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Modelling the Impacts of Teachers' Access, Motivation, Attitude, and Self-efficacy on Mathematics Teachers' Effective ICT Utilization in Classrooms

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This study modelled selected teachers factors on Mathematics teachers' effective application of ICT in classrooms. This study employed a correlational research method. The participants were 322 Mathematics teachers in public secondary school in Enugu Metropolis, Enugu State, Nigeria. Five data collection tools; comprising three adapted and two researcher developed tools were used in the study. The collected data were analyzed using PLS-SEM. The results revealed that teachers' access to ICT, teachers' ICT motivation, and teachers' ICT attitude, and teachers' ICT self-efficacy significantly predicted secondary school Mathematics teachers' utilization of ICT in the classrooms. More so, teachers' ICT attitude played significant complementary partial mediation effect on the relationship between teachers' access to ICT resources and Mathematics teachers 'utilization of ICT facilities in teaching Mathematics. Based on the findings, recommendations were made. The findings imply that government at all levels could see the need to provide ICT facilities in the schools and enhance teachers' ICT motivation, and teachers' ICT attitude, and teachers' ICT self-efficacy.

Keywords: teachers' access to ICT, teachers' ICT attitude, teachers' ICT motivation, teachers' ICT self-efficacy, structural equation modelling (SEM)

INTRODUCTION

The 21st century teachers are expected to effectively apply Information and Communication Technology (ICT)-driven teaching methods in classrooms. However, these expectations seem not to be adequately attained because ineffective utilization of ICT in classrooms is common among teachers (Katayev, et al., 2023). Of course, many factors may be attributed to this unsatisfactory state of affairs (Clipa et al., 2023). Studies have identified teachers' attitudes and demographic variables as influential factors to teachers' effective utilization of ICT (Thanh et al., 2023). However, most of these previous studies failed to explore the role of access to ICT on teachers' effective utilization of ICT in the classroom. More importantly, the knowledge of the direct and mediational effects of psychological factors on mathematics teachers' effective utilization of ICT in developing nations seems to be scarce. While developed nations

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may be focusing on training and professional development for ICT based learning, most developing nations are still experiencing limited access to ICT facilities. More importantly, previous studies have not examined the combined effects of motivation, access, attitude, and self- efficacy on teachers' effective utilization of ICT in classrooms using PLS-SEM in a Nigerian context. Hence, the need to take into cognizance the teachers' access to ICT in effort to modernize teaching and learning in many developing nations. There are scarcity of studies in Nigeria that examined the joint effects of teachers' access to ICT, teachers' ICT attitude, teachers' ICT motivation, and teachers' ICT self-efficacy on teachers' effective utilization of ICT in teaching at secondary school level. Effective usage of ICT could enhance students learning of mathematics.

Mathematics is very vital for national development. Mathematics enables students to acquire skills needed for making prudence decisions required to tackle 21st-century economic challenges. Hence, in this present technological world, every individual utilizes Mathematics for decision-making (Abdul-Ruful & Akanmu, 2019). Essentially, Mathematics is regarded as a tool for critical thinking, creative thinking, and decision-making (Otun & Olaoye, 2019). Of course, improvement in teaching and learning Mathematics would result in a corresponding increase in the economic, scientific, and technological advancement of any nation because Mathematics is needed for every individual to function effectively (Zalmon & Charles-Organs, 2020). Ideally, any nation wishing to enhance its technological and economic growth should ensure that its citizenry is vastly equipped with mathematical knowledge (Ogbu et al., 2024; Ehiwario, Aghamie, & Nwaka, 2020). Students' mathematical knowledge could also influence their achievement in other subjects such as Chemistry, Economics, Physics, Basic Science, and Computer Science as these subjects have some content areas that are related to Mathematics. It is because of the importance of Mathematics that the subject is made compulsory for all pupils and students in primary and post-primary in Nigeria (Federal Republic of Nigeria, 2013). Of course, the importance of Mathematics for scientific and technological advancement cannot be over-emphasized.

However, despite the importance of Mathematics, Nigerian secondary school students' achievement in the subject seems not to be encouraging. For example, researchers have observed that students' achievement in Mathematics has remained poor over the years (Ogbu & Anyaegbu, 2021; Ehiwario et al., 2020; Zalmon et al., 2020; Abdul-Ruful &Akanmu, 2019; Otun & Olaoye, 2019). It is pointed out that in Nigeria, there is an alarming and persistent failure of students in external examinations conducted by the West African Examination Council (WAEC) and the National Examination Council (NECO) (Ahumaraeze & Ekwueme, 2019). WAEC candidates in Nigeria recorded below an average of 50 percent credit pass in Mathematics examinations from 2009 to 2018 (Owan, 2020). More so, the WAEC Chief Examiners' Reports on students' weaknesses in Mathematics examinations from 2008 to 2019 indicated that students have various degrees of weaknesses in all the branches of Mathematics (Ogbu et al., 2023; Ogbu & Anyaegbu, 2021). Major difficulty in learning mathematics is linked to the way mathematical knowledge is conceptualized (Doz, et al., 2024) which could be address by effective integration of technologies in teaching Mathematics.

The reoccurring poor achievement of students in Mathematics has become a worrisome issue to stakeholders in education because of the negative effect it has on individuals' and nations' development (Ogbu & Ugwu, 2023). Development of basic numeracy skills among the citizenry could be hindered by persistent poor performance in mathematics. One of the critical factors that has been found to account for the ugly situation is the teachers' usage of ineffective teaching approaches (Mamud & Alaru, 2018) that could not stimulate students' learning engagement. Interestingly, it is pointed out that students' poor achievement in Mathematics could be curtailed through teachers' effective applications of ICT facilities in teaching (Rishi, 2016; Barau & Emmanuel, 2013; Lim, et al., 2018). Consequently, there is a rising call for educational institutions to effectively apply ICT to teach the 21st-century needed skills and knowledge (Buabeng-Andoh, 2012).

Information and communication technology is a term that is associated with modern society ICT is a set of technologies for collecting, storing, processing, and communicating information (Jimoh, 2019). It could be seen as an umbrella term for all the electronic tools that facilitate the handling and managing of information for instructional delivery. The major component of ICT is the computer system, in which, in most cases, other ICT technologies depend on computer systems for their functioning. ICT facilitates effective educational practices. For example, it is noted that well designed ICT-based instruction has all the capabilities to equip the learners with high interactive ability to develop intellectually and creatively (Youssef, et al., 2021; Jimoh, 2019). Essentially, ICTs, when properly integrated in instructional delivery, enhance students understanding, stimulates students' interest, and increases students' performance (Akogwu, et al., 2019). This implies that effective ICT usage could favour all the students irrespective of their learning abilities. Information communication technology increases students' accessibility to information and facilitates interactions that enhance learning (National Council of Teachers of Mathematics [NCTM], 2011). The use of ICT enhances students' motivation, engagement, and acquisition of skills (Habibu, Abdulla-Al-Mamun, & Clement, 2012). Because of the importance of ICT, educational institutions are attempting to bridge the technological gaps in teaching and learning using ICT tools (Buabeng-Andoh, 2012). Since ICT enables students to have the proper understanding needed to face future development, is recommended, for a relatively long time, that educational institutions teach ICT to students at all levels (Grimus, 2000; Saal et al., 2019) while teachers should utilize ICT in teaching every subject as it could influence students' problem-solving, reasoning behavior and achievement (Grabe & Grabe, 2001; Chaudhari, & Khirwadkar, 2024). It is observed that ICT is very essential in meeting the information challenges of modern societies, but the application of ICT in classrooms in developing countries are grossly inadequate, even among tertiary institutions (Jimoh, 2019). The use of computer adaptive instruction is effective in improvement of academic achievement of both male and female students (Omilani & Raji, 2024). Therefore, modeling factors that drive secondary school Mathematics teachers' effective utilization of ICT in classrooms in Nigeria becomes not only imperative but also timely.

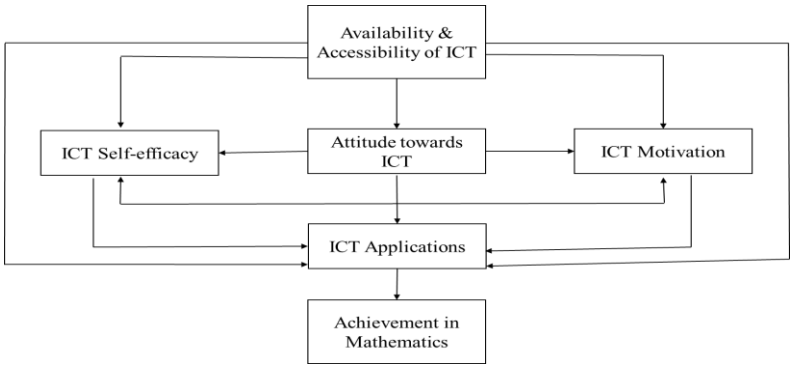

Figure 1
The conceptual framework of the study

The model in Figure 1 illustrates the relationship among the concepts examined in the study. This model is similar to Technology Acceptance Model (TAM) in that both models explain technology usage. TAM posits that acceptance of information technology is a function of teachers' perception on easy of application and usefulness of the technology (Ma & Liu, 2004). The two models, however, differ in that while TAM does not explain the role of access to ICT facilities on effective usage of ICT, the model for this study explains not only the role of access to ICT facilities but also teachers' ICT motivation, attitude, and self-efficacy in teachers' usage of ICT in teaching. In all, six variables, namely, self-efficacy in ICT, attitude towards ICT, motivation in ICT, accessibility of ICT facilities, effective application of ICT in teaching, and students' achievement in mathematics were discussed in this study. Self-efficacy, attitude, and motivation was included in this study because even if ICT facilities are accessible and the teachers are not confidence in their abilities, show negative attitude, or low motivation in effective application of ICT, the objectives for installing ICT facilities will be defeated. The Figure 1 reveals that accesses to ICT could affect teachers' ICT self-efficacy, teacher' attitude to ICT, teachers' ICT motivation, and teachers effective application of ICT. Of course, when schools provide teachers with all the need ICT facilities, it likely to encourage teachers with low ICT self-efficacy, negative attitude towards ICT, and low ICT motivation to develop their ICT skills and through practicing, the teachers could achieve competency in applying ICT in teaching and learning.

Literature Review

Applications of ICT in Instruction Delivery

Ability to use ICT has become one of the most significant skills for students and teachers who wish to remain relevant in today's technological environment. While wide application of technology is closed tied to advances in technology (Maqableh et al., 2024) teachers need to be effective in application of technologies in classrooms. ICT has become unarguably an integral part of modern lifestyle (Hatlevik & Hatlevik, 2018) because of the roles of ICT in all areas of human endevour. In Mathematics classrooms,

the applications of ICT could take the form of content-specific or content-neutral ICT tools (Akogwu et al., 2019). The content-specific ICT tools include computer algebra, dynamic geometry, interactive applets, handheld computation, data collection, analysis devices, and computer-based applications while the content-neutral technologies include communication and collaboration tools (NCTM, 2011). It is expected that since ICT integration has been emphasized for a relatively long time now, teachers should be effectively applying both content-specific and content-neutral ICT technologies in classrooms. However, it is shown that teachers are reluctant to adopt ICT in teaching students (Tazci, 2011), that teachers' usage of ICT is below acceptable standards and little attention is given to the factors that contribute to the situation (Sipila, 2014). Teachers' effective utilization of ICT is even said to be only confined to basic and traditional activities such as the use of ICT for searching for information (Buabeng-Andoh, 2019). The reason behind low usage of ICT among teachers may not be unconnected with the observation that in pre-service teachers' programme lacks adequate content to expose teachers how to effectively apply ICT in classrooms (Forkosh_Baruch & Avidor_Ungar, 2018).

Teachers' Access to ICT Facilities on Teachers' Application of ICT in Classrooms

Teachers cannot utilize ICT in delivery instructions if ICT facilities are not available and accessible for the teachers. Therefore, the most critical factor in teachers' effective utilization of ICT in the classroom might be teachers' access to ICT facilities. It is noted that the necessary condition for the integration of ICT in schools is access to ICT infrastructure and resources (Mafangha, 2016). Effective utilization of ICT facilities in schools is largely a function of the availability and accessibility of ICT facilities (Buabeng-Andoh, 2019). Of course, the relationship between teachers' ICT knowledge and teachers' application of ICT has been explored by researchers and found to be positive and significant (Haltevik & Haltevik, 2018), however, it is important to note that very few teachers may have effective knowledge of ICT if the facilities are not available and accessible for the teachers. It points to the fact that teachers do not make use of ICT if the ICT facilities are not available and accessible to teachers (Buabeng-Andoh, 2019). Provision of ICT to schools, although, does not translate to teachers' automatic utilization of ICT in instruction delivery (Gulbahar, 2008; Ertmer, 2005), teachers who have access to required ICT facilities are more likely to adopt ICT in teaching students than their counterparts who do not have (Tondeur, Valcke, & Van Breek, 2008).

The most prominent factor that could influence teachers' effective utilization of ICT in teaching students is the accessibility of ICT resources (European Commission [EC], 2013). Therefore, accessibility of ICT facilities should take precedence over other potential factors that could influence teachers' application of ICT in the classroom. Consequently, an examination of factors that drive teachers' usage of ICT tools without giving adequate attention to availability and teachers' accessibility of ICT tools seems to be an omission of the most critical factor. Unfortunately, many researchers have failed to explore the role of teachers' accessibility of ICT on teachers' effective utilization of ICT in instruction delivery (Lim, Yiung, Isawasan, Lee, & Lim, 2016; Hatlevik & Hatlevik, 2018). The few available studies on the effect of accessibility of

ICT facilities on teachers' usage of ICT facilities show that access to ICT is significantly related to ICT utilization (Buabeng-Andoh, 2019; Mafangha, 2016; Habibu, et al., 2012) but the studies failed to explore factors that mediate the effect of teachers' access to ICT and teachers' effective utilization of ICT facilities. Now, considering the observation that many African countries such as South Africa, Kenya, Uganda, and Tanzania are even far ahead of Nigeria in applications of ICT in classrooms (Jimoh, 2019), it is worthwhile to model factors that drive secondary school Mathematics teachers' effective utilization of ICT in Nigerian classrooms by exploring both direct and indirect effects of exogenous variables on the endogenous variables. Specifically, accessibility to ICT was considered in this study because shortage of ICT facilities is common in developing countries. Hence, the direct and mediating roles of the factors, which include, Mathematics teachers' accessibility to ICT facilities, Mathematics teachers' ICT attitude, Mathematics teachers' ICT self-efficacy, and Mathematics teachers' ICT motivation in the relationship between access to ICT and teachers' effective utilization of ICT were explored in this study.

Teachers' ICT Attitudes on Teachers' Effective Utilization of ICT in Classroom

Attitude is the individual's reaction toward phenomena, events, objects, or topics. Attitude could determine the individuals' acceptance or rejection of innovation. For instance, the integration of ICT in teaching is strongly influenced by the teachers' attitudes towards technology (Jones, 2001). In this study, teachers ICT attitude is operationalized as the reaction of teachers toward the use of ICT in teaching. Similarly, teachers' negative attitudes towards ICT technologies are one of the major factors hindering teachers' usage of ICT facilities in teaching (Hennessy, Harrison, & Wamakote, 2010). Teachers who have positive ICT attitudes are even more motivated to adopt ICT than their counterparts who have negative ICT attitudes (Mafang'ha, 2016). The observed negative attitude of teachers in the use of ICT tools in the assessment of learning in Nigeria (Aderonmu & Ejeba, 2020) is expected to improve in the post covid-19 era because Covid-19 pandemic experience in terms of challenges faced in the teaching and learning has highlighted the importance of ICT to Nigerian students, teachers, and governments.

It is expected that teachers should show a high level of enthusiasm in using ICT tools in teaching. This is necessary since one of the teachers' 21st-century skills is technological skills (Zorlu & Zorlu, 2021). However, since most of the ICT facilities might be new to most teachers, especially for teachers who are comfortable with traditional teaching methods, there is the possibility that this set of teachers may still be reluctant to use ICT facilities in instruction. To effectively apply ICT in the classroom, teachers must develop a positive attitude towards technology (Mafang'ha, 2016). While attitude plays a significant role in the accomplishment of tasks, there is a gap in the knowledge as regards the role of teachers' attitudes toward ICT on teachers' effective utilization of ICT facilities in teaching Mathematics at the secondary school level in Nigeria. More importantly, the mediating roles of attitude towards ICT in the relationship between teachers' access to ICT and teachers' effective utilization of ICT seems not to have been explored in most of the world. Since the availability of ICT facilities does not automatically guarantee teachers' usage of ICT (EC, 2013), there is a need to explore

the mediating roles of teachers' attitudes towards ICT in the relationship between Mathematics teachers' access to ICT facilities and their applications of ICT in Mathematics instructions. Hence, the study is set to model, among other factors, the direct and indirect effects of teachers' attitudes towards ICT on teachers' application of ICT technologies in Mathematics classrooms.

Teachers' ICT Motivation on Teachers' Effective Utilization of ICT in Classroom

Motivation is the reason or the motive an individual has for engaging in an activity. Teachers' ICT motivation is the reasons or motives teachers have for utilizing ICT in classrooms. Motivation is defined as the attribute that triggers movement, energy, direction, the reason for the behaviour, and the 'what' and 'why' individuals do something (Woolfolk, 2013). Studies have shown that motivation is a strong influencer of students' achievement in Mathematics (Aneshie-Otakpa, 2016; Tella, 2008). Individuals who are highly motivated to perform a given task seem to be more focused and overcome more obstacles to achieve their targets. It noted that one of the major barriers to the use of ICT is both teachers' and students' lack of motivation in applying ICT facilities (Habibu et al., 2012). In addition, teachers' poor acceptance of ICT technologies constituted a hindrance to the implementation of ICT in schools (Habibu et al.). There seems to be limited evidence to show the mediating roles of teachers' ICT motivation on the effects of access to ICT facilities and teachers' ICT attitude on teachers' effective utilization of ICT in teaching. Consequently, the study is poised, among others, to develop a predictive model of direct and mediational effects of teachers' ICT motivation on teachers' effective utilization of ICT in teaching Mathematics.

Teachers' ICT Self-Efficacy on Teachers' Effective utilization of ICT in Classroom

Self-efficacy is a very important factor in teaching and learning. Self-efficacy describes individuals' judgment on their confidence to perform tasks. It is defined as individual confidence in their abilities to perform an action or activities necessary to actualize targets (Bandra, 1997). For the students, self-efficacy has been found to significantly influence learning outcomes (Guo, Connor, Yang, Roehring, & Morrison, 2012). An individual could have self-efficacy in a general or a particular area such as ICT. Teachers' ICT self-efficacy could be described as the teachers' confidence in their abilities to perform ICT-related tasks or to achieve ICT-related objectives. Previous studies have shown that teachers' ICT self-efficacy is a significant predictor of teachers' effective utilization of ICT in delivering instructions (Hatlevik & Hatlevik, 2018; Brun & Hinostroza, 2014; Player-Koro, 2012; Hassan, Rosnaini, & Su, 2016). Teachers' lack of confidence in using ICT is one of the problems that hinder teachers' applications of ICT in classrooms (Hibibu et al., 2012).

Although previous studies show that ICT self-efficacy influences teachers' effective utilization of ICT, there is a gap in the knowledge regarding the mechanism that underlies the effect of ICT Self-efficacy on teachers' ICT usage. For instance, a review of related empirical studies shows that little or no attention has been given to the mediational roles of ICT self-efficacy in the relationship between access to ICT, teachers' ICT attitude, and teachers' effective utilization of ICT. Secondly, most

previous studies on the effect of teachers' ICT self-efficacy on teachers' usage of ICT were not focused on particular subject teachers, such as Mathematics teachers. Therefore, considering the persistent poor achievement of students in Mathematics over the years, it becomes pertinent to examine both direct and mediating effects of Mathematics teachers' ICT self-efficacy on teachers' effective utilization of ICT in Mathematics classrooms using PLS-SEM procedure as this would help to provide insight for appropriate interventions. To model these factors, the relationship among these variables is first hypothesized as shown in Figure 2.

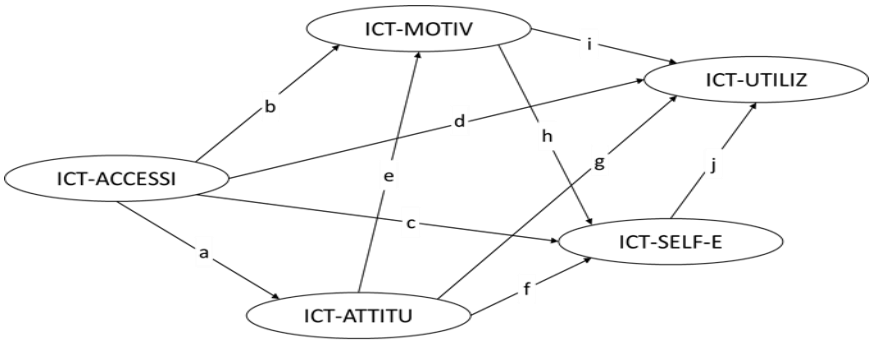

Figure 2
The hypothesized model of ICT applications (Source: Author)

From the Figure 2, it is hypothesized that access to ICT facilities could affect Mathematics teachers' effective application of ICT in the classrooms. This hypothesized path was based on the observation that availability of ICT teaching facilities aids teacher in effective implementation of instruction (Buabeng-Andoh, 2019). It was also hypothesized that Mathematics teachers' attitude towards ICT could also have impact on their effective usage of ICT in teaching and learning. This is agreement with the view of Mafang'ha (2016) that attitude of the teacher towards ICT adoption determine how effective ICT tools are deployed in classrooms. More so, Mathematics teachers' ICT motivation was also theorized as having impact on teacher effective usage of ICT in teaching which aligns with Habibu et al (2012). Mathematics teachers' ICT self-efficacy is also hypothesized to influence teachers' adoption of ICT in teaching and learning. This is in agreement with Hatlevik and Hatlevik, 2018 who discovered that self-efficacy plays significant role on teachers' application of ICT in classrooms. It is further hypothesized that teachers' ICT attitude, ICT motivation, and ICT self-efficacy mediate the link between Mathematics teachers' access to ICT resources and their effective utilization of ICT in teaching and learning Mathematics. The letters in the model, numbered, a-i are used for the computation of the direct and indirect paths coefficients.

From the literature review, it is found out that previous studies on factors that affect teacher' ICT usage gave little or no attention to accessibility of ICT facilities. While the reason for this could be that developed nations have shifted their focus to training of human resource for implementation of ICT-based learning, most of developed nations still lack basic ICT facilities for teaching learning. More so, in Nigeria where ICT

facilities are limited, there is no empirical evidence to demonstrate the individual and joint effects of access to ICT and other factors such as ICT motivation, attitude and self-efficacy on teachers' usage of ICT in classroom. Hence the need for this study.

Purpose of the Study

The main purpose of the study was to model the effects of Mathematics teachers' access to ICT facilities, Mathematics teachers' ICT attitude, Mathematics teachers' ICT motivation, and Mathematics teachers' ICT self-efficacy on Mathematics teachers' applications of ICT in classroom.

Research Questions

The research questions that guided the study are as follows:

1. What is the most parsimonious predictive model that explains the effects of Mathematics teachers' access to ICT facilities, Mathematics teachers' ICT attitude, Mathematics teachers' ICT motivation, and Mathematics teachers' ICT self-efficacy on Mathematics teachers' applications of ICT in classroom?

2. What is the direct effects of Mathematics teachers' access to ICT facilities, Mathematics teachers' ICT attitude, teachers' ICT motivation, and teachers' ICT self-efficacy on Mathematics teachers' applications of ICT in Mathematics classrooms?

3. What is the indirect effects of Mathematics teachers' access to ICT facilities and Mathematics teachers' ICT attitude on teachers' effective utilization of ICT in classrooms?

4. What is the composite effects teachers' access to ICT facilities, Mathematics teachers' ICT attitude, Mathematics teachers' ICT motivation, and Mathematics teachers' ICT self-efficacy on Mathematics teachers' applications of ICT in classroom?

Hypotheses

The following null hypotheses were tested for the study:

1. the direct effects of Mathematics teachers' access to ICT facilities, Mathematics teachers' ICT attitude, Mathematics teachers' ICT motivation, and Mathematics teachers' ICT self-efficacy on Mathematics teachers' applications of ICT in Mathematics classrooms is not statistically significant.

2. the indirect effects of Mathematics teachers' access to ICT facilities and Mathematics teachers' ICT attitude on Mathematics teachers' effective utilization of ICT in classrooms are not statistically significant.

3. the composite effects the composite effects teachers' access to ICT facilities, Mathematics teachers' ICT attitude, Mathematics teachers' ICT motivation, and Mathematics teachers' ICT self-efficacy on Mathematics teachers' applications of ICT in classroom

METHOD

Research Design

The study employed a cross-sectional correlational research method. A correlational method aims at ascertaining the relationships between or among variables in the same population or different populations (Leedy & Ormrod, 2010). Correlational design is deemed appropriate in this study as the relationships among the selected exogenous and endogenous variables were determined.

Area of the Study

The study area was Enugu State Nigeria. Enugu State is located in the South-eastern Nigeria. Enugu State was created in 1999 from old Anambra State. Enugu State is one of the five states that make up the South-East Geopolitical Zone in Nigeria. Enugu State is referred to as the Coal City because of the abundant of coal deposit in the state. Enugu State has 17 Local Government Areas. Majority of the residents of the state are the Igbos. The Igbos are the third major ethnic group in Nigeria. Christianity is the predominant religion in the area, although, last decade has witnessed growing number of youths who are joining African Tradition Religion. The residents of Enugu State comprised farmers, traders, civil/public servants, students, and artisans. While most of the cities are dominated by civil servants and business men and women, the rural areas are dominated by peasant farmers. The farm produce obtained in Enugu State include cassava, yam, maize, rice, and cocoyam, tomatoes, and peppers. There are six education zones in Enugu State, namely; Agbani, Awgu, Engu, Nsukka, Obollo-Afor, and Udi Education Zone. Out of these six education zones, Agbani and Enugu Education Zones are located within the state Capital Territory. While Agbani Education Zone comprised of Nkanu West, Nkanu East, and Enugu South LGAs, Enugu Education Zone comprised Isiuzo, Enugu North, and Enugu East LGAs. The study was conducted within three local government areas; Enugu South, Enugu North,and Enugu East, that made up the state capital.

Participants

All the 356 Mathematics teachers distributed in 34 public secondary schools in the three LGAs; Enugu South 14 schools, Enugu East 9 schools, and Enugu North 11 schools were used for the study. All the 356 Mathematics teachers in the public schools in the study area were the target population, hence sampling was not applied. However, 34 teachers could not be reached, efforts to reach the teachers failed as the researchers visited their schools more than two times but could not see them. Hence, the responses from 322 Mathematics teachers were used in the analysis for this study. The 322 mathematics comprised 180 (55.90% males) and 142 (44.10% females). The average age of the teachers was 46.7 years.

Data Collection Tools

Five data collection tools were used in this study. The first was teachers ICT self-efficacy scale adapted from Musharraf et al. (2018). The teachers ICT self-efficacy scale comprised five items that measure Mathematics teachers' self-efficacy in the use

of ICT. The five items were modified to suit the current study. For example, items that read "I can easily talk to others through the internet using webcam" in the Musharraf et al's scale was modified to "I can easily teach mathematics through the internet using webcam". Item that initially read "I can easily use chat room on internet was rewritten to "I can easily use chat room on internet to discuss mathematics". The rating of the teachers' ICT self-efficacy scale was on a 4-point scale that ranged from strongly disagree to strongly agree. Three experts in Educational Psychology Unit vetted the instruments to ensure the face validity of the tools. Construct validity was determined by assessing average variance extracted and by assessment of discriminant validity for the measurement model using Heterotrait-Monotrait ratio of correlations (HTMT). The suggestions by these experts were incorporated in the final draft of the instruments. The reliability of the ICT self-efficacy obtained using Cronbach' alpha after trial testing of the scale. A reliability index of 0.76 was obtained.

The second data collection tool was a 5-item teachers' ICT attitude scale adapted from Chauham & Sharma (2022). The items in the teachers' ICT attitude scale contains modified statements that measure Mathematics teachers' ICT attitude. The scale contains questions such as "I am eager to learn more about ICT", "I feel confident while working with ICT tools", and "I will like to have ICT tools for teaching mathematics". The ratings of the teachers' ICT attitude scale was on four point Likert type scale that ranged from strongly disagree to strongly agree. The reliability coefficient obtained for the ICT attitude scale was 0.89.

The third instrument was teachers' ICT motivation scale adapted from Senkbeil (2018). The teachers' ICT motivation scale comprised five items that measured teacher's motivation to use ICT. The item that originally read "I use internet and computer in order to find specific information" was modified to suit the current study thus: "I use internet and computer in order to find specific information about mathematics", the item that read "I use internet and computer in order to do my homework" was modified to "I use internet and computer in order to prepare my lesson plans". The scale was rated on a four point Likert type scale that ranged from strongly disagree to strongly agree. The reliability index for the ICT motivation scale was 0.89.

The fourth tool was teachers' access to ICT that was developed by the researchers. The teachers' access to ICT contains five items. The items contains statements such as "I have my personal computer", I have access to mathematics software such as ChatGPT, and Geogebra", and "my school has functional computer laboratory for teaching mathematics". The items were rated also on a 4-point scale that ranged from strongly disagree to strongly agree. The reliability index teachers' access to ICT was 0.90.

The fifth data collection tool was teachers' application of ICT scale developed by the researchers. The scale contains five items that assess teachers' adoption of ICT in mathematics instructions. The items contains statements such as "I use ICT tools in developing my lesson plans", "I use ICT based facilities in delivering mathematics instructions", and "I use ICT in assessing my students' academic progress". The items were also rated on a 4-point Likert scale that ranged from strongly disagree to strongly agree. The reliability coefficient obtained for the teacher' application of ICT was 0.81.

Method of Data Analysis

The collected was first screened for missing value and no missing value was detected. Because PLS-SEM is a non-parametric approach to structural equation, no assumption was tested. PLS-SEM was used to analyse the collected data using RStudio version 4.1.3 (R-Core Team, 2022) and seminr package version 2.2.1 (Ray, Dank, & Valdez, 2021). The interpretation of indirect effects in this study was based on Zhao, Lynch, and Chen (2010) guidelines which state if the indirect path is not significant and the direct path is also not significant it indicates no mediation effect. However, if the indirect path is significant but the direct path is not significant, it indicates full mediation. If both the direct path and indirect path are significant and the product of the direct path and the indirect path is positive it implies complementary partial mediation, however, if the product is negative, it indicates competitive partial mediation. Heterotrait-Monotrait ratio of correlations (HTMT), a statistical technique used to assess discriminant validity was used to assess the construct validity of the scales while the internal consistence was assessed using rhoA.

FINDINGS

Development of predictive models using PLS-SEM involves assessing first the measurement models and structural model of the hypothesized mode. This model was assessed to answer the research questions and test the hypotheses generated for the study. Hence, the results of the study were presented in line with the research questions and the hypotheses in this part of the study.

Table 1
Assessment of the convergent validity for the measurement model

Block	Item	X	SD	Loading	AVE	CR
ICT-ACCESS	ACCESS1	3.348	0.965	0.90	0.74	0.92
	ACCESS2	3.224	0.986	0.84		
	ACCESS3	3.217	1.009	0.84		
	ACCESS4	3.304	1.005	0.87		
ICT-MOTIVA	MOTIV1	3.112	1.011	0.80	0.61	0.87
	MOTIV2	3.171	0.985	0.76		
	MOTIV3	3.211	1.029	0.73		
	MOTIV4	3.211	0.979	0.84		
ICT-ATTITU	ATTIT1	3.373	1.028	0.86	0.76	0.91
	ATTIT2	3.320	0.992	0.87		
	ATTIT3	3.332	1.025	0.89		
ICT-SELF-E	SELFE1	3.180	1.022	0.75	0.53	0.77
	SELFE2	3.665	0.486	0.76		
	SELFE3	3.537	0.547	0.67		
ICT-UTILIZA	UTILIZ	2.356	0.453	1.00	1.00	1.00

Table 1 shows the item mean, standard deviation, item loadings, the construct's Average Variance Extracted (AVE), and Composite Reliability (CR) for Assessment Convergent Validity for the Measurement Model. The four indicator loadings of the reflectively measured constructs for ICT-ACCESS, four indicator loadings of ICT-MOTIVA, three indicator loadings of ICT-ATTITU, and two indicator loadings of ICT-

SELF-E are greater than the recommended benchmark value of 0.708 (Hair, Risher, Sarstedt, & Ringle, 2019), which implies sufficient levels of indicator reliability. One indicator loading of ICT-SELF-E had a value of 0.67 and was retained as doing so helped to improve the construct reliability. The indicator SELFE3 (loading, 0.67) has the least indicator-explained variance with a value of 0.45 (= 0.67), while the indicator ACCESS1 (loading, 0.90) has the most explained variance, with a value of 0.81 (= 0.90). Apart from SELF3, all the indicator loadings had explained variance values that were well above the threshold value of 0.5. Similarly, Table 1 shows that the AVE values of ICT-ACCESS (0.74), ICT-MOTIVA (0.61), ICT-ATTITU (0.76), and ICT-SELF-E (0.53) are far above the needed threshold level of 0.50 (Hair et al., 2019). Thus, the measures of the four reflectively measured constructs have high levels of convergent validity. The internal consistency reliability values are also displayed in on Table 1. The reliability coefficient, rhoA values of 0.92 (ICT-ACCESS), 0.87 (ICT-MOTIVA),

```
> kj4$vif_antecedents
ICT-UTILIZA :
ICT-ACCESSI  ICT-ATTITU  ICT-MOTIVA  ICT-SELF-E
       2.195       2.309       1.533       1.406

ICT-SELF-E :
ICT-ACCESSI  ICT-ATTITU  ICT-MOTIVA
       2.020       2.263       1.526

ICT-MOTIVA :
ICT-ACCESSI  ICT-ATTITU
       1.967       1.967

ICT-ATTITU :
ICT-ACCESSI
          -
```

0.91(ICT-ATTITU), and 0.77 (ICT-SELF), all the four reflectively measured constructs have great levels of internal consistency reliability. Thus implying that all construct measures are reliable. The rhoA is describe as the best estimate of the internal consistence reliability as the values lie between the Cronbach's alpha reliability values and the composite reliability values (Hair et al., 2022).Note that the internal consistency reliability values of ICT-UTILIZA (1.00) does not indicate perfect reliability since ICT-UTILIZA is measured with a single item and by definition, its internal consistency reliability has value of 1.

Table 2
HTMT for assessment of discriminant validity for the measurement model

Relationship	Original Est.	Boot. Mean	Boot. SD	T Stat.	2.5% CI	97.5% CI
ICT-ACCESSI -> ICT-ATTITU	0.77	0.77	0.05	17.00	0.68	0.85
ICT-ACCESSI -> ICT-MOTIVA	0.55	0.56	0.06	8.57	0.42	0.68
ICT-ACCESSI -> ICT-SELF-E	0.61	0.61	0.05	11.10	0.49	0.71
ICT-ACCESSI -> ICT-UTILIZA	0.58	0.58	0.03	17.11	0.51	0.64
ICT-ATTITU -> ICT-MOTIVA	0.65	0.64	0.06	11.33	0.54	0.75
ICT-ATTITU -> ICT-SELF-E	0.56	0.56	0.06	9.52	0.44	0.67
ICT-ATTITU -> ICT-UTILIZA	0.59	0.58	0.03	17.57	0.52	0.65
ICT-MOTIVA -> ICT-SELF-E	0.42	0.43	0.06	6.88	0.31	0.54
ICT-MOTIVA -> ICT-UTILIZA	0.56	0.56	0.04	14.75	0.48	0.63
ICT-SELF-E -> ICT-UTILIZA	0.47	0.47	0.05	9.69	0.37	0.56

Table 2 shows the hertero-trait-mono-trait HTMT ratio of Correlation values for all pairs of constructs for Assessment of Discriminant Validity for the Measurement Model. It can be seen that all HTMT values are obviously below the conservative minimum value of 0.85 (Henseler et al., 2015). The HTMT values were further tested

for significance using 90% two-sided bootstrapped confidence intervals and all the HTMT values were found to be significant. This is evident as the upper 90% confidence interval values are well below the benchmark of value of 0.90.

Figure 3
Assessment of Collinearity Issue of the Structural Model

Figure 3 shows the variance inflation factor (VIF) for the pair of the constructs. The VIF values ranged from 0.00 to 2.26 which are well below the 3.0 benchmark. Hence there existed no evidence of collinearity between any of the constructs.

Research Question One: What is the most parsimonious model that explain the effects of teachers' accessibility of ICT facilities, teachers' ICT attitude, teachers' ICT motivation, and teachers' ICT self-efficacy on teachers' effective utilization of ICT in Mathematics classrooms?

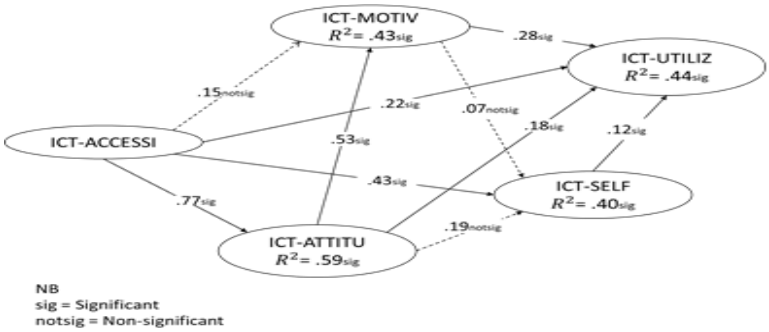

Figure 4
The validated model of the study

The Figure 4 shows the validated model of this study. The broken lines indicate non-significant paths whereas the solid lines indicate significant paths. The model was developed by answering the research questions and the hypotheses that were generated to guide the study.

Table 3
Bootstrap confidence intervals of direct effects of exogenous variable on endogenous variable

Relationship	Orig Est.	f^2	Boot. Mean	Boot. SD	T Stat.	2.5% CI	97.5% CI
ICT-ACCESSI -> ICT-ATTITU	0.77	1.44	0.77	0.05	17.01	0.66	0.84
ICT-ACCESSI -> ICT-MOTIVA	0.15	0.06	0.15	0.11	1.28	-0.07	0.35
ICT-ACCESSI -> ICT-SELF-E	0.43	0.12	0.44	0.10	4.21	0.25	0.66
ICT-ACCESSI -> ICT-UTILIZA	0.22	0.03	0.22	0.06	3.48	0.10	0.34
ICT-ATTITU -> ICT-MOTIVA	0.53	0.20	0.53	0.11	4.71	0.31	0.74
ICT-ATTITU -> ICT-SELF-E	0.19	0.02	0.18	0.13	1.47	-0.11	0.41
ICT-ATTITU -> ICT-UTILIZA	0.18	0.02	0.17	0.07	2.51	0.03	0.31
ICT-MOTIVA -> ICT-SELF-E	0.07	0.01	0.06	0.08	0.78	-0.10	0.23
ICT-MOTIVA -> ICT-UTILIZA	0.28	0.08	0.28	0.05	5.90	0.19	0.37
ICT-SELF-E -> ICT-UTILIZA	0.12	0.02	0.12	0.06	2.07	0.00	0.22

Table 3 shows the Path Coefficients (Orignal Est) and the Bootstrap Confidence Intervals of Path Coefficients of Direct Effects of Exogenous Variables on Endogenous Variables. It can be seen that teachers' access to ICT has a strong positive impact on teachers' attitude towards ICT ICT-ACCESSI -> ICT-ATTITU (β=0.77, $f^2 = 1.44$), weak effect on teachers' ICT motivation ICT-ACCESSI -> ICT-MOTIVA (β =0.15, f^2=0.06), and moderate effect on teachers' ICT self-efficacy ICT-ACCESSI -> ICT-SELF-E (β =0.43, f^2=0.12), and teachers' effective utilization of ICT ICT-ACCESSI -> ICT-UTILIZA (β =0.22, f^2=0.03). Similarly, teachers' ICT attitude has moderated effect teacher' ICT self-efficacy, [ICT-ATTITU -> ICT-SELF-E (β =0.53, f^2=0.20)] , weak effect on teachers' ICT self-efficacy ICT-ATTITU -> ICT-SELF (β =0.19, f^2=0.02), and also weak effect on teachers' effective utilization of ICT ICT-ATTITU -> ICT-UTILIZA (β =0.18, f^2=0.02). It can be seen that teachers' ICT motivation exert weak effects on teachers' ICT self-efficacy, ICT-MOTIVA -> ICT-SELF-E (β =0.07, f^2=0.01) and teachers' effective utilization of ICT, ICT-MOTIVA -> ICT-UTILIZA (β =0.28, f^2=0.08). Similarly, teachers' ICT self-efficacy has weak effect on teachers' ICT utilization of, ICT-SELF-E -> ICT-UTILIZA (β =0.12, f^2 =0.02). Further analyzing the path coefficient estimates, and the corresponding effect size shows that the primary drivers teachers utilization of ICT are both teachers' ICT-MOTIVA (β =0.28, f^2=0.08) and ICT-ACCESS (β =0.22, f^2=0.03), as demonstrated by the larger path coefficients and effect sizes as compared with those of ICT-ATTITU and ICT-SELF.

Table 3 further shows the path coefficients (Original Est.) and the 95% bootstrap confidence intervals of path coefficients of direct effects of exogenous variables on endogenous variables. It can be seen that the 95% CI for the effects, ICT-ACCESSI -> ICT-ATTITU ($\beta = 0.77, f^2 = 1.44,$ 95% C1[0.66, 0.84]), ICT-ACCESSI -> ICT-SELF-E ($\beta = 0.43, f^2 = 0.12,$ 95% C1[0.25, 0.66]), and ICT-ACCESSI -> ICT-UTILIZA ($\beta = 0.22, f^2 = 0.03,$ 95% C1[0.10:0.34]) did not contain zero, hence were all significant while ICT-ACCESSI -> ICT-MOTIVA ($\beta = 0.15, f^2 = 0.06,$ 95% C1[-0.07, 0.35]) contains zero and therefore was not significant. Similarly the 95% CI for the effects, ICT-ATTITU -> ICT-SELF-E ($\beta = 0.53, f^2 = 0.20,$ 95% C1[0.31, 0.74]) and ICT-ATTITU -> ICT-UTILIZA ($\beta = 0.18, f^2 = 0.02,$ 95% C1[0.03, 0.31]) did not contain zero, hence, the effects were significant while the ICT-ATTIT-> ICT-SELF ($\beta = 0.19, f^2 = 0.02,$ 95% C1[-0.11, 0.41]) contains zero and therefore was not significant. Similarly, ICT-MOTIVA -> ICT-SELF-E ($\beta = 0.07, f^2 = 0.01$, 95% C1[-0.10, 0.23]) was not significant whereas ICT-MOTIVA -> ICT-UTILIZA ($\beta = 0.28, f^2 = 0.08$, $95\%\ C1[0.19, 0.37]$). ICT-SELF-E -> ICT-UTILIZA ($\beta = 0.12, f^2 = 0.02$, $95\%\ C1[0.01, 0.22]$). These findings imply that the effect sizes of the selected variables were significant predictors of effective ICT utilization.

Table 4
Path coefficients of total indirect effect of exogenous variables on endogenous variables

	ICT-ACCESSI	ICT-ATTITU	ICT-MOTIVA	ICT-SELF-E	ICT-UTILIZA
ICT-ACCESSI			0.41	0.18	0.36
ICT-ATTITU				0.04	0.17
ICT-MOTIVA					0.01

Table 4 shows the total indirect effects of the exogenous variables on the endogenous variables. The total indirect effects ranged from weak, ICT-MOTIVA -> ICT-UTILIZA (0.01) to moderate ICT-ACCESSI-> ICT-MOTIVA (0.41) which implies that the effect of teachers' ICT motivation on teachers' effective utilization of ICT was the weakest while the effect of availability and accessibility of ICT resources on teacher teachers' attitude towards ICT has the strongest effect. The mediating effects of specific mediators are shown in the Table 5.

Hypothesis Three: the indirect effects of the exogenous variables on the endogenous variables is not significant.

Table 5
Confidence intervals of specific indirect effects of exogenous variables on endogenous variables

Relationships	Est.	Boot. Mean	2.5% CI	97.5% CI	Remark
ICT-ACCE -> ICT-ATTI -> ICT-MOT (a*e)	0.41	0.41	0.20	0.62	F
ICT-ACCE -> ICT-ATTI -> ICT-SELF (a*f)	0.15	0.14	-0.07	0.34	D
ICT-ACCE -> ICT-MOT -> ICT-SELF (b*h)	0.01	0.01	0.01	0.08	CP
ICT-ACCE -> ICT-ATTI -> ICT-UTILIZ (a*g)	0.14	0.13	0.02	0.26	CP
ICT-ACCE -> ICT-SELF -> ICT-UTILIZ (c*j)	0.05	0.05	0.01	0.15	CP
ICT-ACCE -> ICT-MOT -> ICT-UTILIZ (b*i)	0.04	0.04	-0.01	0.13	D
ICT-ATTI -> ICT-MOT -> ICT-SELF (e*h)	0.04	0.03	-0.03	0.17	N
ICT-ATTI -> ICT-MOT -> ICT-UTILIZ (e*i)	0.15	0.15	0.06	0.27	CP
ICT-ATTI -> ICT-SELF -> ICT-UTILIZ (f*j)	0.02	0.02	0.01	0.09	CP
ICT-MOT -> ICT-SELF -> ICT-UTILIZ (h*j)	0.01	0.01	0.01	0.05	CP

F: Indirect-only (full mediation), D: Direct-only (no mediation), CP: Complementary (partial mediation), N: No effect (no mediation)

Table 5 shows the 95% bootstrapped confidence intervals for specific indirect effects of the exogenous variables on endogenous variables. Based on Zhao et al., 2010 recommendation for assessment of mediation effects, the relationships, ICT-ACCE -> ICT-ATTI -> ICT-MOT is significant (0.41, 95% CI [0.20, 0.62]) and implies full mediation, ICT-ACCE -> ICT-ATTI -> ICT-SELF is not significant (0.15, 95% CI [-0.07, 0.34]) which implies only the direct effect, and ICT-ACCE -> ICT-MOT -> ICT-SELF is significant (0.01, 95% CI [0.01, 0.08]) which implies complementary partial mediation. Similarly, ICT-ACCE -> ICT-ATTI -> ICT-UTILIZ and ICT-ACCE -> ICT-SELF -> ICT-UTILIZ are significant (0.14, 95% CI [0.02, 0.26]) and (0.05, 95% CI [0.01, 0.15]) with complementary partial mediation effects respectively. ICT-MOT has no significant mediation effect (0.04, 95% CI [-0.03, 0.17]) in the relationship, ICT-ATTI -> ICT-MOT -> ICT-SELF but has significant complementary partial effect (0.15, 95% CI [0.06, 0.27]) in the relationship ICT-ATTI -> ICT-MOT -> ICT-UTILIZ. Similarly, ICT-SELF has significant complementary partial effects (0.02, 95% CI [0.01,

0.09]) and (0.01, 95% CI [0.01, 0.05]) in the relationships ICT-ATTI -> ICT-SELF -> ICT-UTILIZ and ICT-MOT -> ICT-SELF -> ICT-UTILIZ respectively.

Table 6

Coefficients of determination (R^2) and $Adj - R^2$ for assessment of the model's explanatory power

Variables	R^2	$Adj - R^2$	Remark
ICT-UTILIZA	0.44	0.43	Moderate
ICT-SELF	0.40	0.39	Moderate
ICT-MOTIVA	0.43	0.42	Moderate
ICT-ATTITU	0.49	0.59	Moderate

Table 6 shows the R^2 and $Adjusted - R^2$ for the model's in sample explanatory power. The R^2 values for ICT-UTILIZA (0.44), ICT-SELF (0.40), ICT-MOTIVA (0.43), and ICT-ATTITU (0.49) are considered moderate based on Hair et al (2022) R^2 interpretation guidelines. This implies that 44% variation in the ICT-UTILIZA, 40% variation in ICT-SELF, 43% variation in ICT-MOTIVA, and 49% variation in ICT-ATTITU are explained by their respective exogenous variables while remaining percentages are accounted by other factors not included in the study.

DISCUSSION

Poor utilization of ICT tools in teaching and learning in developing nations can only be overcome when a suitable model of the factors that affect teachers' effective utilization of ICT is developed and appropriately applied. This study utilized partial least square structural equation modelling and modelled the accessibility to ICT tools, teachers' attitude toward ICT, teachers' ICT self-efficacy, and teacher' motivation on Mathematics teachers' effective utilization of ICT in teaching mathematics. The obtained measurement and structural models implies that hypothesized model was supported by the data. In other words, the model was considered appropriate to explain the roles of the selected variables for this study in Mathematics teachers' effective utilization of ICT in teaching mathematics at secondary school levels.

The findings of the study showed that teachers' access to ICT facilities has significant effect on Mathematics teachers' effective utilization of ICT in teaching Mathematics. The findings are in agreement with (Buabeng-Andoh, 2019) who observed that effective utilization of ICT in schools is largely a result of the availability and accessibility of ICT tools by teachers. The findings also corroborate (Mafangha, 2016) who noted that the necessary condition for the adoption of ICT in schools is the teachers' accessibility to ICT resources. Of course, the significant relationship between access to ICT resources and teachers' application of ICT in teaching Mathematics is not surprising as school managers would try to ensure that teachers make use of the provided ICT-based instructional materials for teaching students. The reason for the significant effect of accessibility of ICT on teachers' usage of ICT could be that teachers are likely to be more motivated to apply ICT facilities when the facilities are available. It is worth noting that most teachers may not have the skills and resources to improvise ICT-based instructional materials, hence, the unavailability of the ICT instructional materials

would make the teacher resort to the use of lecture methods. Most ICT instructional materials are electronic devices and such, require constant usage for them to function properly. Therefore, with this knowledge, teachers may likely strive to maintain the few available ICT teaching aids in their school by putting them into constant use. The study, however, is not in tune with Anjum et al. (2022) who reported that the availability of ICT resources does not significantly relate to students' utilization of ICT for academic purposes. This findings is very surprising, because it is expected that students use ICT facilities for learning. This unwarranted situation could be a result of students' increased utilization of the internet for social networking instead of their academic activities. Teachers' constant use of ICT tools will not only make the teacher more effective in using ICT but also encourage students to follow suit.

The findings of the study also revealed that teachers' ICT attitude had a significant impact on secondary school Mathematics teachers' application of ICT in Mathematics classrooms. The findings are consistence with the view of Mafangha (2016) that teachers' positive attitude toward ICT is a crucial factor for effective applications of ICT in classrooms. The findings are also in consonance with Hennessy et al. (2010) that teachers' negative attitudes towards ICT hinder teachers' application of ICT in teaching students. The reason for the significant effect of teachers' ICT attitude on teachers' applications of ICT in teaching Mathematics is obvious as attitude determines whether one would devote interest in a task or not. Teachers with positive ICT attitudes would make use of ICT as compared to teachers who display negative ICT attitudes.

The study further revealed that teachers' ICT motivation had a significant influential factor in secondary school Mathematics teachers' effective utilization of ICT in Mathematics classrooms. The explanation for the significant effect of motivation on teachers' usage of could be that more emphasis has been given to the need to shift from traditional teaching methods to the use of modern teaching approach. Because the teachers would want to remain relevant, they could become enthusiastic to new innovation such as ICT-based instruction. The findings are in line with Habibu et al. (2012) who observed that the major barrier to the use of ICT is teachers' motivation. The findings also align with Beardsley et al. (2021) that an increase in teachers' skills in the use of digital technologies was associated with motivation to use ICT tools. The likely reason for the effect of ICT motivation on teachers' effective utilization of ICT in teaching Mathematics could be that teachers who are intrinsically motivated to handle ICT facilities derive joy in doing so and could make use of the available ICT facilities in instruction delivery. Again, teachers who are highly motivated to use ICT can explore new ways ICT could be used in teaching Mathematics as compared to less motivated teachers. Although teachers that had high motivation did not show skilfulness in using ICT (Paudel, 2020), these teachers may have likely show better attempts in utilizing ICT. The set of teachers with high motivation to use ICT can easily fit into 21st-century classrooms with minimal training. Hence the need to get teachers motivated in the use of ICT.

According to the findings of the study, teachers' ICT self-efficacy was a significant factor that determines Mathematics teachers' effective utilization of ICT in Mathematics classrooms. The findings corroborated Akram et al. (2022) that teachers

confidence and belive in the use technology makes teaching more exciting and learning more meaningful. The findings also align with Huang et al. (2021) who students' self-confidence in using ICT has a significant relationship with the students' ICT usage. The findings agreed with Hatlevik and Hatlevik (2018) who noted that teachers' applications of ICT are significantly predicted by teachers' ICT self-efficacy. The findings also corroborated Brun and Hinostroza (2014), Player-Koro (2012), and Hassan et al. (2016) who noted that teachers' ICT self-efficacy is a major determinant of teachers' effective utilization of ICT in teaching and learning episodes. The findings of the study are not surprising given the role of self-efficacy in learning. A teacher who has high self-efficacy in using ICT will not feel ashamed if he or she fails while attempting to use ICT tools. A highly self-confident teacher may tend to show more willingness to corroborate with others to learn how to use ICT. This demonstrates that teachers' confidence in their abilities to make use of ICT facilities could in reality make the teachers to practice using ICT facilities in classrooms. For a teacher to demonstrate whatever he has learned in terms of using ICT tools, such teachers must believe in his ability to practice what has been learned. On the other hand, a teacher with low ICT self-efficacy would show some anxiety when it comes to the application of ICT. It can therefore be said that as the teachers' self-efficacy increases, their application of ICT in teaching mathematics will increase. Hence, exposing teachers to opportunities that would develop their ICT self-efficacy could be an appropriate strategy to enhance the use of ICT in teaching and learning.

The results of the study showed that teachers' ICT attitude had a significant complementary partial mediational effect on the relationship between teachers' access to ICT resources and Mathematics teachers 'utilization of ICT facilities in teaching Mathematics. This finding corroborated Clipa et al. (2023) who observed that attitude was one of the major factors that influence ICT usage in classrooms. The mediational role of attitude is not surprising because the availability of ICT tools in schools could make some teachers with negative attitudes towards ICT to develop positive attitudes towards ICT, especially when they see their colleagues using ICT in teaching the students. Because the availability of ICT could alter the negative attitude of the teachers to a positive attitude, these teachers are would likely to start applying ICT in teaching. These teachers, of course, will not like to appear odd before the students, hence would adjust their attitude which would make them to become more ICT compliant. Teachers cannot use ICT tools adequately if they do not have a positive attitude towards the use of ICT. It is noted that teachers had a positive attitude toward the use of ICT (Thanh et al., 2023), availability of ICT tools could contribute to this positive attitude towards the use of ICT.

Teachers' ICT motivation had no significant mediation effect in the relationship between access to ICT facilities and ICT facilities usage. Teachers' ICT motivation and teachers' ICT self-efficacy had a significant complementary mediation effect in the relationship between secondary school Mathematics teachers' ICT attitude and the teachers' effective utilization of ICT facilities in teaching Mathematics. Similarly, teachers' ICT self-efficacy played a complementary mediation effect in the relationship between teachers' ICT motivation and teachers' application of ICT. The reason for the observed mediation effect is in line with the findings of EC, 2013 that the availability of

ICT facilities does not guarantee the automatic application of ICT in teaching and learning.

CONCLUSION AND SUGGESTIONS

The roles of access to ICT facilities, motivation, attitude, and self-efficacy on mathematics teachers' effective application of ICT in classrooms have been determined. The findings of the study may not only be applicable to Nigerian context given that most of the developing nations experience similar economic and political challenges making them unable to give the require attention to education. It is concluded that accessibility of ICT facilities had significant impact on teachers' usage of ICT facilities implying that the government, the school proprietors, and other stakeholders in education in developing nations where ICT facilities are often limited should prioritize provision of ICT facilities in the schools. More so, the impact of access to ICT on teachers' ICT usage is not surprising because the teachers could even be motivated to attempt to use the ICT once they can easily lay their hands on them. It is also concluded that teachers' ICT motivation, attitude, and self-efficacy were impactful on the level of teachers' integration of available ICT facilities in teaching mathematics. This highlights the need for workshops, seminars, and conferences that aim at enhancing teachers' ICT attitude, teachers' ICT motivation, and teachers' ICT self-efficacy to be organized by the government and school owners.

While the study concluded that access to ICT facilities, motivation, attitude, and self-efficacy had impact on mathematics teachers ICT usage, there is need to explore the roles of these variable in teachers' adoption of ICT-based learning across other subjects, regions for streamlining of studies on the drivers of teachers' ICT usage. Off course, developed nations may generally have better ICT facilities as compared to developing nations, there could still be a need for developed nations to explore the role of quality and quantities of ICT-facilities on teachers' ICT professional development and training. In addition, the moderation and mediation roles of teachers' demographic information, such as teachers' gender, qualification, and teaching experience on teachers' application of ICT in classroom could be further investigated.

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