devices and communication devices. When the ICT resources are combined together, they form a well networked base of learning. ICT creates a channel for students to obtain a huge amount of experience and guide them to enter the global community. In this way the students not only can extend their personal view, thought, and experience, but also can learn to live in the real world (Nwangwu, et al., 2014).

ICT could be better described as all the digital technologies that help individuals, businesses and organizations process information. ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form, for example, personal computers, digital television, email and robots (Riley, 2012). The figure below displays various ICT resources.

Table 1. Displaying Evolution of Various ICT Resources

Display	Television	Radio	Projectors	Storage Device	Communication	Computer
Blackboard	Monochrome CRT	Radio	Homemade Slide Projector	Paper/Book	Face to Face	Mainframe Computer
Flannel Board	Color CRT	HAM Radio	Photographic Slide Projector	Magnetic Tape	Post Mail	Desktop Computer
Peg Board	Plasma TV	FM Radio	Opaque Projector	Magnetic Drum	Telegram	Laptop Computer
Magnetic Board	LCD TV	Community Radio	Film Projector	Floppy Disc	Telephone	Palmtop Computer
White Board	LED TV	Mobile Radio	Micro Projection	Compact Disc	Mobile Phones	Netbook
Interactive White Board	3D/HD TV	Internet Radio	Overhead Projector	DVD	e-mail	Tablet
Collaborative Virtual Tools	UHD TV	Podcast	Digital Projection Panel	Hard Disks	Forum/Online Groups	Phablet
Wearable Display	Interactive TV		Multimedia Projector	Optical Devices/Pen Drive	Chat	Wearable Computing
Bendable Display	IPTV		Document Camera	SD Card	Instant Messaging	Nanobots
Foldable Display	OLED TV		LED/Pico Projector	Data Centres	Web Conferencing	
Holographic Display			Wearable Projector	Cloud Storage		

(Source: Paily and Mysore, 2016)

Thus, it can be deduced that ICT is not mainly the technology per se; it is also the processes of storing, retrieving, manipulating and receiving or transmitting of digital data. More so, it incorporates the way these different uses work together. ICT also incorporates different computing hardware (mainframes, servers, networked storage, PCs); the hardware market consisting of MP3 players, mobile phones, personal devices; online software services; application software collection from the simple home-developed spreadsheet to the complex enterprise packages. In addition, it includes the hardware and software needed to operate networks for transmission of information as well as the internet which stands out as the major driver of most of the ICT (Adamkolo, 2014).

The concern for the application of ICT in Africa is increasing and vividly growing. However, while there is much knowledge about how ICT are being used in developed countries, there is not adequate information on how ICT are being introduced into schools in developing countries (Beukes-Amiss and Chiware, 2006). Looking at the developing countries, the teachers and students have limited access to ICT.

Research studies such as Ipusu and Ukama (2008) have indicated that science and Mathematics develop faster in countries that embrace ICT. As a result of the significance of ICT to education, the National Council of Teachers of Mathematics (NCTM) (2001) reported that all teachers and students should have access to necessary ICT. Most research studies concluded that students would benefit tremendously if ICT is integrated into Mathematics education. Therefore, there is every need to harness its potential for education development (Ejar, et al., 2016).

Moreover, research study such as Salman, et al., (2013) revealed that Mathematics teachers are aware of the ICT resources for teaching and learning. Research studies such as Sim and Theng (2007); Taiwo (2009); Olaniyan and Opayinka (2012); Ng'eno, et al., (2013); Mustafa (2014); Ejar, et al., (2016) and Nwoke and Ikwuanusi (2016) have documented the perceptions of teachers about using ICT resources in the teaching and learning of Mathematics. The teachers' perception of ICT motivates teachers to apply ICT in the classroom, and the perception is being influenced by attributes such as gender and teaching experience. The studies also revealed that teachers' perception of ICT predicts teachers' performance in the classroom.

Teachers' awareness and perceptions occupy a central position to the success in ICT implementation in teaching and learning (Khalid, 2016). Khalid (2016) mentioned the importance of evaluating teachers clearly, when he reported that, "to initiate the change to an online system of course, it is important to assess the readiness of the various stakeholders". When teachers are presented with a new technology, the following key factors would influence their decision about how and when they will actually use it in the classroom: perceived ease of use, perceived usefulness, attitude towards use, behavioral intention to use and external variables (Simin, et al., 2016).

Clearly, teachers' awareness and perception of ICT are crucial to the success or failure of ICT integration in the classroom. Thus, it would be unwise to suggest ICT integration into Mathematics lessons before investigating Mathematics teachers' awareness and perception of ICT resources for teaching and learning Mathematics. Concerned with this phenomenon; this study was motivated to investigate the senior school Mathematics teachers' awareness and perceptions of ICT resources for teaching and learning: a case of Nigeria.

METHOD

The study was a descriptive research of the survey type. The descriptive research of the survey type was considered as the appropriate method because the study was directed towards people's views, opinions and behaviors. It involved administration of questionnaire to the respondents to collect data.

The population for this study consisted of all Senior Secondary School Mathematics teachers in Kwara State, Nigeria. The sample for the study comprised of two hundred and fifty five (255) senior secondary school Mathematics teachers in Kwara-Central, Kwara State Nigeria. All public and private senior secondary school Mathematics teachers were randomly sampled.

The instrument used in this study was a questionnaire entitled "Mathematics Teachers' Awareness and Perceptions of ICT Resources Questionnaire" (MTAPIRQ). The instrument was used to investigate senior school teachers' awareness of ICT resources, the teachers' perceived ease of using ICT resources, perceptions of ICT resources usefulness and influence of years of teaching experience on the teachers' perceptions.

The MTAPIRQ was divided into five (5) sections. Section A sought information on teachers' bio-data. Section B contained questions on ICT resources awareness on which respondents were required to tick the appropriate options (YES or NO). Sections C, D and E contained items on which respondents were required to tick the appropriate options on a 4-point Likert scale type of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). Sections C and D contained items about teachers' perception on ease of using ICT resource and perceived usefulness of ICT resources.

The research instrument (MTAPIRQ) was given to two lecturers who were experts in Mathematics education in the Department of Science Education and two lecturers from the Department of Educational Technology, University of Ilorin, to determine the face and content validity of the instrument. For reliability test, the instrument was administered on twenty (20) Senior Secondary Mathematics teachers who did not participate in the final research but similar in characteristics. A test-retest method was used to ensure the instrument reliability. The reliability index of the instrument was found to be 0.83 using Cronbach Alpha.

Descriptive and inferential statistics were used to analyse the collected data.. Research questions 1-3 were answered using descriptive statistics of percentages. Inferential statistics of chi-square was used to answer research questions 4-5 and test hypotheses 1-2 at 0.05 level of significance.

RESULTS AND DISCUSSION

Results

This section presents the analysis of the data gathered in the study and the results of the analyses. The analyses and results are presented according to the research questions raised and the research hypotheses formulated. The responses of the senior school Mathematics teachers were analyzed using percentage and chi-square statistical tool. Statistical Package for Social Sciences (SPSS) version 22 was used to analyzed the data collected. All the hypotheses were tested at 0.05 level of significance.

Table 2 presents the demographic characteristics of the Mathematics teachers that participated in the study. As shown in the table, two hundred and fifty-five (255) teachers participated in the study, out of which 176(69%) were experienced while 79(31%) were less-experienced.

Table 2. Demographic Characteristic of Mathematics Teachers

Variable	Type	Frequency (F)	Percentage (%)
Years of experience	Experienced	176	69
	Less – experienced	79	31
Total		255	100

Research Question 1: Are Mathematics teachers aware of the ICT resources?

Table 3 revealed the number, as well as percentages of senior school Mathematics teachers’ awareness of ICT resources for teaching and learning. Table 2 indicated that senior school Mathematics teachers are aware of the ICT resources.

From Table 3, the senior school Mathematics teachers’ awareness of the following ICT resources are higher than others: Video Player, Computers, Televisions and Internet with 99.2%, 99.2%, 95.7% and 95.7% respectively. While the teachers’ awareness of the following ICT resources are the lowest: Bulletin boards, Slides and Electronic notice board with 57.3%, 75.3 and 76.5 respectively. This answers research question 1.

Table 3. Mathematics Teachers’ Awareness of ICT Resources

S/N	Teachers’ awareness of ICT resources	A F (%)	NA F (%)	TOTAL F (%)
1	Radio	237(92.9)	18(7.1)	255(100)

2	Satellite	230(90.2)	25(9.8)	255(100)
3	Interactive CDs	206(80.8)	49(19.2)	255(100)
4	Telephone	236(92.5)	19(7.5)	255(100)
5	Projectors	237(92.9)	18(7.1)	255(100)
6	Video Player	244(95.7)	11(4.3)	255(100)
7	Televisions	244(95.7)	11(4.3)	255(100)
8	Computers	253(99.2)	2(0.8)	255(100)
9	Screen	222(87.1)	33(12.9)	255(100)
10	Internet	253(99.2)	2(0.8)	255(100)
11	Slides	192(75.3)	63(24.7)	255(100)
12	Electronic notice boards	195(76.5)	60(23.5)	255(100)
13	Disc player	223(87.5)	32(12.5)	255(100)
14	Bulletin boards	146(57.3)	109(42.7)	255(100)
15	Mobile phones	238(93.3)	17(6.7)	255(100)

NOTE:

A = Aware

NA = Not Aware

Research Question 2: What are Mathematics teachers' perception on the ease of using ICT resources for teaching and learning of Mathematics?

Table 4 shows the number, as well as percentages of Mathematics teachers' perception of ease of using ICT resources for teaching and learning. Table 4 indicated that Mathematics teachers perceived the ICT resources as being easier to use for teaching and learning of Mathematics.

From Table 4, the most held perception on the ease of using ICT resources for teaching and learning of Mathematics were: ICT for Mathematics teaching and learning requires more technical support (89.8%); ICT is easy to use in the Mathematics classroom (81%); and ICT for Mathematics learning does not require advance computer skill (58%). The least held perception on the ease of use ICT resources for teaching and learning of Mathematics were: ICT is too complex for Mathematics teaching and learning (31%); Hardware and software problems often disrupt the Mathematics lesson (49%); ICT for Mathematics teaching does not require advance computer skill (53.7%). This result provides answer to research question 2.

Table 4. Mathematics Teachers' Perception on the Ease of Using ICT Resources

S/N	Mathematics teachers' perceptions on the ease of use of ICT resources.	A F (%)	D F (%)	TOTAL F (%)
1	ICT is easy to use in the Mathematics classroom.	208(81.0)	47(19.0)	255(100)
2	Hardware problems often disrupt the Mathematics lesson.	125(49.0)	130(51.0)	255(100)
3	Software problems often disrupt the Mathematics lesson.	125(49.0)	130(51.0)	255(100)
4	ICT is too complex for Mathematics teaching.	79(31.0)	176(69.0)	255(100)
5	ICT is too complex for Mathematics learning	79(31.0)	176(69.0)	255(100)
6	ICT for Mathematics teaching requires more technical support.	229(89.8)	26(10.2)	255(100)
7	ICT for Mathematics learning requires more more technical support.	229(89.8)	26(10.2)	255(100)
8	ICT for Mathematics teaching does not require advance computer skill.	137(3.7)	118(46.3)	255(100)
9	ICT for Mathematics learning does not require advance computer skill.	145(58.0)	110(44.0)	255(100)

A = Agree

D = Disagree

Research Question 3: What are Mathematics teachers' perception of the usefulness of ICT resources for teaching and learning?

Table 5 shows the number, as well as percentages of Mathematics teachers' perception of the usefulness of ICT resources for teaching and learning. As shown in the table, the teachers had strong positive perception of the usefulness of ICT resources for teaching and learning.

The most held perceptions about the usefulness of ICT resources for teaching and learning of Mathematics were: Using ICT resources in teaching and learning of Mathematics would improve students' performance (96.9%); Using ICT resources in Mathematics teaching and learning is capable of encouraging collaboration among students (95.3%); and Using ICT resources in Mathematics teaching and learning would enhance students' participation (93.7%). The least held perceptions about the usefulness of ICT resources for teaching and learning of Mathematics were: Using ICT resources in Mathematics teaching and learning would create room for individualized learning (62%); Using ICT resources would make Mathematics teaching and learning more diverse (84.7%); and Using ICT resources would make teaching and learning of Mathematics easier (85.1%) This result provides answer to research question 3.

Table 5. Mathematics Teachers' Perceptions about the Usefulness of ICT Resources

S/N	Mathematics teachers' perceptions about the usefulness of ICT resources	A F (%)	D F (%)	TOTAL F (%)
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1	Using ICT resources in Mathematics teaching would concretize perceived abstract topics.	223(87.5)	32(12.5)	255(100)
2	Using ICT resources in Mathematics learning would concretize perceived abstract topics.	223(87.5)	32(12.5)	255(100)
3	Using ICT resources in teaching of Mathematics would improve students' performance.	247(96.9)	8(3.1)	255(100)
4	Using ICT resources in learning of Mathematics would improve students' performance.	247(96.9)	8(3.1)	255(100)
5	Using ICT resources would make Mathematics teaching more diverse.	216(84.7)	39(15.3)	255(100)
6	Using ICT resources would make Mathematics learning more diverse.	216(84.7)	39(15.3)	255(100)
7	Using ICT resources would improve presentation of materials in Mathematics class.	238(93.3)	17(6.7)	255(100)
8	Using ICT resources would make teaching of Mathematics easier.	217(85.1)	38(14.9)	255(100)
9	Using ICT resources would make learning of Mathematics easier.	217(85.1)	38(14.9)	255(100)
10	Using ICT resources would increase pupils' motivation to learn Mathematics.	238(93.3)	17(6.7)	255(100)
11	Using ICT resources in Mathematics class would enhance students' participation.	239(93.7)	16(6.3)	255(100)
12	Using ICT resources in Mathematics class is capable of encouraging collaboration among students.	243(95.3)	12(4.7)	255(100)
13	Using ICT resources in Mathematics class would create room for individualize learning.	158(62.0)	97(38.0)	255(100)
14	Using ICT resources in Mathematics class would facilitate ease of use and interaction between student and computer.	235(92.2)	20(7.8)	255(100)

A = Agree

D = Disagree

Research Question 4: Does Mathematics teachers' years of teaching experience influence their perception of the ease of using ICT resources for teaching and learning of Mathematics?

H_{01} : Years of teaching experience has no significant influence on the perception of Mathematics teachers on the ease of using ICT resources for teaching and learning of Mathematics.

A Chi-square analysis as shown on table 6 was conducted to compare experienced and less-experienced Mathematics teachers' perception of the ease of using ICT resources for teaching and learning of Mathematics. It was found that no significant difference exists in the perception of Mathematics teachers based on years of teaching experience. [$\chi^2_{(3, 255)} = 5.60, p > 0.05$]. Since p-value (0.13) is greater than 0.05 (level of significance), the null hypothesis (H_{02}) was not rejected. Hence, Mathematics teachers' years of

teaching experience do not influence their perception of the ease of using of ICT resources for teaching and learning of Mathematics.

Table 6. A Chi-Square Analysis of Mathematics Teachers' Perceptions of the Ease of Using ICT Resources Based on Their Years of Teaching Experience

Teaching Experience	χ^2	df	Sig	Decision
Pearson Chi-square	5.60	3	.13	NS
Likelihood Ratio	5.78	3	.12	NS
Linear-by Linear Association	563	1	.45	NS
No of Valid Cases	255			

Research Question 5: Does Mathematics teachers' years of teaching experience influence their perceptions of the usefulness of ICT resources for teaching and learning of Mathematics?

H₀₂: Years of teaching experience has no statistical significant influence on the perceptions of Mathematics teachers about the usefulness of ICT resources for teaching and learning of Mathematics.

A Chi-square analysis as shown on table 7 was conducted to compare experienced and less-experienced Mathematics teachers' perceptions of the usefulness of ICT resources for teaching and learning. It was found that no statistical significant difference exists in the perceptions of experienced and less-experienced Mathematics teachers. [$\chi^2_{(3, 255)} = 2.52, p > 0.05$]. Since p-value (0.47) is greater than 0.05 (significance less), the null hypothesis (H₀₃) was not rejected. Hence, Mathematics teachers' years of teaching experience do not influence their perception of the usefulness of ICT resources for teaching and learning.

Table 7. A chi-square Analysis of Mathematics Teachers' Perceptions about the Usefulness of ICT Resources Based on Their Years of Teaching Experience

Teaching Experience	χ^2	df	Sig	Decision
Pearson Chi-square	2.52	3	.47	NS
Likelihood Ratio	2.61	3	.46	NS
Linear-by Linear Association	.03	1	.86	NS
No of Valid Cases	255			

Discussion

This section presents the discussion of results in the previous section. Conclusion was drawn based on the results and recommendations were made. Also, suggestions were raised to encourage further studies.

The study showed that Mathematics teachers are aware of the ICT resources for teaching and learning. This could be as a result of the popularity of the ICT resources. This implies that teachers may probably hold positive or negative perception about ICT resources for teaching and learning of Mathematics. This finding is in line with the finding of Salman, et al., (2013) that Mathematics teachers are aware of the ICT resources.

The study also showed that Mathematics teachers perceived the ICT resources as easier to use for teaching and learning. This may probably be as a result of teachers' regular use of the ICT resource for personal purposes different from teaching and learning of Mathematics. This implied that teachers are likely to apply ICT in Mathematics classroom. This result is in agreement with the report of Tella, Tella, Toyobo, Adika and Adeyinka (2007) that teachers perceived the ICT resources as easier to use for teaching and learning.

Another finding showed that the teachers had positive perceptions of ICT resources' usefulness for teaching and learning. The teachers' perceived usefulness may be as a result of their perceived ease of using the ICT resources. Since they perceived the resources as being easier to use they are more likely to perceive them as being useful. This implied that teachers are likely to apply ICT in Mathematics classroom if ICT resources are made available. This result is in accordance with the report of Wilson (2014); and Ejar, et al., (2016) that Mathematics teachers had positive perceptions about the usefulness of ICT resources for teaching and learning of Mathematics.

Moreover, findings revealed that no statistical significant difference exists in the perceptions of experienced and less-experienced Mathematics teachers about the ease of using ICT resources for teaching and learning of Mathematics. This could be attributed to regular personal interaction with the ICT resources by both the experienced and less-experienced teachers. This implies that teachers may probably make use of ICT resources for teaching and learning Mathematics irrespective of their teaching experience if the schools are well equipped. None of the previous studies available to the researchers had investigated the Mathematics teachers' perceptions of ease of using ICT resources based on years of teaching experience.

Finally, findings showed that no statistical significant difference exists in the perceptions of experienced and less-experienced Mathematics teachers about the usefulness of ICT resources for teaching and learning of Mathematics. This could be attributed to benefits derived from personal usage of the ICT resources by both the experienced and less-experienced teachers. This implies that teachers may probably make

use of ICT resources for teaching and learning Mathematics irrespective of their teaching experience. This result is in contrast with the report of Ng'eno, et al., (2013) that there was a statistically significant difference in teachers' perception to integrate ICT in secondary Mathematics instruction by teaching experience.

CONCLUSION

The study concluded that Mathematics teachers are aware of the ICT resources. The teachers perceived the ICT resources as easier to use for teaching and learning of Mathematics. The study also concluded that Mathematics teachers had positive perceptions of ICT resources' usefulness. It was finally concluded that Mathematics teachers' perceptions of ICT resources for teaching and learning are not dependent on their years of teaching experience.

From this study's major findings and conclusion, the following suggestions are considered relevant:

1. Adequate manpower and ICT resources should be made available to secondary schools by the government so as to enable teachers to judiciously make use of ICT resources for Mathematics teaching and learning.
2. The government should organize Seminars and Workshops for Mathematics teachers in order to enable them realize that ICT resources are easy to use for effective teaching and meaningful learning of Mathematics in schools.
3. Mathematics teachers' years of experience should not be a major determinant in recruiting good and competent teachers on the field.

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