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Relationship between familiarity and competency in integrating information and communication technology into mathematics instruction

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ABSTRACT

Government, through the National Council for Curriculum and Assessment implemented new educational reforms in 2019. Paramount among the tenets in the new reforms is information and communication technology (ICT). However, there was an inadequate research on mathematics teachers' familiarity and competency levels. The study, as proscribed in the positivist paradigm, applied a descriptive survey design in a cross section of the participants. All 75 mathematics teachers from the public junior high schools were conveniently sampled and participated in this study. In the instrumentation, the researchers used the structured questionnaire to collect data. With the help of statistical package for service solutions version 25, the researchers analyzed the data through the means and their associated standard deviations. It came to light that student-teachers' moderate familiarity and competency level of integrating ICT in mathematics instruction was predominant. Notwithstanding, familiarity level was a significant predictor of their competency level. It was thus suggested that mathematics teachers should take matters of familiarity and competency levels as key factors determining ICT integration for mathematics instruction.

Keywords: familiarity and competency, information and communication technology, mathematics instruction, mathematics teachers, public junior high school

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INTRODUCTION

Governments in Ghana have efforts made to promote quality mathematics education at all levels. Most recent attempt was the National Council for Curriculum and Assessment (NaCCA) led new educational reforms in 2019, which was implemented in September 2019. The new curriculum places emphasis on critical thinking, enquiry, and problem solving. It is expected that pupils are well equipped in these skills so that they can function effectively as individuals, prepare adequately for the world of work. This will in no small way impact significantly to the individual, the nation and the world in general (Ministry of Education, 2019).

Theoretical Framework

The researchers deployed the unified theory of acceptance and use of technology (UTAUT) as the underlying theoretical frameworks. These twin theories propelled the mathematics teachers to show adequate familiarity and professional competence on the usage of information and communication technolog (ICT) in mathematics teaching in general (Netsianda & Ramalla, 2021). It has widely been accepted that integrating ICT into mathematics teaching promotes student motivation, arouses their curiosity, ensures active participation and enhances academic performance (Haji Ismail et al., 2023). However, teachers' familiarity and competency is a significant factor in examining integrating ICT into mathematics education at all levels. Aslan and Zhu (2016) and Perienen (2020) explain factors determining teacher's competency. Some of these factors are knowledge, skills and ability. Extant literature shows that familiarity and competency levels are key to the implementation of into mathematics instruction (Onwuagboke et al., 2015). Nwosu et al. (2018) support the course of this argument and recommend the same factors for consideration to propel mathematics instruction to much higher heights.

Additionally, it has been observed that knowledge of ICT integration concepts is a strong predictor of its successful application and usage in mathematics instruction (Okolije, 2016). The perspectives of these scholars imply that effective integration if ICT in classrooms hinges on teachers' competency and is a strong predictor of its success in mathematics learning. Therefore, efforts should be made to ensure the development of mathematics teachers' competency levels to guarantee effective and smooth amalgamation of ICT and mathematics education for improved learning of the subject. Hence, for a successful integration of ICT into mathematics instruction to be achieved, there must be a cogent assessment of this marriage over time.

Familiarity and Competency

Teachers' familiarity of ICT and competency levels must receive considerable attention in recent times, and therefore, not new. Indeed, scholars opined that the need to determine whether a relationship exists between familiarity and competency of ICT integration is based on the conviction that familiarity is a predictor and bolster of teachers' ICT competency (Padayachee, 2017). Quite apart, teachers' positive attitude cannot be glossed over in the consideration of this milieu and should enhance the familiarity and competency in much better ways. Being familiar with ICT is an excellent indicator not only for confidence, desire and readiness but also an outstanding demonstration of a very positive attitude toward ICT acceptance and use in instructional processes. Several previous studies have shown that familiarity levels of teachers are an important predictor of their competency in the usage (Uluyol & Sahin, 2016).

Consistent with previous proclamation, the lace between ICT and mathematics is not a new phenomenon. Both the process and product create positive engagement, motivation and curiosity. The many different software applications and the interfaces that are embedded into the features make mathematics instructions not just fun but also explorative and innovative (Teo & Milutinovic, 2015). It is therefore imperative that teachers continue to strive to improve their pedagogical content knowledge to meet the ever-growing new innovations and innovations in these knowledge explosive application software. Teacher competency then stands as the strongest driving force for the integration in school mathematics. The ultimate beneficiary of such teacher competency is national and global assets that can be tapped into the development of other related fields of human endeavors.

Even though competency and familiarity remain one of the key driving forces towards achieving this goal, they remain untold, and their impact remains unnoticed. This gap is not just a research problem but also a huge gaps observed in theory, practice and policy. Many teachers still grapple to use best suitable theories in ICT. Policy makers become frustrated on directing ICT-mathematics instruction and students just become mere followers of the system of non-direction. Although education authorities are generally aware that teachers' competency and familiarity levels affects their classroom instructional practices, it appears there is still no clear directions on the relationship between mathematics teachers' familiarity and teachers' competency.

The researchers thus investigated this relationship with respect to ICT integration in mathematics instruction (Esfijani & Zamani, 2020; Kaleli-Yilmaz, 2015). The level of mathematics performance among pupils in Effutu Municipal Education District of Ghana in recent years is disturbing. **Table 1** presents a four-year results of pupils in the first external examination in the primary or basic school, called basic education certificate examination (BECE). The analysis of BECE showed that generally, a good percentage of the candidate performed below average. The report showed that the pass rate was just 59.52%. The year 2016 recorded 60.50% pass and 39.50% fail. Performance in 2017 declined with 58.20% of the students passed and 41.80% failed. Performance improved over the previous year in 2018 with 60.80% pass and 39.20% failure. The year 2019 pass rate dropped to 59.60% while fail increased to 41.40%. The trend in performance revealed that there has been a steady decline in academic performance, and if no attempt is made to halt this trend, performance could worsen in the years ahead.

Table 1. Performance in BECE

Cohort	Pass (%)	Fail (%)
2016	60.50	39.50
2017	58.20	41.80
2018	60.80	39.20
2019	58.60	41.40
Average	**59.52**	**40.48**

These results have implications on the education and future of the pupils. Firstly, the results suggested that for the past four years, nearly 41.00% of the pupils could not meet the required prerequisites that would qualify them for admission into second cycle institutions because Mathematics is a compulsory subject that constitutes a vital component in the grading of BECE results. Secondly, it could be estimated that more than 40.00% of the graduates have their education truncated and their hopes dashed as a result of their failure in mathematics. This problem must become a matter for public policy and debate on the best instrument to use for classroom mathematics instruction.

Research (Padayachee, 2017; Sawyerr, 2021) has documented that teacher's familiarity and competency to integrate ICT in mathematics has a link with students' mathematics performance. As a result, one is likely to attribute the poor performance in mathematics in the municipality to mathematics teachers' familiarity and competency levels of ICT in mathematics instruction. Without familiarity and competency, asking teachers to integrate ICT into mathematics instruction would create much burden and further aggravate the poor performance in mathematics (González-Pérez & Ramírez-Montoya, 2022). However, the lack of empirical proof in the Municipality to confirm this conclusion would trigger questions on the credibility of the conclusion, and subsequently render it unscientific. It is against this background that the researchers carried out the study to investigate mathematics teachers' familiarity and competency levels in integrating ICT in mathematics instruction, which is critical to turning the table round for the better. Consequently, the following three research questions guided the study:

1. What is the familiarity level of JHS mathematics teachers' integration of ICT for mathematics instruction?
2. What is the competency level of JHS mathematics teachers' integration of ICT for mathematics instruction?
3. What is the relationship between familiarity and competency levels in integrating ICT into mathematics instructions?

METHODOLOGY

Philosophical Underpinning

The positivist philosophy underpinned this study. It is deduced that the positivist epistemological viewpoint suggests that the only authentic knowledge is derived from structured and controlled procedures as contained in the natural sciences like biology, chemistry, and physics. In essence, social scientists are required to adopt laid down processes to arrive at knowledge that is tenable. With the positivist tradition, this study would require the use of structured questionnaires to gather quantifiable data for statistical analysis to test theories and hypotheses (Creswell & Creswell, 2017).

Research Design

The cross-sectional research design was adopted for this study. In this design, we explored the design to collect data from a cross section of the pupils over a period of time. The main purpose of adopting the design was to describe the teachers' levels of competency and familiarity. With this design, the data is collected at just a single point in time although the time it took to collect all of the data may take place anywhere from days to few weeks or more. The cross-sectional survey provided an opportunity to elicit a large volume of data within a relatively short time with less cost, which enable the research to take a snapshot of the prevailing conditions. By implication, this design enabled the researchers to define the units of data collection as it ensured rapid data collection with minimal expenditure of efforts, time and money (Creswell & Creswell, 2017).

Research Approach

The researchers deploy the quantitative approach to underpin the study. With this approach, the researchers gathered data from the views of the participants in relation to the phenomenon. This phenomenon was mainly the relationship between two variables and mathematics instruction (Creswell & Creswell, 2017).

Research Setting

The researchers conducted the study in one municipal district, called the Effutu Municipality in the Central Region of Ghana. It is located along the coastline of Central Ghana and has over five educational sub-districts, which are called circuits. Each circuit has over ten primary and basic schools. The school are mainly coeducational for both boys and boys. In each of the schools, you can meet male and female teachers who teacher various subjects.

Population (Target and Accessible)

In this study, the researchers targeted teachers who teach mathematics in the study area. The schools are built and financed by the state and private proprietors. However, because many teachers in the primary classes do not teach mathematics extensively, we resorted to teachers in the public junior high school (JHS). This group of teachers were chosen as the accessible populations for reasons being that vast majority of these teachers in the public JHS are part-time teachers in the private schools, hence including these private schools will be a duplication of relevant evidence needed with respect to the study. The teachers were considered appropriate for the study because their experience in ICT integration has implication on pupils BECE mathematics performance.

Sample and Sample Size Determination

The census method was used to involve all the 75 mathematics teachers in the Effutu Municipality of Ghana. These teachers were selected based on the convenience and their proximity to the university (Haji Ismail et al., 2023).

Instrumentation

We used mainly the questionnaire to collect the data from the teachers. The questionnaire was made simple, unambiguous, straightforward, reader friendly and easy to understand (Cohen et al., 2018). Because of these attributes, many teachers found no problems reading and responding to the items and the researchers equally incurred minimal cost and expenditure. The researchers themselves developed an ICT integration closed-ended questionnaire to investigate mathematics teachers' best way of integration of ICT into mathematics instruction.

We structured the sections of the questionnaire from A to D. Section A consisted of the respondents' biographic data (excluding names and other personal identity). The section provided some information on gender, age, professional qualification, years of teaching mathematics and rank. Section 'B' consisted of a five-point Likert scale, which involved "5=high, 4=above average, 3=moderate, 2=below average, and 1=low", which explore the familiarity level of mathematics teachers, the third section "C" looked at competency level of ICT usage among JHS mathematics teachers and the fourth section "D" also explored the challenges that are associated with the integration. The closed-ended questionnaires were administered to all the eighty-seven respondents to solicit data from mathematics teachers.

Reliability

The reliability statistics calculated for the internal consistency for the questionnaire (Cohen et al., 2018). Earlier, a pilot test was used to help to modify and restructure the items in the questionnaire. It was piloted among 25 mathematics teachers in the Gomoa West District. Gomoa West District is the nearest area and has similar geographic and educational characteristics to the area of the study.

The questionnaire consisted of three sections and the reliability coefficient each of the section was calculated. "α" is the alpha value for measuring the internal consistency. For teacher familiarity level on ICT integration α=0.71, on teachers' competency level of ICT integration had α=0.83 and the final section, which was on challenges associated with ICT integration was α=0.70. A Cronbach's alpha coefficient greater 0.70 is considered reliable and good indicative of internal consistency. The reliability coefficient guided the researcher to identify and correct some items that were wrongly formulated, those that give some unintended results as well as those that were similar in meaning to other items.

Validity

The researchers used validity instruments to assess the construct that the instruments were supposed to measure. An instrument is said to be valid if it measures what it is supposed to measure. Face validity was used to assess whether an instrument appeared to measure what it was supposed to measure. Content validity addressed the match between items and the content or subject domain they were intended to measure. Construct validity was used to measure intelligence and other all personality factors related to intelligence. Criterion validity was used to measure the correlation between the instrument and criterion. A high correlation between 0.50 and 1.00 was deemed a high degree of validity (Tambara, 2015). Apart from these measures, the researchers consulted other academics who are experts in the field of mathematics education who deeply scrutinized and assessed the instruments for their relevancy. This was done mainly to ensure that instruments addressed all relevant issues in phenomenon under study.

Data Analysis

The questionnaire was coded and entered into the statistical product for service solution (SPSS) version 25. The data were then explored to identify missing data and outliers. Descriptive statistics (mean [M] and standard deviations [SDs]) was used for the analysis of demographic data and the first two research questions. After satisfying the assumptions, we further subjected the analysis to Chi-square test to compare familiarity and competency levels. The following two possible results were expected from the comparisons:

1. If the test statistic is lower than Chi-square value, we would fail to reject the hypothesis of equal levels of familiarity and

Table 2. Information of teachers

Variables & categories	Frequency (n)	Percentage (%)
Sex		
Male	42	56.00
Female	33	44.00
Age		
Less than 30	15	20.00
30-39 years	44	58.70
40-49 years	15	20.00
50+	1	1.30
Academic qualification		
Certificate A	3	4.00
Diploma	11	14.60
Bachelor's degree	47	62.70
Masters	14	18.70
Years of experience		
1-3 years	13	17.30
4-6 years	8	10.70
7-10 years	30	40.00
11+ years	24	32.00

Note. Source: Fieldwork data (2021)

competency. Then we would conclude that the level of familiarity of the students across the entire population have the same level of competency. So, we say the fit of equal levels is "good enough."

2. If the test statistic is higher than Chi-square value, we would reject the hypothesis of equal levels. Hence, we cannot conclude that the level of familiarity in ICT is the same in each of the level of competency. So, the fit of equal levels is "not good enough" (Creswell & Creswell, 2017).

RESULTS AND DISCUSSIONS

Table 2 shows that there were more male (56.00%) than female (44.00%). Teachers of age 30-39 dominated (58.70%), followed by less than 30 years (20.00%), ages of 40-49 (20.00%) and 50 years and above (1.50%). The most dominant professional qualification was bachelor's, followed by master's, diploma (14.60%) and certificate 'A' (4.00%). Most of the teachers spent seven to10 years teaching mathematics, followed by 11 years and above, one to three years, and four to six years. The demographic distributions of the teachers were fairly represented by all variables and showed little signs of bias. In this way, the researchers could deduce conditions necessary to analyze the issues of familiarity and competency levels (Perienen, 2020).

Mathematics Teachers Familiarity

In this study, mathematics teachers' familiarity was assessed in the following constructs: their access and ownership of digital tools, their frequency of using digital tools and knowledge, their experience with e-Learning and the use of instructional activities using ICT. In this study, M and SD were calculated to determine the perceived level of familiarity. The 5-point Likert scale data interpretation showed that M of less than 2.50 indicated low familiarity, M between 2.50 and 3.50 showed moderate familiarity, and M of 3.50 and above indicated high familiarity (Perienen, 2020).

The findings in **Table 3** shows varied familiarity levels for mathematics teachers on integrating ICT in mathematics instruction. However, the information showed that teachers had moderate familiarity on the frequency of use of digital tools and knowledge, which was rated first (M=3.05, SD=0.86), followed by moderate familiarity on access and ownership to digital tools (M=2.65, SD=1.00), moderate instructional activity using ICT (M=2.61, SD=1.19), while mathematics teachers had low familiarity on experience with e-learning, which was the least form of familiarity experienced by mathematics teachers (M=2.44, SD=0.65). Overall, mathematics teachers had moderate familiarity level of ICT integration in mathematics instruction yielding an M of (M=2.69, SD=0.65). In view of the fact that M score is 3.00, it was concluded that except for knowledge of frequency and frequency of use of digital tools, all the other facets of familiarity were low among mathematics teachers.

Mathematics Teachers' Competency

The results of the research question have been displayed on **Table 4**. Using the same criteria as in **research question one**, M of 2.50 indicated low competency, M between 2.50 and 3.50 showed moderate competency, and M of 3.50 or higher indicated high competency.

It is revealed from the findings in **Table 4** that the mathematics teachers had varied levels of competency on the indicators outlined in this study. Indeed, the findings showed that the respondents rated highest on making personal (M=3.55), followed by ICT use (M=3.51), mastery of range of educational and assessment paradigms (M=2.81, SD=0.78), using ICT as a mind tool (M=2.68, SD=0.85), while the overall level of competency yielded (M=3.02, SD=0.70). Additionally, it could be realized that Mathematics teachers exhibited high variables of competency and ICT use but moderate competency in mastering educational and assessment, using ICT as a mind tool as well as the overall.

Relationship Between Familiarity and Competency Levels

The researchers ensured that the following assumptions binding the chi-square statistics were tested and satisfied:

1. The data values came from a simple random sample from the full population.
2. The categorical or nominal data was not appropriate for continuous data.
3. The data set was large enough so that at least five values were expected in each of the observed data categories.

To draw a conclusion, we compared test statistic to a critical value from Chi-square distribution involving the following four steps:

Table 3. Familiarity of mathematics teachers

Sub-scales of familiarity	Mean	Standard deviation	Level of familiarity
Knowledge of & frequency of use of digital tools	3.05	0.86	Moderate familiarity
Access & ownership to digital tools	2.65	1.00	Moderate familiarity
Instructional activity using ICT	2.61	1.00	Moderate familiarity
Teachers experience with e-learning	2.44	0.67	Low familiarity
Overall familiarity level	**2.69**	**0.65**	**Moderate familiarity**

Note. Source: Fieldwork data (2021)

Table 4. Competency mathematics teachers

Sub-scales of competency	Mean	Standard deviation	Level of competency
ICT personalization	3.55	0.91	High competency
ICT use	3.51	1.02	High competency
Mastery of range of educational & assessment paradigms	2.81	0.78	Moderate competency
Using ICT as a mind tool	2.68	0.85	Moderate competency
Overall level of competency	**3.02**	**0.70**	**Moderate competency**

Note. Source: Fieldwork data (2021)

1. We first decided on the risk we are willing to take of drawing an incorrect conclusion based on our sample observations. For the familiarity data, we decided prior to collecting data that we were willing to take a 5.00% risk of concluding that the familiarity counts across the full population were not equal when they really were. That is, we set the significance level, α, to 0.05.
2. We calculated a test statistic. Our test statistic was 57.95.
3. We found the theoretical value from the Chi-square distribution based on our significance level. The theoretical value was the value we expected if the familiarity was the same across each student's competency.
4. In addition to the significance level, we also needed the *degrees of freedom* to find this value. For the goodness of fit test, this is one fewer than the number of categories. We have five competency levels, so we have 5-1=4 degrees of freedom. The Chi-square value with α=0.05 and four degrees of freedom is 9.884.
5. We compare the value of our test statistic (57.95) to Chi-square value. Since 57.950>9.884, we rejected the null hypothesis that the familiarity levels were equal. In fact, Pearson correlation coefficient of 0.878 showed that they were strong relationships between familiarity and competency levels.

We make inference that familiarity levels across the full population do not have an equal number of competency levels.

Discussion of Findings

We would discuss the findings of the two research questions in this section. This would enable teachers to finetune the areas of inadequacies and even improved upon their areas of comparative strengths.

Research question one was formulated in response to the first research objective, which sought to explore the familiarity level of JHS mathematics instruction. Having solicited the view of the respondents in the questionnaire, it was prudent to measure their familiarity level of integrating ICT in mathematics instruction. The findings with respect to the familiarity indicators: that is, their access and ownership of digital tools, their frequency of using digital tools and knowledge, their experience with e-Learning and the use of instructional activities using ICT revealed that, JHS mathematics teachers have moderate familiarity level on the frequency of use of digital tools and knowledge that rated first, followed by moderate familiarity on access and ownership to digital tools, moderate instructional activity using, whiles low familiarity on experience with e-learning was the least form of familiarity experienced by mathematics teachers (Alhashem et al., 2022).

With the overall, depicting mathematics teachers had moderate familiarity level of ICT integration in mathematics instruction. Considering access and ownership of digital tools as an indicator, the results denote that, a good number of mathematics teachers have moderate familiarity with ICT integration in mathematics instructions. Studies (González-Pérez & Ramírez-Montoya, 2022; Padayachee, 2017) show that there is diversity among teachers in terms of their access and ownership of digital tools instruction. These revelations can therefore serve as a basis for developing policy and mechanism Regarding teachers experience with e-learning as an indicator of teachers' familiarity of ICT integration, the results indicated that mathematics teachers have low familiarity level, depicting that majority of mathematics teachers seldom used the digital tools for online mathematics instructional activities. The access and use of digital tools cannot be surest bet teachers' use of digital tools during online instructional activities.

Similarly, on frequency of using digital tools and knowledge, the results showed that technology has created enormous impact on use and knowledge of integrating technology into mathematics instruction, hence it is revealed that public JHS mathematics teachers have moderate knowledge and frequency of use of digital tools. Most teachers have moderate ICT knowledge and hence used it for lesson preparation and information searching, even though teachers are found to have moderate knowledge and frequency of use of digital tools , they are however reluctant to integrate it in their instructional activities. One reason assigned to this phenomenon is the fact that many teachers fail to utilize ICT tools to stimulate students' higher-order cognitive thinking and the active reconstructions of knowledge (Esfijani & Zamani, 2020).

Furthermore, on the aspect of teachers' instructional activity using ICT as an indicator of familiarity, the findings revealed that, public JHS mathematics teachers moderately use computer-based technologies as part of their requirement for effective lesson delivery in the classrooms, which brings about students learning and improvement of their conceptual understanding of concepts that they teach. The integrating computer technology into mathematics instruction is the best strategies for making classroom mathematics learning practical, real and authentic. This draws knowledge closer to real life situations and boost applications of the classroom knowledge. There are lessons in using computer- based technologies among teachers. These lessons are the increase in interest and attention, provision of feedbacks, real life experiences, higher thinking skills and better understanding of numeracy and literacy skills (Esfijani & Zamani, 2020).

Research question two sought to examine the teachers' integration of ICT in mathematics instruction. It was discovered that mathematics teachers had varied levels of competency of integrating ICT for mathematics instruction, for instance, considering the indicators of ICT competency, that is, making personal use, teachers had high competency on the use of technologies such as maths-apps, programs and web 2.0 applications, which facilitate mathematics instruction in the classrooms. Teachers' personal use of ICT is an essential prerequisite for efficiency and effectiveness for successful teaching and learning (Perienen, 2020).

Additionally, on the aspect of mastery of range of educational paradigm and using ICT as a mind tool, the findings revealed that public JHS mathematics teachers have moderate competency on databases, spreadsheets, search engines, visualization tools as compared to the other two indicators of ICT competency, although ICT integration help teachers relate to pupils and to mathematics content, and this consolidate mathematics knowledge and its applications to life, mathematics teachers in the Municipality are thus said to have moderate competency of ICT integration but nonetheless seldom use it in their instructional delivery. Mathematics teachers must therefore continuously develop their competency of ICT. For example, teachers must therefore continuously develop themselves and learn and in this learning process, pay more attention to mind tools as they play an important role, encourage teachers to form groups to facilitate cooperative learning, boost continuous professional development and retain more competently qualified teachers (Perienen, 2020). More importantly, even though mathematics teachers had high and moderate competency, they were reluctant in their quest to integrate ICT. There is the possibility that teachers would exercise the greatest of knowledge in the various applications' software necessary to propel mathematics instructions (Netsianda & Ramaila, 2021).

Research question three made an inferential conclusion that familiarity levels across the full population do not have an equal number of competency levels. The overall findings revealed that although public JHS mathematics teachers have moderate familiarity with regards to these indicators; knowledge and frequency of use of digital tools, access and ownership of digital tools and teachers' instructional activity using ICT, nevertheless they were found to have low familiarity on their experience with e-learning of mathematics (Okolije, 2016; Sawyerr, 2021).

Key Findings

On familiarity level, the findings showed a greater number of mathematics teachers had moderate familiarity level of ICT integration in mathematics instruction. It further revealed that even though mathematics teachers had moderate familiarity for 'knowledge of frequency' and 'frequency of use of digital tools', all the other indicators of familiarity were uncommon among mathematics teachers.

On competency level, the findings revealed that mathematics teachers had varied levels of competency on the indicators outlined in the study. Indeed, the findings showed that the respondents rated highest on 'making personal use of ICT'. This variable was important to help teachers use ICT tools, master the strategies and effectively assess learning. Additionally, it revealed that mathematics teachers' competency was high. This definitely helped the teachers use ICT tools to create and innovate mathematics and effectively pass on to their students who can apply the knowledge of mathematics in every human endeavour.

On their relationship, it revealed that familiarity and competency levels were not the same. Some mathematics teachers exhibited high competency in making personal use of ICT. However, some exhibited moderate competency in mastery of range of educational and assessment paradigms and using ICT as a mind tool as well as the overall. This mixed situation was the same for familiarity.

CONCLUSIONS

It therefore sufficed to conclude that teachers had fair knowledge of familiarity and competencies. Familiarity levels across the full population did not have an equal number of competency levels. However, much still leaves to be desired if stakeholders aspire to achieve greatest performance of mathematics.

Implications

With reference to the findings of the study, the following implications could be derived for policy consideration:

1. Mathematics teachers should take the matters of familiarity levels as key factors determining ICT integration in mathematics instruction, by undergoing continuous professional development programs.
2. Mathematics teachers, as a matter of urgency, should collaborate among themselves to design ICT-based activities that are geared towards improving on their ICT competency.
3. Broader research across other geographic areas of education and countries on could enhance teachers' familiarity and competency.
4. It was anticipated that the findings could support teachers with knowledge to integrate ICT into mathematics instruction.
5. The findings would generate public debate and attract the attention of policy makers and other education stakeholders to address challenges of ICT integration.
6. The findings significantly impacted on teachers' familiarity and competency levels in integrating ICT in classroom instruction.

The findings revealed that mathematics teachers had a moderate level of familiarity and competence in integrating ICT in mathematics teaching. However, the level of familiarity was a significant predictor of their level of competence. Therefore, it was recommended that mathematics teachers should take issues of familiarity and proficiency levels as key factors determining the integration of ICT for mathematics teaching.

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