Original Research Article

A SURVEY OF JUNIOR AND SENIOR HIGH SCHOOL TEACHERS' PERCEPTIONS AND PERCEIVED SKILLS OF ICT INTEGRATION IN TEACHING AND LEARNING OF MATHEMATICS

ABSTRACT

Aims: The study sought to investigate the mathematics teachers' perceptions and perceived skills of ICT in the teaching and learning of mathematics in some selected junior and senior high schools in Ghana.

Study Design: This study used descriptive cross-sectional survey research design.

Methodology: The main instrument used for the study was questionnaire. The sample size for the study comprised both JHS and SHS mathematics teachers. In this study, cluster sampling and simple random techniques were used to select one hundred and twenty (120) teachers in junior and senior high schools in the keta municipality of the Volta region of which 76 were males and 29 were females. Out of the one hundred and twenty (120) teachers selected, one hundred and five (105) teachers presented back the questionnaire for analysis, 42 were J.H.S teachers and 63 were S.H.S teachers.

Results: The respondents agreed that using ICT in teaching and learning of mathematics is good, indicating positive perception among teachers. Again, the respondents showed that they possess some level of skills in using ICT in teaching and learning of mathematics.

Conclusions: Most mathematics teachers in the J.H.S and S.H.S have positive perception and skills to support the view that the integration of ICT in the teaching and learning of mathematics is useful and can improve teaching and learning in the mathematics classroom.

Keywords: *ICT, Mathematics, Perception, Skills, teaching and learning*

INTRODUCTION

The world is now a global village as per the current trends of information and communication technology (ICT). The importance of ICT in the lives of people and students in particular cannot

be underestimated. This is true because ICT enables rapid and easy access to a wide range of information in the world. In fact, it is now difficult to imagine a world without information technology for which Ghana is not an exception. In the view of Atteh, Assan-Donkoh, Ayiku, Nkansah and Adams (2020b) the use of ICT has become more and more popular in instructional setting due to the availability of its numerous capabilities since most students feel motivated by using computer technologies, as they can learn and advance more independently. It is believed that the use of technology makes it easier for students to perform multiple rapid computations and also offers quicker and more accurate feedback that is unbiased (Atteh *et al*., 2020b). Agreeing to the fact that the world today has become a global village with all parts of human existence comprehensively reliant on computers and advanced communication systems for its functioning, it has become essential for our teachers to learn how to acquire the ICT skills to be effective teachers (Bingimlas, 2009) because, there is the conception that ICT can play a key role in enhancing teaching and learning (Lewis & Goodison, 2004). Therefore, it has been established that many teachers use ICT tools including social media and other social networking sites to upgrade themselves and students learning capacity to assist and empower students and make them active individuals in the learning environment (Atteh, Assan-Donkoh, Mensah, Boadi, Badzi and Lawer, 2020a).

There is a widespread agreement that teachers' knowledge and skills in ICT plays a significant role (Koehler & Mishra, 2006). As a result, the government and other institutions have put in huge sums of money in the procurement of computers and creation of computer laboratories in most junior and Senior high schools. This brings about a question of whether mathematics teachers need any additional backing to be able to incorporate efficiently the use of ICT in their everyday teaching schedules.

In mathematics teaching and learning, teachers' beliefs about mathematics learning with or without using technology are considered to be important because it could influence teaching and learning, and curriculum reform. Just as teachers hold beliefs about mathematics that may influence how they teach or structure the learning environment, teachers also hold beliefs about the use of technology. Notwithstanding the apparent benefits of the use of ICT for educational purpose, studies show that in many cases, the learning potential of ICT is deprived as many teachers who are ICT literate do not use it in their teaching (Lau & Sim, 2008). Barak (2006)

reveals that teachers abuse ICT for their own learning but they are cautious about integrating advanced technologies in their instruction. According to Barak, while teachers recognize the potential of technology in stimulating students' learning and making school studies relevant to real-life contexts, they do not think that ICT is preferable for class-based instruction or for promoting cooperation and reflection in learning.

Therefore, it can be suggests that teachers' perceptions are critical to the success or failure of ICT integrating in the teaching and learning process (Can and Cagiltay, 2006). Teachers tend to use technology in ways shaped by their own personal perspectives on the curriculum and on their pedagogical practices (Lai, Pratt, & Trewern, 2001). Can and Cagiltay (2006) conducted a study to investigate the perceptions and future plans of a group of prospective computer teachers in Turkey. The study revealed that participants have positive perceptions regarding the use of computer games with educational features in education. However, some of the participants have doubts, especially concerning the issues of classroom management and the educational effectiveness of new computer games currently on the market. This may be due to the perception of the participants about the adoption of new technologies other than the ones they are familiar with. Consequently, these teachers might be reluctant to use new computer games and technology in their future instructional practice. Furthermore, some studies have also indicated that, recurring faults, and the expectation of faults occurring during ICT use in teaching sessions reduces teachers' confidence and cause teachers to avoid using technology (Slaouti & Barton, 2007).

However, to use technology to facilitate student learning, teachers need additional knowledge and skills that depends on a consideration of the interactions among technology, content, and pedagogy. That is, technology integration requires that pre – and in – service teachers understand:

a. the technology tools themselves, combined with,
b. the specific affordances of each tool that, when used to teach content, enable difficult concepts to be learned more readily, thus resulting in the achievement of meaningful student outcomes (Angeli & Valanies,2009).

This suggests that teachers need knowledge of the technology itself. Thus, if teachers are going to prepare their students to be technologically capable; they need to have, at the very least, basic

technology skills. This was confirmed by Lawless and Pellegrino (2007) that "technological literacy has fast become one of the skills of teaching" (p. 580).

Teaching with technology requires teachers to expand their knowledge of pedagogical practices across multiple aspects of the planning, implementation, and evaluation process. According to Cennamo, Ross, and Ertmer (2010), to achieve technology integration that targets student learning, teachers need knowledge that enable them to:

a. Identify which technologies are needed to support specific curricular goals,
b. Specify how the tools will be used to help students meet and demonstrate those goals
c. Enable students to use appropriate technologies in all phases of the learning process including exploration, analysis, and production
d. Select and use appropriate technologies to address needs, solve problems, and resolve issues related to their own professional practices and growth.

Purpose of the study

The study sought to investigate the mathematics teachers' perceptions and perceived skills of ICT in the teaching and learning of mathematics in some selected junior and senior high schools in Ghana. In view of that, this research investigated:

1. The JHS and SHS mathematics teachers' perceptions of ICT use in teaching mathematics.
2. Teachers' skills in ICT use among JHS and SHS mathematics teachers.

Research questions

The study was steered by the following research questions:

1. What are the perceptions of JHS and SHS mathematics teachers ICT integration in teaching?
2. What are the skills of JHS and SHS mathematics teachers in ICT?

METHODOLOGY

This study used descriptive cross-sectional survey research design to seek answers to the research questions. According to Fraenkel and Wallem (2000) cross-sectional survey involves

collecting information at just one point in time from a sample that has been drawn from a predetermined population by administering questionnaire or ability to test individuals to find out specific characteristics of the group. A questionnaire was chosen as an instrument to gather the data for this study after a careful review of suitable literature. Benefits of a questionnaire include consistency of presentation of questions to the respondents, assurance of anonymity for the respondents and less time taken to administer (Fraenkel & Wallem, 2000; Muijs, 2004). The questionnaires used for the data collection were closed-ended. The questionnaire for soliciting responds on perceptions was multi-dimensional in nature with a Likert scale and the items were scaled using 5 point Likert scale which started with "Strongly Disagree to Strongly Agree". Additionally, the questionnaire for soliciting responds on perceived skills was also multi-dimensional in nature with a Likert scale and the items were scaled using 4 point Likert scale which started with "Cannot use to High use". The questionnaire consisted of two main sections with the first section soliciting opinion of respondents on the perceptions of teachers on ICT use whilst the second section dealt with the perceived skills of teachers aside the biographic section.

The sample size for the study comprised both JHS and SHS mathematics teachers. They were drawn from all public Senior and Junior High Schools in the Volta region of Ghana. In this study, cluster sampling technique was used to select one hundred and twenty (120) teachers in junior and senior high schools in the keta municipality of the Volta region. Cohen, Manion, & Morrison (2000) explain cluster sampling as a type of sampling method where the researcher divides the population in separate groups called clusters. Then simple random sample of clusters is selected from the population. In this study, the researcher divided the Volta region into three clusters (Northern, Southern and Central clusters). Southern cluster was selected and within that Keta municipality was selected using simple random sampling. The teachers who participated in this study had a wide variety of educational backgrounds and experiences with their educational qualifications ranging from Teachers' Cert A to first degree and their number of years of teaching ranging between 2-20 years. Out of the one hundred and twenty (120) teachers selected, one hundred and five (105) teachers presented back the questionnaire, 42 were J.H.S teachers and 63 were S.H.S teachers. The response rate was 87.5% which is statistically a good return rate valid for analyses (Cohen, Manion, & Morrison, 2000). Out of the 105 mathematics teachers, 72% (n=76) were male and 28% (n=29) were female.

RESULTS

Research Question One: What are the perceptions of SHS and JHS mathematics teachers ICT integration in teaching.

Table 1: Teacher's perceptions of ICT integration in teaching and learning of mathematics

Item	SA N (%)	A N (%)	N N (%)	D N (%)	SD N (%)	Total
1. ICT can improve teaching and learning	78(74)	23(22)	4(4)	0(0)	0(0)	105
2. ICT can enhance students' participation and feed back to teachers.	50(48)	49(46)	4(4)	0(0)	2(2)	105
3. ICT can enhance teacher and student interaction.	48(46)	51(48)	6(6)	0(0)	0(0)	105
4. ICT can enhance collaboration among students	52(49)	46(44)	5(5)	2(2)	0(0)	105
5. The internet provides a means of expanding and applying what has been taught in class	66(63)	32(30)	4(2)	1(1)	2(2)	105
6. When using ICT, my role will be a facilitator of individual students learning	30(28)	62(59)	9(9)	2(2)	2(2)	105
7. ICT tends to increase students learning motivation	58(55)	36(34)	7(7)	4(4)	0(0)	105
8. Computers promote students' ability with learning task (eg. Writing, analyzing data, or solving problems)	33(31)	57(55)	1(1)	12(11)	2(2)	105
9. I believe by integrating ICT in teaching, I am helping students to	74(71)	26(24)	4(4)	1(1)	0(0)	105

acquire the basic computer education needed for their future career						
10. ICT can enhance students' critical thinking	42(40)	24(23)	9(9)	30(28)	0(0)	105

Table 1 above shows that the respondents agreed with the statements items in 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 with over 60% or above choosing either Agree/Strongly Agree to each of the statements. This shows that the respondents agreed that using ICT in teaching and learning of mathematics is good, indicating positive perception among teachers.

Research Question Two: What are the skills of SHS and JHS mathematics teachers in ICT?

Table 2: indicates mathematics teachers' ratings on their ability to use ICT tools in the teaching and learning process.

Item	High N(%)	Moderate N (%)	Low N(%)	Cannot use N (%)	Total
1. Word processor (eg. Microsoft Word)	44(41)	42 (40)	8 (8)	11(11)	105
2. Spread Sheet (eg. Microsoft Excel)	26(25)	54 (51)	14(13)	11(11)	105
3. Presentation Packages (eg. Microsoft Power Point)	28(27)	56 (53)	8(8)	13 (12)	105
4. Data Base (eg. Microsoft Acess)	28(27)	33 (31)	23(22)	21(20)	105
5. Search Engines (eg. Google, Bing, etc)	50(47)	35 (33)	9 (9)	11 (11)	105
6. Communication (eg. E – mail, Skype, twitter, etc)	45(43)	48 (45)	2(2)	10(10)	105
7. Instructional Softwares (eg. Geogebra, Drive 5, SPSS, etc)	18(17)	29 (28)	35(33)	23 (22)	
8. Hardwares (eg. Printers, Projectors, Scanners, etc)	34(32)	36 (35)	21(20)	14(13)	

Table 2 above shows that the respondents agreed with the statements items in 1, 2, 3, 4, 5, 6, and 8 with over 58% or above choosing either High/Moderate to each of the statements. This shows that the respondents agreed that they possess some level of skills in using ICT in teaching and learning of mathematics. However, slightly more than half of the respondents indicated that they cannot use instructional software's. Majority, 55% (n=58) out of 105 respondents indicated they cannot use instructional software's.

DISCUSSION

The result of the findings in table 1 revealed that SHS and JHS mathematics teachers have positive perceptions about ICT integration in teaching and learning of mathematics. However, this finding agrees with the views of Can and Cagiltay (2006); Lua and Sim (2008) who revealed that, in general, teachers broadly have positive perceptions about the use of ICT in the teaching and learning process. The study also revealed that Most of the J.H.S and S.H.S mathematics teachers indicated that ICT integration is useful in:

a. Improving teaching and learning.
b. Enhancing students' participation and feed back to teachers.
c. Increasing students learning motivation.
d. Helping students to acquire the basic computer education needed for their future careers.
e. Promoting cooperative work among students.
f. Helping students to expand and applying what has been taught in class.

This result is in line with the results of other similar studies carried out in different countries, for instance, Lua and Sim (2008). Lua and Sim (2008) found that, in general teachers broadly agree that the use of ICT:

a. make them more effective and organize in their teaching,
b. help them to meet the varying needs of students,
c. make their lesson plan richer with the use of the internet.

Accordingly, there is a need to encourage prospective teachers to move belief into practice so that their positive perceptions about the usefulness of ICTs in the teaching and learning process will replicate in our institutions.

Additionally, the result of the findings in table 2 revealed that majority of SHS and JHS mathematics teachers had the skill in the following ICT tools:

a. Word Processor (eg. Microsoft Word)
b. Spread Sheet (eg. Microsoft Excel)
c. Presentation Packages (eg. Microsoft Power Point)
d. Search Engines (eg. Google, Bing, etc)
e. Communication (eg. E – mail, Skype, twitter, etc)
f. Hardwares (eg. Printers, Projectors, Scanners, etc)
g. Data Base (eg. Microsoft Acess)

This result is in line with the results of other similar research carried out by Koehler and Mishra (2006, 2009) which presented the concept Technological Pedagogical Content Knowledge (TPACK) to stress the complete set of competencies teachers need to effectively integrate ICT in their educational practice.

Hence, notwithstanding the generally positive perception of mathematics teachers about ICT integration, circumstantial conditions might affect the effective putting into practice technology integration in mathematics instruction, for example when teachers lack the skills of using instructional software's in mathematics, as the study found that slightly more than half of the JHS and SHS mathematics teachers indicated that they cannot use instructional software's.

CONCLUSION/RECOMMENDATIONS

In view of the findings of the study, most mathematics teachers in the J.H.S and S.H.S have positive perception and support the view that the integration of ICT in the teaching and learning of mathematics is useful and can improve teaching and learning in several different folds. In addition, it was also found in the study that majority of the mathematics teachers had the skills in various ICT tools which are useful and forms the central requirement of the integration of technology into teaching and learning in the mathematics classroom. The following are therefore recommended in the study:

1. The Ministry of Education and the Ghana Education Service should make available the necessary ICT infrastructure in schools in order to promote ICT integration in the

teaching and learning process and also to bring out policies that binds all mathematics teachers to use ICT in their lessons.

2. The regional or district education service should organize workshops occasionally to expose teachers to the new trends of ICT applications or instructional software's.
3. Heads of the various J.H.S and S.H.S institutions should try and organize in – service training in professional development courses related to the integration of ICT in teaching and learning of mathematics for their teachers.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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