

PERCEPTIONS ON THE PRACTICES OF ICT INTEGRATION IN TEACHING AND LEARNING: A SURVEY OF SCHOOL MATHEMATICS TEACHERS

ABSTRACT

Aim: The study Sought to investigate school mathematics teachers use of ICT in teaching and the perceived barriers and challenges of ICT integration in the teaching and learning of mathematics.

Study Design: The study used a case study research design.

Methodology: 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. Out of the one hundred and twenty (120) teachers selected in the Keta municipality of the Volta region, one hundred and five (105) teachers presented back the questionnaire with a response rate of 87% for analysis. Of the one hundred and five (105) teachers, 72% were males and 28% were females.

Results: The study indicated that the extent to which mathematics teachers use ICT in teaching mathematics was very little. However, mathematics teachers often use ICT for general computer applications such as finding information on the internet for teaching, communicating with colleagues and students, sending emails and preparing notes for teaching etc.

It was revealed that, Respondents do not have adequate training and access to instructional technology.

Respondents perceived that, the scarcity of printers and presentation equipment in schools may limit their ability to integrate ICT in the teaching and learning process.

Conclusions: Most mathematics teachers do not use ICT in their teaching because of the technical know-how and inadequate ICT tools. However, those teachers with little knowledge of ICT prefer to use ICT for general purposes rather than teaching.

Keywords: mathematics; integration; Information and Communication Technology.

1.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 exaggerated. 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.

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 [1] because, there is the conception that ICT can play a key role in enhancing teaching and learning [2]

Consequently, the new educational reforms in Ghana which was launched in June, 2007 placed much importance on the integration of ICT tools in all subject areas and most importantly emphasis on ICT as a tool for teaching mathematics. For example, the syllabus for teaching mathematics at the Senior High School level put emphasis on the use of spreadsheet in drawing graphs and calculating mean, mode, median and standard deviation and also make use of the calculator and the computer for problem solving and investigations of real-life situations [3].

The government of Ghana recognizes the need for teacher support for mathematics teachers in various ways. He considers ICT literacy as an engine for accelerated development as enshrined

in the Ghana Information and Communication Technology for Accelerated development [4]. According to the ICT4AD policy,

Ghana's educational system is expected to improve by using ICT to: (i) improve and expand access to educational training and research resources; (ii) improve the quality of education and training and (iii) make the educational system responsive to the needs and requirements of the economy and society with specific reference to the development of the information and knowledge-based economy and society [5]. Comprehensive research studies have revealed that technology plays important role in teaching and learning mathematics. For example, [6] argue that technology develops the way mathematics should be taught and enriches students understanding of basic concepts. As a result, there has been substantial effort by the Government in the introduction of ICT in teacher education as well.

Furthermore, University of Education, Winneba (UEW) and the University of Cape Coast (UCC), the two teacher training universities in Ghana have made enormous investment in technological facilities and infrastructure over the years to increase accessibility of ICT facilities and equipment to students and lecturers for effective ICT instruction [7].

There is a widespread agreement that teachers' knowledge and skills in ICT plays a significant role [8] 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. Nevertheless, it is still uncertain whether these computers are being used effectively by teachers in their routine lesson delivery. 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.

It was therefore imperative to conduct an empirical study that would investigate the mathematics teachers' perceptions on practices of ICT integration in the Ghanaian educational system.

1.1 Purpose of the Study

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

1.2 Research Questions

The following research questions guided the study:

1. To what extent do JHS and SHS mathematics teachers use ICT in teaching?
2. What are the barriers and challenges to ICT integration in the teaching and learning of mathematics as perceived by mathematics teachers?

2. METHODOLOGY

The population of the study comprised of all public Senior and Junior High School Mathematics Teachers in the Volta region of Ghana. 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. [9] explain cluster sampling as a type of sampling method where the researcher divides the population in separate groups called clusters.

This study used cross-sectional survey research design. According to [10] 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.

The main instrument used was the questionnaire, which were self-administered consisted of close ended format and rating scale type of questions. Thus, the usage of the likert scale. According to [11] Likert scale looks interesting to respondents and people often enjoy completing this type of scale.

The questionnaire focused on three (3) main parts (A-C).

Part (A) contained six (6) items that solicited for information on the demographic of the respondents. The variables in part (A) covered respondents' gender, age, highest qualification, teaching experience, computer experience and computer usage.

While the second part (B) consisted of six (6) items (i.e. 25 – 30), that solicited for information on respondents' ICT use in teaching and learning of mathematics, with rating

Scale: Almost always (3), Frequently (2), Often (1), Never (0)

The last part (C) consisted of fourteen (14) items (i.e. 31 - 44) that solicited for information on respondents' perceptions of Barriers and Challenges in ICT integration in teaching and learning of mathematics, with rating Scale: Strongly Agree (SA = 5), Agree (A = 4), Neutral (N = 3), Disagree (D = 2), Strongly Disagree (SD = 1).

Out of the one hundred and twenty (120) teachers selected, one hundred and five (105) teachers presented back the questionnaire. The response rate was 87.5% which is statistically a good return rate valid for analyses [9].

3. RESULT

3.1 Research Question One

To what extent do JHS and SHS mathematics teachers use ICT in teaching?

Table 1 indicates how mathematics teachers' rate their frequency of ICT use in the teaching and learning of mathematics. Majority of the respondents (76%, $n = 79$) indicated that they never use ICT in giving class instruction for item 25.

For item 26, majority 79% ($n = 83$) indicated that they never use ICT in communicating with students.

Also, item 27 majority 79% (n = 83) indicated they never use ICT in organizing class discussions, demonstrations and presentations.

Furthermore majority 76% (n = 79) of the respondents indicated they never use ICT to assess students learning through test for item 28.

Item 29 majority 87% (n = 91) of the respondents indicated they never use ICT in sending feedback to students.

Lastly, for item 30 majority 86% (n = 91) of the respondents indicated they never use ICT in supporting collaboration among students. The result above indicates that basically mathematics teachers do not use ICT in their teaching.

3.2 Research Question Two

What are the barriers and challenges to ICT integration in the teaching and learning of mathematics as perceived by mathematics teachers?

Table 2 indicates respondents perceived barriers of ICT integration in the teaching and learning of mathematics. Out of 105 respondents 63% (n=66) of them generally agreed that they have adequate training and access to instructional technology (Item 31). This shows that, slightly more than half of the respondents were of the view that they have adequate training and access to instructional technology.

Slightly more than half (53%, n=56) of the respondents generally disagreed that using technology for instruction is cheap in Ghana (Item 32). This means that more than half of the respondents noted that using technology for instruction in Ghana is not cheap.

For Item 33, (59%, n=62) of the respondents generally agreed that there are training opportunities for teachers on the field to acquire new computer knowledge or skills.

For item 34, 60% (n= 63) of the respondents generally disagreed that they have personal a computer they use for teaching. This shows most teachers do not have personal computers that they can use for teaching.

Somewhat more than half (73%, n=77) of the respondents generally agreed that their school has a computer laboratory (Item 35). This means that more than half of the respondents noted that their schools have computer laboratories.

Again, somewhat more than half (52%, n=55) of the respondents generally agreed that they have access to their school's computer laboratory (Item 36). This means that more than half of the respondents have access to their school's computer laboratory.

Also, 56% (n=59) out of the 105 respondents generally disagreed that there are sufficient computers in computer laboratories (Item 37).

For item 38, 68% (n=71) generally disagreed that there are sufficient presentation equipment and 39, 67% (n=70) generally disagreed that there are sufficient input devices (item 39).

Consequently, more than half (68%, n=71) of the respondents generally disagreed that there are sufficient output devices (Item 40).

For item 41, 64% (n= 67) of the respondents generally disagreed which means that most of the respondents perceived that there is no frequent technical support in their schools.

More than half (60%, n= 63) of the respondents generally with item 42 which implies that, most of the respondents perceived that there is no sufficient time to develop instructional materials that use computers in their school.

For Item 43, respondents agreed (66%, n=69)) that their expertise in computer skills will help them in using instructional technology.

More than half (67%, n= 70) of the respondents generally disagreed with item 44 which suggests that, most of the respondents perceived that there are no professional development courses related to the integration of ICT organized frequently in their schools.

Item	All most always	Frequently	Often	Never	Total
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	N (%)	N (%)	N (%)	N (%)	
25. I use ICT in giving class instruction	8 (8)	18 (17)	11(11)	68 (65)	105
26. I use ICT in communicating with students	8 (8)	14 (13)	18 (17)	65 (62)	105
27. I use ICT in organizing class discussions, demonstrations and presentations	0 (0)	22 (21)	14 (13)	69 (66)	105
28. I use ICT in assessing students learning through test	14(13)	12 (11)	11 (11)	68 (65)	105
29. I use ICT in sending feedback to students	6 (6)	8 (8)	17(16)	74 (71)	105
30. I use ICT in supporting collaboration among students	0 (0)	14 (13)	15 (14)	76 (72)	105

Table 1. Teachers frequency of ICT use in the teaching and learning of mathematics.

Table 2. Teachers' perception of barriers and challenges in ICT integration in teaching and learning of mathematics

Item	SA N (%)	A N (%)	N N (%)	D N (%)	SD N (%)	Total
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31.	I have adequate training and access to instructional technology	14 (13)	52 (50)	20 (19)	8 (8)	11 (11)	105
32.	Using technology for instruction is cheap in Ghana	6 (6)	10 (10)	4 (31)	31 (30)	25 (24)	105
33.	There are training opportunities for teachers on the field to acquire new computer knowledge or skills	8 (8)	54 (51)	19 (18)	8 (8)	16 (15)	105
34.	I own a computer that I use for teaching	18 (17)	17 (16)	7 (7)	38 (36)	25 (24)	105
35.	My school has a computer laboratory	47 (45)	30 (29)	4 (4)	14 (13)	10 (10)	105
36.	I have access to my school's computer laboratory	27 (26)	28 (27)	9 (9)	27 (26)	14 (13)	105
37.	There are sufficient computers in computer laboratories	14 (13)	26 (25)	6 (6)	31 (30)	28 (27)	105
38.	There sufficient presentation equipment	8 (8)	19 (18)	7 (7)	40 (38)	31 (30)	105
39.	There are sufficient input devices in computer laboratories	4 (4)	5 (25)	5 (5)	40 (38)	30 (29)	105
40.	There are sufficient output devices	0 (0)	25 (24)	9 (9)	43 (41)	28 (27)	105
41.	There is frequent technical support in me	0 (0)	21 (20)	17 (16)	28 (27)	39 (37)	105
42.	There is sufficient time to develop instructional materials that use computers in my						

school	0 (0)	22 (21)	20 (19)	36 (34)	27 (26)	105
43. my expertise in computer skills will help me in using instructional technology	14 (13)	55 (52)	11 (11)	7 (7)	18 (17)	105
44. Professional development courses related to the integration of ICT are organized frequently in my school	0 (0)	26 (25)	9 (9)	20 (19)	50 (48)	105

4.DISCUSSION

Results indicated that the extent to which mathematics teachers use ICT in teaching mathematics was very little. However, mathematics teachers often use ICT for general computer applications such as finding information on the internet for teaching, communicating with colleagues and students, sending emails and preparing notes for teaching etc. This result is consistent with the findings of [12] who established that majority of the teachers in SHS level in Ghana do not use ICT in classrooms but often use technology to prepare lesson notes, browse the web and send emails.

Similar studies carried out in different countries also confirm the result. For example, [13] established that even though teachers show great interest and motivation to learn about the potential of ICT, in practice, the use of technology is moderately low and it is concentrated on a narrow range of applications, with word processing being the predominant use. Also, a study conducted by [14] to examine the extent of ICT use in instruction revealed that very few teachers are serious users of computers in the classroom.

Again, it was revealed that:

- Respondents saw that they do not have adequate training and access to instructional technology
- Respondents perceived that, the scarcity of printers and presentation equipment in schools may limit their ability to integrate ICT in the teaching and learning process.
- Respondents perceived that, there are insufficient computers in computer laboratories
- Training of Mathematics teachers regularly can help them to use ICT in instructing Mathematics [15].

These results are in consistent with the findings of other studies, which revealed that lack of training for teachers especially in the use of mathematics software, lack of ICT resource in schools, insufficient time to integrate ICT due to overloaded mathematics syllabus, lack of knowledge and skills required by teachers to integrate ICT in the teaching and learning process are some of the problems in integrating ICT in mathematic teaching and learning e.g.,[16];[17]; [18]

Conversely, a number of conditions that may enhance the use of computers in the classroom were suggested by [19]. These include (i) allocation of time in the school schedule for students to use computers as part of class assignments, (ii) availability and convenient access to ICT facilities and equipment, and (iii) teachers' personal philosophies that support a student-centered, constructivist pedagogy.

5. CONCLUSION AND RECOMMENDATIONS

Most mathematics teachers do not use ICT in their teaching because of the technical know-how and inadequate ICT tools. However, those teachers with little knowledge of ICT prefer to use ICT for general purposes rather than teaching. The following decisions or actions are therefore recommended in the study:

1. The Curriculum Research Development Division (CRDD) of the Ghana

Education Service in collaboration with the related agencies in the Ministry of Education should carry out research to review critically the mathematics curriculum and revise the existing syllabus to explicitly state what ICT tools must be used and how it should be used in the teaching and learning process.

2. In collaboration with some NGOs the district or regional education service can donate computers to less equipped schools and also as a way of motivation, teachers can be given laptops in a form of loan packages.
3. The heads of the institutions in collaboration with the Heads of Departments should emphasize the use of computer laboratory by each teacher at least once a week in both J.H.S and S.H.S level, to encourage the use of ICT in the teaching and learning of mathematics.

DISCLAIMER

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 funded by personal efforts of the authors.

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