Ensuring Uninterrupted Academic Interactions: Focus on Digital Interface for Mathematics Teachers in Ondo and Ekiti States, Nigeria

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ABSTRACT

The study investigates ensuring uninterrupted academic interactions with a focus on digital interface for Mathematics teachers in Ondo and Ekiti States. Sample for this research comprised 150 (70 males, 80 females) Mathematics teachers. Purposive sampling technique was adopted in making selections of some Mathematics teachers from the Mathematics Association of Nigeria (MAN) groups in each state. This sample consisted of teachers from rural and urban areas of the two states. This research used descriptive survey design which enables information obtainable from a representative sample of the targeted population and described situations as they exist. Instrument use to collect data for the study was a self-developed questionnaire tagged "Technology Literacy Assessment Questionnaire (TLAQ)". The instrument was validated, and reliability tested before usage. Two research questions were raised to guide the study. The questions were answered descriptively using simple frequency count, percentage, mean, and Standard Deviation. Two research hypotheses were formulated for the study, and tested using Chi square statistic and t-test statistic of independent sample. Based on the data analysis, findings of the study established that educators typically recognize the importance of technology integration in Mathematics instruction; yet, differing degrees of accessibility, technical proficiency, and institutional backing affect their utilization of digital resources. Although digital teaching practices have shown a beneficial effect on student performance relative to traditional approaches, issues including insufficient infrastructure and gaps in digital literacy remain. Furthermore, gender emerged as a significant factor influencing Mathematics instructors' utilization of technology, indicating that elements such as experience, exposure, and institutional support are more pivotal. The study recommended that government and educational partners should offer ongoing professional development programs to improve teachers' digital competencies.

Keywords: Digital Interface; Mathematics; Teachers, Teaching; Secondary School.

INTRODUCTION

Technology with its geometrical progressive growth has revolutionized the world today. The totality of humanity is embedded in technology, spanning from birth to death, encompassing every field of human endeavour, health and wealth, culture and esthetic. Many academic researchers observed that the use of virtual teaching and learning had been and would continuing to provide succor to free flow movement in time of standstill which could be caused by; insurgency; viral infection; flood; banditry and other natural disasters. It has become a common occurrence in our society to witness a complete shutdown of academic activities occasioned by: banditry, insurgency and kidnapping, political upheaval or sectional agitations, natural phenomenon like flooding, outbreak of communicable disease, industrial unrest, lockout or lockdown. Students and parents often become victims of sudden standstill of academic activities because of time and treasure wasted while staying at home doing nothing. Many people were witnesses to the backlash effects of sudden closure of schools that rendered students idle during COVID – 19. invariably, idle students have been

engaging in nefarious and antisocial activities, which resulted into sudden death while the females are exposed to raping and unplanned pregnancy. It is a verifiable submission that, since we have entered into the current millennium, the youths which constitute the highest percentage of learners in Nigeria have been on the receiving end of industrial agitations and lockdown.

As other citizens of the advanced nations of the world are experiencing globalization, courtesy of the cutting-edge discoveries in modern technology; education dynamism has taken a global leap. An individual cannot afford to stand aloof and allow the divide to become widened the more. Teachers and students need not appear as lame ducks because of school closure when there are several State-of-the-art technologies that can guarantee continuity of academic activities outside the traditional classrooms.

However, it would be a worrisome situation if Nigeria as a country should be an outcast among other developing nations because of low digital literacy. It is a known fact that our epileptic power supply has affected many professionals. The educational infrastructure in the country can not stand in comparison with the digitally active countries of the world. Mathematics which is gateway to science and technology is dreaded by our youths because of its abstract nature. Today mathematics as a discipline has been made simple through the invention and application of modern technology. The use of Excel or Spreadsheet has ameliorated the constraints encountered on group calculations, data organisation, statistical analysis, modelling and simulation and other variants of mathematics calculations

As a matter of urgency, it is high time our nation summoned the relevant stakeholders for a complete overhauling of the educational system so that our citizens don't lag behind at the global perspectives. Moreover, Akinwamide, (2020) discovered that the present-day generation of digital conscious students don't want to be passive recipients of knowledge but active participants in the classroom practices. They are almost at the stopping edge of going to classes with textbooks allowing various modern technological gadgets to take over; the smaller the better.

The world has become a global village as technology travels as fast as ray of light and the breakthrough in technology is the keystone of pedagogical submissions. It could be imperative therefore to have a rethinking on how to ensure progress and welcome development in a rapidly changing world of technology. The research workshop therefore, is an overview presentation of how modern technologies can be of assistance to teachers in Mathematics classroom during shutdowns or lockouts. Researches abound that showed teachers perspective about technology in education as a welcomed development (Bütün & Karakus, 2021; Delphine, Onesme, & Alphonse 2023). The tremendous and perpetual development in digitalization being experienced by the technologically advanced nations of the world has helped to overcome some of the barriers in teaching and learning. Applications of modern-day technologies in the field of education makes it possible for teachers, students and other stakeholders on education to join communities of people well beyond their immediate environment to critically review, analyze, contribute, criticize and organize issues logically. Hence, contextually and professionally, the transformations of the entire society is made attainable. The existence of new communication technologies such as Zoom, Google Class, YouTube, WhatsApp and other computer enhancements with new software and networking applications improve teaching and learning processes in the area of time limit, feedback, having large coverage, record keeping, gaining new ideas and easy retrieval of stored information. The effective use of technologies in teaching of a subject like mathematics helps in ameliorating constraints and academic conflicting situations. Teaching and learning can happen virtually anywhere and at any time with the involvement of technology for the purpose of achieving the desirable learning outcomes. The incessant low performance of students in Mathematics at every category of basic schools and secondary levels despite innumerable importance of the subject and its position as a core subject in the curriculum, demand for attention. The integration of technology into teaching and learning have been proved to be productive in the field of education (Kaushik & Sugandha, 2022). Mathematics educators are also expected to key into this wave for better performance of students in the subject. It is very important to consider the point through which information can be passed across while employing technology in mathematics education. Digital interface is the point of connection of two or more devices or systems by the users for the purpose of interaction through appropriate mode of communication such as audio, visual, audio-visual, touchscreens and gestures. Connections can be effectively carried out using devices such as smart

phones, laptops, tablets, desktops, computer networks and operating systems. The involvement of learning interface allows teaching and learning to take place anywhere at any time. Digital interface gives the privilege of the learner viewing the teacher even when he is in another city or country. It promotes interaction among the students and between the students and the educator. This medium enables the mathematics teacher to cover much of the syllabus with better assessment. Since both males and females use of smartphones, it could be assumed that the involvement of technology in the teaching of mathematics could be no gender biased. Grimus, 2014 compared how boys use phones with that of girls and concluded that there was no difference.

Statement of the Problem

Studies at both conceptual and empirical levels abound today of the great exploits which have been garnered through modern technologies in the advance countries of the world. No nation can afford to stand in isolation while others are employing cutting-edge digital tools to solve educational problems. Teachers cannot be staying at home doing nothing due to disruptions of traditional face-to-face classroom setting that has been a common scenario in Nigeria. For example, the riverine areas of Niger Delta in Nigeria always declare impromptu holidays because of flooding yearly. This emergency holidays may come up at anytime and school activities always stop abruptly. Now if the students and the teachers are well developed technologically, academic activities would still be going on through Zoom, Google Meet, Whatsapp and the likes. Therefore, it is justifiable to seek alternative to the traditional classroom setting. The issue of poor performance in Mathematics both in internal and external examinations is not satisfactory compared with the importance of the subject by considering the role it plays in every field of human endeavours. Educators have been out to find solutions to this appalling failure in Mathematics especially in this era of technology made easy. Among other observed issues that were responsible for the students' performance in Mathematics was lack of quality involvement of digitization in the teaching and learning of Mathematics. Researches abound which showed that involvement of digitization in the teaching and learning processes improves learners' performance. It has been observed that a greater percentage of Mathematics teachers cannot teach Mathematics virtually. Problem of appalling failure in Mathematics could be reduced to the base level if the teachers of Mathematics are acquainted with the importance of digitalization and how learning processes can be conducted through the use of technological devices. Hence, this research seeks to educate the instructors about the benefits of the involvement of technology in the teaching of Mathematics and also lead the teachers through the use of smart phones through internet connectivity in the teaching and of Mathematics for better performance.

Objective of the Study

The study investigates the possibility of ensuring uninterrupted academic interactions with the focus on digital interface for Mathematics teachers in Ondo and Ekiti States of Nigeria.

Specifically, the study sets to;

1. examine the teachers' perspective in the integration of technology into the teaching and learning of Mathematics
2. determine the effect of gender on Mathematics teachers' usage of Technology in the teaching of Mathematics.

Research Questions

Two research questions were raised to guide the study;

1. What is teachers' perspective in the integration of technologies into the teaching and learning of Mathematics?
2. Will gender have effect on digitalising the teaching of Mathematics?

Research Hypotheses

Two null hypotheses were generated for the study;

1. There is no significant integration of technology in the teaching and learning of Mathematics by the Mathematics teachers.
2. There is no significant difference between the male and female Mathematics teachers in the use of technology in the teaching of Mathematics.

LITERATURE REVIEW

Problem of unsatisfying performance of students in Mathematics is age-old (Popool 2014; Mabena, Namayammu & Ramapela 2021). It has been the concern of educators to find a permanent solution to this recurring unpleasant yield in Mathematics. Enu, Agyman & Nkum (2015); Mosimege & Winnaar (2021) observed that inadequate teaching and learning materials as well as teaching methods affects learners' performance in Mathematics negatively. Virtual teaching has been tested and found productive in the teaching of Mathematics (Agogbua & Stanley, 2021). If Mathematics teachers are not furnished with the rightful information especially on the implementation of virtual learning which have been researched into and observed to be appropriate for the effective Mathematics education, then, the desired achievement could be far from hands.

Binandam (2022) submitted that lack of coverage of Mathematics curriculum content is one of the factors that hinders students from performing up to expectation in Mathematics. This problem can be solved as the teacher have the opportunity to meet learners at any time of the day even at night without stress using internet connection. By this, the enormous work in the curriculum will be subdued this also gives the opportunity to the teacher not only to treat all the topics in the syllabus but also to lead the students through under-listed exercises after each topic with ease. It is imperative that the teacher explores a teaching method that will appreciate the value of time (Gamit 2023). Digitalization could reduce excesses that can lead to waste of time such as distractions that evolve in face-to-face classroom sessions. The major focus of any research will be adding to quality and knowledge, this has not really been achieved to a greater height because the set of people to practice the effectiveness of the findings of such researches to bring out its dividends which are quality and knowledge are not involved; teachers to implement the findings of several researchers that support digitalization should be trained on how to effectively teach Mathematics virtually.

Bütün & Karakus (2021) established that there is the need to acquaint Mathematics teachers on how technologies can be used in Mathematics teaching in distance education environment. This is in agreement with the aim of this study that both Mathematics teachers and students should be trained on how to use technological devices in the teaching and learning of Mathematics. Buttressing this, is the summation of Malizar, Almanthari, Maulina & Bruce, (2020) that there are barriers to e-learning one of which is lack of adequate professional development concerning technology, lack of technology support, competency and confidence. This is a major reason why the teachers should be educated on how to teach virtually as established by this study. Summarily, to checkmate viral infection of undesired performance in Mathematics through virtual instruction, Mathematics instructors should be well groomed in digitalization.

METHODOLOGY

The study adopted a descriptive design of the survey type. This is to afford the researcher to gather all necessary information on the different variables of the research. The decision to use the design was based on its effectiveness in giving needed information about the representative sample of a targeted population to describe situations as they exist.

Population for the study ccomprised of all Senior Secondary School II Mathematics teachers in Ondo and Ekiti States of Nigeria. The sample for the study consisted of 150 (70 males, 80 females) Mathematics teachers. Purposive sampling technique was adopted in making selections of some Mathematics teachers from the Mathematics Association of Nigeria (MAN) groups in each state. This sample consisted of teachers from rural and urban areas of the two states.

Self-developed questionnaire tagged "Technology Literacy Assessment Questionnaire (TLAQ)" was employed to collect data for the study. The instrument was validated by expert in the field of statistics before usage. The

reliability of the instrument was tested using Pearson's Product Moment and the result 0.81 was obtained which was considered appropriate for the study. Section A of the questionnaire was on respondents' personal information. Section B consisted of items that are arranged in four-point Likert scales: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The researcher administered the questionnaire personally to the respondents. Before the respondents started to respond to the items, the aims of the whole exercise were explained to them. They were asked to respond to every question as honestly as possible and they were assured of the confidentiality of any information given. The instructions on how to respond to the questionnaires were read to the respondents to ensure proper filling. The instrument was validated by consortium of experts from the field of Mathematics and Statistics. Reliability of the instrument was tested using test-retest method to ensure that the instrument was highly reliable before usage.

The procedure for the study was in stages. First stage; the researcher visited the Area Education Officers (AEO) that supervise the affairs of the selected schools for permission. The researchers visited the selected schools to take permission from the principals and also to acquaint the Mathematics teachers with the purpose of the study. Consent form was filled by the teachers. Second stage; WhatsApp group was created for the training of the selected SSS II Mathematics teachers. The data obtained was subjected to appropriate statistical tests. For the analysis of data, the researchers used descriptive statistical tools of frequency counts, percentages, and weighted mean in the answering of research questions raised to guide the study. The Pearson Product Moment Correlation (PPMC) statistic was employed to evaluate the hypotheses established for the study at a 0.05 level of significance using SPSS Version 26.

RESULTS AND DISCUSSION

Research Question 1

What is teachers' perspective about the integration of technologies into the teaching and learning of Mathematics?

Table 1: Response to the teachers' perspective about the integration of technology into the teaching and learning of Mathematics

S/N	Item	SA (%)	A (%)	D (%)	SD (%)	Mean	SD
1	Technology enhances students' understanding of mathematical concepts.	98 (65.3)	33 (22.0)	12 (8.0)	7 (4.7)	3.16	.310
2	I feel confident using technology to teach Mathematics effectively.	47 (31.3)	80 (53.3)	19 (12.7)	4 (2.7)	3.11	.321
3	The integration of technology in Mathematics instruction makes lessons more engaging for students.	55 (36.7)	54 (36.0)	35 (23.3)	6 (4.0)	3.07	.405
4	Lack of access to digital tools is a major challenge in integrating technology into Mathematics teaching.	52 (34.7)	58 (38.7)	28 (18.7)	12 (8.0)	2.82	.174
5	Professional training and workshops are necessary to help teachers effectively use technology in Mathematics education.	57 (38.0)	50 (33.3)	29 (19.3)	14 (9.3)	2.91	.375

SA=Strongly Agreed; A=Agreed; D=Disagreed; SD=Strongly Disagreed

Table 1 shows the statistical analysis of responses to the teachers' perspective on the integration of technologies into the teaching and learning of Mathematics with a mean range of 2.82 – 3.16 (lowest and highest mean scores) and a standard deviation range of .174 – .405. Analysis revealed that (87.3%) of the

respondents agreed with the assertion that technology enhances students' understanding of mathematical concepts while the remaining (12.7%) held opposing opinion.

It was also held by (84.6%) of the respondents that they feel confident using technology to teach Mathematics effectively; (72.7%) of the respondents held that the integration of technology in Mathematics instruction makes lessons more engaging for students; (73.4%) of the respondents held that lack of access to digital devices is a major barrier in integrating technology into Mathematics education while (71.3%) of the respondents held that Professional training and workshops are necessary to help teachers effectively use technology in Mathematics education.

Conclusively, integration of technology into the teaching and learning of Mathematics was found to be very effective.

Research Question 2

Will gender have effect on the mathematics teachers' use of Technology in the teaching of Mathematics?

Table 2: Response to whether gender have effect on digitalising the teaching of Mathematics

S/N	Item	SA (%)	A (%)	D (%)	SD (%)	Mean	SD
1	Gender influences the confidence level of Mathematics teachers in using technology for teaching.	54 (36.0)	48 (32.0)	32 (21.3)	16 (10.7)	3.22	0.473
2	Male Mathematics teachers are more likely to integrate technology into their lessons than female teachers.	38 (25.3)	60 (40.0)	32 (21.3)	20 (13.3)	3.41	0.458
3	Female Mathematics teachers face more challenges in adopting new technological tools for teaching.	38 (25.3)	53 (35.3)	43 (28.7)	16 (10.7)	2.69	0.49
4	Gender plays important role in determining the frequency of technology use in Mathematics classrooms.	55 (36.7)	50 (33.3)	28 (18.7)	17 (11.3)	2.85	0.478
5	Training and support in technology use should be tailored differently for male and female Mathematics teachers.	54 (36.0)	55 (36.7)	25 (16.7)	16 (10.7)	3.37	0.46

SA=Strongly Agreed; A=Agreed; D=Disagreed; SD=Strongly Disagreed

Table 2 shows the statistical analysis of responses to whether gender have effect on Mathematics teachers' usage of ttechnology in the teaching of Mathematics with a mean range of 2.69 – 3.37 (lowest and highest mean scores) and a standard deviation range of .458 – .490. Analysis revealed that most of the respondents (68.0%) agreed with the assertion that gender influences the confidence level of Mathematics teachers in using technology for teaching, while the remaining (32.0%) held contrary perception.

It was further held by majority of the respondents (65.3%) that male Mathematics teachers are more likely to integrate technology into their lessons than female teachers, (60.6%) of the entire respondents held that female Mathematics teachers face more challenges in adopting new technological tools for teaching, (70.0%) of the respondents indicated that gender plays an important role in determining the frequency of technology use in

Mathematics classrooms, while (72.7%) of the respondents held that training and support in technology use should be tailored differently for male and female Mathematics teachers.

Conclusively, the usage of technology in the teaching of Mathematics is gender biased in favour of male Mathematics teachers.

Hypotheses Testing

Hypothesis 1

There is no significant integration of technology in the teaching and learning of Mathematics by the Mathematics teachers.

Table 3: Chi Square Test analysis of the integration of technology in the teaching and learning of Mathematics by the Mathematics teachers

Test	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	111.010[a]	1	0.001		
Continuity Correction[b]	90.14	1	0.001		
Likelihood Ratio	61.921	1	0.001		
Fisher's Exact Test				0.001	0.001
Linear-by-Linear Association	29.973	1	0.001		
N of Valid Cases	150				

Df= degree of freedom

The result of the analysis in table 3 showed the chi Square Test analysis of integration of technology in the teaching and learning of Mathematics by the Mathematics teachers. The chi-square test revealed that calculated $\chi^2(.001)$, $p<0.05$, while df = 1, N=150 This implies that there is a significant integration of technology in the teaching and learning of Mathematics by the Mathematics teachers. Hence, the null hypothesis was not upheld.

Hypothesis 2

There is no significant difference between the male and female Mathematics teachers in the use of technology in the teaching of Mathematics.

Table 4: t-test analysis of the difference between the male and female Mathematics teachers in the use of technology in the teaching of Mathematics

Gender	N	Mean	SD	df	$t_{(cal)}$	$t_{(tab)}$	Decision
Male	70	49.60	10.58	148	3.05	1.98	S
Female	80	40.11	13.22				

P<0.05 level of significance S = Significant

From table 4 above, the mean score perception of the male respondents (M = 49.60,SD = 10.58) was higher than the mean perception of the female respondents (40.11, SD = 13.22) with a mean difference of (9.49). The measure of variability (standard deviation) has a difference of (2.68). The t-test analysis shows that the calculated value (3.05) was higher than the table value (1.98) at 0.05 level of significance. This implies that there was a significant difference between the male and female Mathematics teachers in their use of technology in the teaching of Mathematics, $1.98(148) = 3.05$, $p<0.05$. Hence, the null hypothesis was not

upheld. Since the male respondents had higher mean perception score more than the female respondents, it implies that male Mathematics teachers integrates the use of technology in the teaching of Mathematics more than their female counterparts.

DISCUSSION OF FINDINGS

The study investigated ensuring uninterrupted academic interactions with a focus on digital interface for Mathematics teachers in Ondo and Ekiti States, Nigeria. The descriptive analysis of the study showed that mathematics teachers have positive perception concerning the involvement of technology in the teaching of mathematics. Buttressing this was the conclusion of Delphine, Onesme, & Alphonse, (2023) that technology is a tool for enhancing mathematics class interaction. The findings showed that a greater percentage of the mathematics teachers have the opinion that technology can be more productive in the teaching of mathematics. This was in consonance with the summation of Bright, Welcome & Arthur, (2024) that students' performance was improved with the integration of technology. Hence, the use of technology in the teaching of mathematics could be found effective than conventional strategies on students' performance in Mathematics. The inferential analysis indicated that there was a significant integration of technology in the teaching and learning of Mathematics by the Mathematics teachers. In support of the findings of the study, Bütün & Karakus (2021) from their work titled "Mathematics teachers' views on distance education and their beliefs about integrating computer technology in Mathematics courses" showed that there is the need to acquaint Mathematics teachers on how technologies can be used in Mathematics teaching in distance education environment. This implies that both Mathematics teachers and students should be trained on how to use technological devices in the teaching and learning of Mathematics. Buttressing this is the summation of Malizar, Almanthari, Maulina & Bruce, (2020) that there are barriers to e-learning one of which is lack of adequate professional development concerning technology, lack of technology support, competency and confidence.

Lastly, descriptive analysis of the study further revealed that the use of technology in the teaching of Mathematics-by-Mathematics teachers is gender biased in favour of male teachers. The inferential analysis revealed that there was a significant difference between the male and female Mathematics teachers in the use of technology in the teaching of Mathematics. The male respondents had higher mean perception score more than the female respondents, it implies that male Mathematics teachers integrates the use of technology in the teaching of Mathematics more than their female counterparts. This assertion was in support of Abidin, Mathraani & Hunter, (2018) that males have better performance in the class activities through the use of technology than their female counterparts.

CONCLUSION

This research examined methods to maintain continuous academic engagement using digital platforms, concentrating on Mathematics educators in Ondo and Ekiti States, Nigeria. The results indicate that educators typically recognize the importance of technology integration in Mathematics instruction; yet, differing degrees of accessibility, technical proficiency, and institutional backing affect their utilization of digital resources. Although digital teaching practices have shown a beneficial effect on student performance relative to traditional approaches, issues including insufficient infrastructure and gaps in digital literacy remain. Furthermore, gender emerged as a significant factor influencing Mathematics instructors' utilization of technology, indicating that elements such as experience, exposure, and institutional support are more pivotal. To facilitate seamless academic interactions, it is essential to engage in teacher training, supply sufficient digital resources, and establish regulations that encourage the efficient integration of technology in Mathematics instruction. By focusing on these aspects, educational stakeholders may guarantee that digital interfaces function as durable instruments for enhancing Mathematics instruction in Nigeria.

RECOMMENDATIONS

1. The government and educational partners should offer ongoing professional development programs to improve teachers' digital competencies.

2. Schools ought to be furnished with contemporary digital instruments, such as interactive whiteboards, projectors, and mathematical software, to facilitate efficient technology integration.
3. A combination of digital and traditional teaching approaches should be employed to enhance students' understanding and performance.
4. Regular evaluations and comparative analyses should be undertaken to ascertain the effect of digital instruction on student performance.
5. Both male and female educators should have equitable access to technological training programs to address any skill deficiencies.
6. Policies must be instituted to promote equitable involvement in digital teaching methodologies, guaranteeing that female educators are not marginalized.
7. Specialized mentorship and support programs ought to be implemented for female educators to enhance their confidence in utilizing digital tools.

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