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# Investigating the Adoption and Integration of ICT in the Teaching and Learning of Mathematics

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**ABSTRACT**
*This paper investigates the perceptions of undergraduate and postgraduate in-service teachers towards adoption and integration of ICT in the teaching and learning of mathematics in Zimbabwe's schools. A total of 43 participants took part in the study. The data was collected using a 40-item questionnaire which contained 33 structured and 7 open-ended questionnaires. Focus group discussions were also undertaken in the study. The Statistical Package for Social Scientists (SPSS) was used to analyse the data. Chi-Square test and Analysis of Variance (ANOVA) were performed to test hypotheses of different treatment means. Some constructs were perceived to be very important while others were perceived to be not that important. The constructs which were consistently given high scores were; computer technology is easy to use, generates interest, improves confidence, gives quality lesson presentation, is motivating, enhances good career prospects, clarifies concepts, gives prestige and is pivotal for national development. Those constructs which were consistently ranked low included among others; ICT is addictive, time wasting and expensive. The study also shows that even though the majority of teachers percieved ICT in positive light, the teachers faced hurdles which militated against the adoption and integration of ICT in their teaching of mathematics. Prominent hurdles which were revealed include unreliability and unavailability of electricity and internet onnectivity, inadequate infrastructure and lack of relevant training that is necessary in the full utilization and integration of ICT in their actual teaching practices. Lack of administrators' support and lack of access to computer laboratories were also cited as notable hindrances. Study findings also suggested that teachers' negative perceptions towards ICT could be attributed to fear of losing relevance, authority and influence as they strongly felt that increased ICT use would lead to redundancy. It is therefore recommended that when embracing ICT in the teaching and learning of mathematics, empahasis must be directed towards those constructs which were identified to be statistically signifant in the study.*

## INTRODUCTION

Mathematics forms the cornerstone of scientific and technological development in every society and is an undisputed agent of any nation's development and wealth creation (Eniayeju & Azuka, 2010; Ale & Adetula, 2010). The study of mathematics is invaluable because it leads to many academic and career opportunities, for instance, medicine, engineering, agronomy and economics to name just but a few professions. Thus the study of mathematics is a determinant of the scientific, industrial, technological and social progress of a society (Amponsah, Ametefe, J & Mensah F, 2013). Statistics from the Zimbabwe Schools Examinations Council (ZIMSEC) show that the pass rates for mathematics have remained

low over the years, with the pass rate for the subject in the November 2012 examination having been reported as 13.91% (Share, 2013). Such a trend is disturbing and one possible way to improve pass rates in mathematics would be to incorporate ICT in the teaching and learning of mathematics (Usman & Ezeh, 2010).

From our observation, Zimbabwe has in recent years witnessed a phenomenal growth in the use of ICT in the day-to-day lives of its people. Mobile technology has taken the country by storm, with the Posts and Telecommunications Regulatory Authority of Zimbabwe reporting that Zimbabwe's mobile tele-density had reached 103.5% by year ending December 2013 (Kabweza, 2014). The major networks in the country have also provided internet services on top of the many services they avail to their clients. Many mobile subscribers in Zimbabwe also utilise Facebook, Twitter and Whatsup platforms in their daily socio-economic and business activities. The boom in the Zimbabwe's ICT sector Zimbabwe has been witnessed by the mushrooming of internet cafes, computer retail shops and several professional computer courses being offered at public and private educational institutions throughout the country. The Zimbabwean government has also chipped in by donating computers to schools (The Finacial Gazzette, 1 November 2012 & The Herald, 12 June 2014)

However, a major concern has been the slow pace in ICT integration in the country's educational system (Bhukuvhani et al, 2011), and this occurrence has also been observed in other countries as well (Knights, 2009). This state of affairs is exacerbated by the fact that Zimbabwe has a dedicated ICT policy that was adopted in 2005 with the sole aim of promoting ICT usage in the education system as recommended by the Nziramasanga Commission Report of 1999 (Isaacs, 2007). In order to unravel the whole scenario, the researchers were driven by a burning desire to find possible reasons why implementation of ICT in classroom practice is far below expectations. Granted, findings of this research may persuade policy-makers to come up with strategies to accelerate implementation of ICT Policy in Education.

Daily human activities involve use of technology in one way or another, be it using the computer, talking on the mobile phone or watching television, just to name but a few (Onasanya et-al, 2010). ICT has thus become increasingly important in our daily lives and in our educational system (Goyal et al, 2011). Using appropriate technology in the teaching of mathematics, even from the primary school level, would be a way of trying to meet the second goal of the Millennium Development Goal (MDGs), as this strives to meet students' mathematical needs, thereby preparing them to solve societal problems and thus making them functional members of society (Usman & Ezeh, 2010).

Research has shown that ICT use can enhance better teaching methodologies and improved student performance (Usman & Ezeh, 2010) as it enhances students' understanding of basic mathematics conceots (Mohd & Maat, 2013). A technology-rich teaching and learning environment affords new ways of engaging students in learning mathematics (Brown, 2006). Technology introduces new teaching and learning techniques whose pragmatic role cannot be underestimated (Lagrange, 2003). Despite the prevalence of ICTs in every facet of modern human experience, and despite the fact that the modern day student lives, moves, communicates, learns and works in a technology-driven environment, ICTs have not been widely integrated into the teaching and learning in schools (Onasanya etal, 2010). Research has revealed that while the potential of ICT to enhance the teaching and learning of mathematics is being recognised (Goyal et al, 2011), the integration of ICT into classrooms seems to be more difficult than expected (Lagrange, 2003).

Against this background of increased technology use, the researchers sought to investigate the level of adoption and integration of ICTs in the classroom, particularly the mathematics

classroom. The research is focussed on the teacher for the main reason that the teacher is recognised as being pivotal to the adoption and integration of ICT in schools (Lagrange, 2003). The teachers' perceptions and attitudes have a bearing on the extent and pace of the adoption of modern methods of teaching which make use of technology to enhance effective teaching and learning (Andoh, 2012). In a similar study, Knights (2009) investigated the perceived impact of ICT on mathematical learning by mathematics teachers in the United Kingdom. In her study she found out that even though teachers felt comfortable using ICT in their classrooms, they were reluctant to allow pupils to use technology because of potential behaviour management issues and unfamiliarity with the computer programmes available.

There is need to sensitise our educational practitioners, be they teachers or lecturers, towards computer literacy because the success of adoption and integration of ICT in our Educational system will be guaranteed (Onasanya, 2010). The perceptions, which ultimately shape the attitudes of teachers towards ICT, are a major determinant of the adoption and integration of computers in their teaching (Andoh, 2012). Hence it is important to gain an insight and understanding of the teachers' perceptions and beliefs on technology in order to accelerate the wholesale adoption and integration of ICT in Zimbabwe's education system.

## RESEARCH QUESTIONS

1. What are the in-service teachers' perceptions towards adoption and integration of ICT in the teaching of mathematics?
2. Are there any statistically significant differences in the in-service teachers' perceptions by gender?
3. Are there any statistically significant differences in in-service teachers' perceptions between rural teachers and their urban counterparts?
4. What are the factors that hinder adoption and integration of ICT in schools?

## RESEARCH METHODOLOGY

This research design for the study was based on a survey. The study comprised of 26 fourth-year Bachelor of Science Education (HBScEd Mathematics) and 17 first-year Master of Science Education (MScEd Mathematics) degree programmes in the 2013-2014 academic year. The participants were in-service teachers practising in Zimbabwean schools and were enrolled at Bindura University of Science Education to further their education. Convenient sampling technique was used to sample the participants. A 40-item questionnaire which contained 33 structured and 7 open-ended questions was self-administered and the response rate was 91%. The Statistical Package for Social Scientists (SPSS) was used to analyse the data. The Chi-Square test and Analysis of Variance (ANOVA) statistical techniques were performed to test the hypotheses that guided the study. The sample size of 43 was deemed sufficient to carry out the study considering the analyis techniques used to meet the assumption of the responses, that is, Chi-Square test for association and ANOVA for treatment means.

## RESULTS AND DISCUSSION

Seventy-two percent (31) of the partcicipants were male while twenty-eight percent (12) were female. Forty-nine percent (21) had done ICT prior to coming to university while fifty-one percent (22) had not done so. Forty-seven percent (20) were teaching in rural schools, while thirty-seven percent (16) and sixteen percent (7) were teaching in urban and peri-urban urban schools respectively. Nine percent (4), seventy-two percent (31) and nineteen percent (8) were teaching at primary, secondary and tertiary levels respectively. Teaching experience ranged from 4 years to 24 years. On being asked if they were computer literate all paricipants were affirmative. Fifty-six percent (24) indicated that they had access

to internet at their schools while forty-four percent [19] had no access.

**Teaching aids**

**Table 1.** Have you ever used an Overhead Projector (OHP) when teaching mathematics?

| Response | Frequency | Percent |
|---|---|---|
| Yes | 15 | 35% |
| No | 28 | 65% |
| Total | 43 | 100% |

The results shown in Table 1, above shows that even though all the participants had indicated that they had some degree of computer literaty, that is, they were familiar with computers in general, the results above show that the Overhead projector which is often used in conjuction with a computer/laptop is not being adequately used in Zimbabwe's schools. This is detrimental to the full realization of the the potential offered by ICTs in the effective teaching of mathematics.

**Table 2.** Which resource do you prefer when teaching mathematics?

| Resource | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Chalkboard/Whiteboard | 27 | 63% | 63% |
| Overhead Projector | 15 | 35% | 98% |
| Both | 1 | 2% | 100% |
| Total | 43 | 100% | |

Table 2 above ndicates that the 63% of partcipants prefer the chalkboard over the overhead projector. The reasons advanced for this by the paricipants varied widely. Among the group that preferred the chalkboard, 37% indicated that the chalkboard clearly shows all the steps as working of a problem progresses, 19% cited lack of knowledge of using OHP as the reason for prefering to use the chalkboad while 12% indicated that the chalkboard was always accessible and available. Other less prominent reasons included that the chalkboard is easy to use (8%) and saves time (4%).

Of those particpants who preferred the OHP, 54% felt that the OHP gives quality presentation which is clear and neat, 15% gave the reason that the OHP is less laborious and 8% thought that the OHP covered much more work in less time and that the OHP is highly interactive and draws attention of the learner (8%).

These results give us an impression that the chalkboard, even in this modern era, is still popular with most teachers in Zimbabwe.

Internet usage

**Table 3.** Results for weekly internet usage

| Weekly Internet Usage (Hours) | Frequency | Percent (%) | Cumulative Percentage |
|---|---|---|---|
| <5 | 29 | 67 | 67 |
| 5-10 | 6 | 14 | 81 |
| 10-15 | 8 | 19 | 100 |
| Total | 43 | 100 | |

The frequencies in Table 3 above show that a majority 67% of the participants have a weekly internate usage of less than 5 hours, which is less than adequate when compared to Whitney (2009) who found that an average internet user was by then online for 13 hours per week. Reasons advanced to explain low internet usage include unavailability or unreability of power and internet connectivity as well as time constraints.

Presentation of written work

**Table 4.** In which form do you prefer to prepare and submit your assignment?

| Type | Frequency | Percent | Cumulative Percentage |
|---|---|---|---|
| Handwritten form | 6 | 14% | 14% |
| Printed form. Third person types it for me on a computer | 5 | 12% | 26% |
| Printed form. Type it on a computer myself | 32 | 74% | 100% |
| Total | 43 | 100% | |

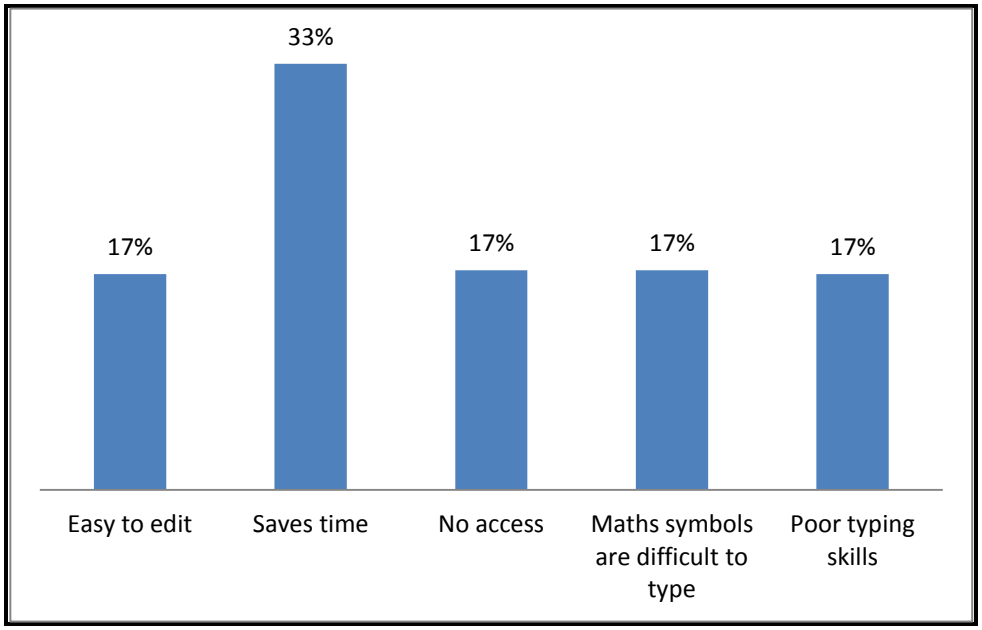


**Figure 1** Reasons for preferring to prepare and submit handwritten assignments

Results shown in Figure 1 show that those who prefer to submit handwritten assignments feel that, since they have poor typing skills, they would save time in respect of typing, proof-reading and editing. Seventeen percent did not have any other choice because they had no access to technology.

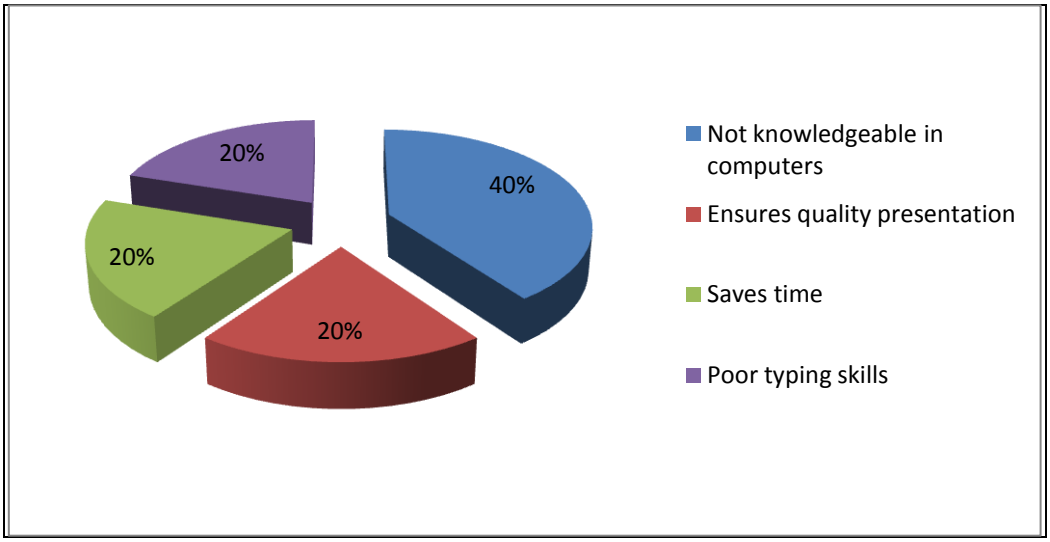


**Figure 2.** Reasons for preferring assignments typed by third party

It is noted from the findings in Figure 2 above that those who prefer to have their assignment typed by third party are not knowledgeable in computers, have poor typing skills which have a bearing on time management.

Table 4 reveals a high proportion of participants (74%) would prefer to type and print their assignments by themselves when compared to the other two options. Reasons advanced included that they were knowledgeable in computers (31%) which made their typing, proof-reading, editing easier and cheaper. Sixteen percent of those participants who preferred to type and print their own assignment also enjoyed the opportunity of typing in order to improve their computer skills. Nine percent felt that a typed assignment is clearer and more presentable. These results are an indicator of the participants' readiness to adopt ICT in their academic activities

**Computer packages**

**Table 5.** Mean frequency scores and standard deviations for various resources

| RESOURCE | MEAN FREQUENCY OF USE SCORE (Current Study) | MEAN FREQUENCY OF USE SCORE (Knights' 2009 Study) | STANDARD DEVIATION (Current Study) |
|---|---|---|---|
| Microsoft Word | 3.09 | 2.13 | 0.89 |
| Microsoft Excel | 2.56 | 1.77 | 0.83 |
| Microsoft PowerPoint | 2.37 | 2.65 | 0.66 |
| Microsoft Publisher | 1.79 | ----- | 0.67 |
| Internet (Free sites) | 2.51 | 2.39 | 0.80 |
| Data Projector | 1.74 | 2.73 | 0,48 |
| MATLAB | 1.26 | ----- | 0.62 |
| MINITAB | 1.30 | ----- | 0.64 |
| LATEX | 1.51 | ----- | 1.05 |
| MATHEMATICA | 1.19 | ----- | 0.55 |
| MAPLE | 1.16 | ----- | 0.43 |
| JAVA | 1.33 | ----- | 0.61 |

Results indicate that although a high proportion (86%) had access to computers at their workplaces, they still did not utilise the full functionality of computers as evidenced by low mean frequency of use scores as shown in Table 4 above. A mean frequency score of 3 would indicate moderate usage while a score of 5 would signal high usage and a score of 1 would indicate very low usage. The table shows that participants are use Microsoft Word much more than all the others, whose mean frequency scores are well below 3. Results also show low mean frequency of use scores for mathematical and statistical packages which range from 1.16 to 1.51. This clearly shows that participants have a deficiency in those packages.

When compared to Knight's 2009 study which was done in the United Kingdom, we notice that the results for the current study are comparable for Microsoft PowerPoint, internet (free sites) but higher values for Microsoft Word and Microsoft Excel. However the current study shows that the use of the Data Projector has not yet gained momentum in Zimbabwe's schools. This agrees with findings already discussed under the section 'Teaching Aids', where it was found that 63% preferred the chalkboard over the overhead projector which was favoured by 35% of the participants.

Perceived benefits of adopting and integrating ICT

**Table 6.** What do you consider to be the benefits of ICT in the mathematics classroom?

| Benefits | Frequency | Percent | Valid Percent |
|---|---|---|---|
| Saves time/fast | 9 | 21% | 22% |
| Easy storage/retrieval of data | 1 | 2% | 2% |
| Highly motivating/arouses interest | 10 | 23 | 24% |
| High quality presentation/diagrams clear and legible | 3 | 7% | 7% |
| Facilitates research | 5 | 12% | 12% |
| Easy lesson presentation | 1 | 2% | 2% |
| Enhances effective learning/teaching | 3 | 7% | 7% |
| Easy to make demonstrations | 1 | 2% | 2% |
| Keep up with modern technology | 3 | 7% | 7% |
| Less work for teacher | 2 | 5% | 5% |
| Highly interactive | 1 | 2% | 2% |
| Allows quick feedback | 1 | 2% | 2% |
| ICT use is student-centred | 1 | 2% | 2% |
| Total | 41 | 95% | 100% |

Mean responses for perceptions

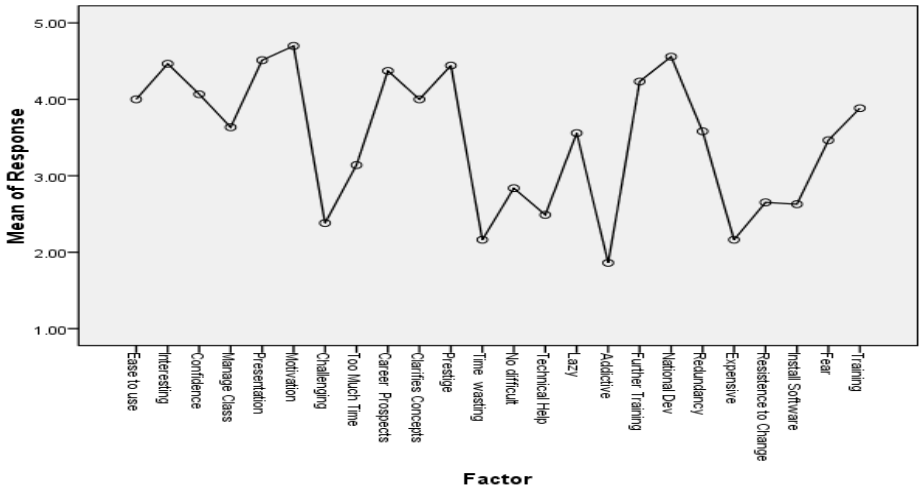


**Figure 3.** Mean of response for perceptions

A Likert scale was used where 5 stood for strongly agree, 4 – agree, 3 – neutral, 2 – disagree and 1 – disagree strongly. Figure 3 shows very high average ratings ranging between 4 and 5 for; computers are easy to use, generates, improves confidence, quality lesson presentation , motivating, enhances good career prospects, clarifies concepts, gives prestige, pivotal for national development and need for further training. These results reveal that teachers were unanimous in their acceptance and readiness to adopt and integrate ICT in their teaching of mathematics, provided that the relevant training was provided to them. They also felt that ICT use was highly motivating to students and was pivotal for national development in a world that has become a global village.

However the study witnessed very low ratings for; ICT is addictive, time wasting and expensive. This implies that teachers do not regard using ICT as time wasting nor expensive and they do not feel that students would get hooked on computers to the detriment of their academic work. This tells us that teachers, despite isolated incidences or drawbacks that may result as a consequence of infusing ICT in their teaching of mathematics, they prefer using it nonetheless. This was despite the teachers' highly held perception that if not handled with care, ICT use could result in students' laziness where they would stop thinking and would be entirely be dependent on the computers to solve problems for them. This observation was confirmed by Gilbert (2005). They felt that such an outcome would be highly undesirable and unacceptable and would need to be guarded against at all cost.

Perceived challenges or factors hindering adoption and integration of ICT.

**Table 7.** Which challenges or factors hinder ICT adoption and integration?

| Factor | Frequency | Percent | Valid Percent |
|---|---|---|---|
| ICT resources expensive to acquire | 20 | 46.5% | 55.6% |
| Internet facilities not always available | 1 | 2.3% | 2.8% |
| Lack of support from administrators | 2 | 4.6% | 5.6% |
| Lack of teachers' computer training | 7 | 16.3% | 19.4% |
| no power/erratic power supply | 5 | 11.6% | 13.9% |
| lack of access to computer laboratory | 1 | 2.3% | 2.8% |
| Total | 36 | 83.7% | 100% |

Overally the prominent perceived challenges of adopting and integrating ICT were lack of finacial resources (55.6%), lack of teacher training (19.4%) and unavailability of power (13.9%). Other challenges included lack of internet facilities (2.8%), lack of administrators' support (5.6%) and lack of access to computer laboratories (2.8%).

The table above shows that a sizable percentage (56%) find the cost of ICT as a hindrance to its adoption and integration in schools followed by those who cite lack of computer training(19%) as a major factor. Other factors highlighted include unavailabilty of internet (3%), lack of administrator's support (3%), erratic power supply (14%) and lack of access to computer laboratory (3%).

Percieved drawbacks of adopting and integrating ICT

**Table 9.** Location of teacher versus percieved disadvantages of ICT.

| Reason | Rural (%) | Urban(%) | Peri-Urban(%) |
|---|---|---|---|
| Lack of practice by students | 22% | | 11% |
| Teachers' lack of computer training | 6% | 29% | 3% |
| Some schools not electrified | 22% | | 14% |
| ICT makes teachers lazy | 6% | 7% | 24% |
| Abuse of computers | 6% | | 3% |
| Lack of financial resources | 11% | 7% | 3% |
| Teacher's authority reduced | 11% | | 5% |
| Lack of control by teacher | 6% | | 5% |
| Affected by frequent power cuts | 11% | 29% | 8% |
| Teacher becomes redundant | | 7% | 3% |
| Demonstrations not possible on computers | | | 3% |
| No immediate feedback | | 7% | 3% |
| Too fast-paced for slow learners | | | 3% |
| ICT resources expensive to acquire | | | 3% |
| Students need close monitoring | | 7% | 3% |
| Students get hooked on ICT devices | | | 5% |
| Setting up hardware time consuming | | 7% | 3% |
| TOTAL | 100% | 100% | 100% |

The results show that twenty-two percent of rural shools electrified and 14% of the peri-urban schools were electrified while all urban schools were electrified, assuming that the teachers taught at different schools. Teachers operating in the per-urban and ruaral areas felt that was it not for lack of electrical power, then adoption and integration of ICT would be made easier.

Peceived computer ease of use

**Table 13.** Highest qualification versus perceived computer ease of use.

| Computers are easy to use | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Strongly Disagree | Disagree | Not sure | Agree | Strongly Agree | Total |
| Highest qualification | CE | | | | 50% | 50% | 100% |
| | Diploma | 4% | 4% | 12% | 64% | 16% | 100% |
| | Bachelor Degree | | | | 81% | 19% | 100% |

Table 13 above, all degree and cerificate holders find computer easy to use while eighty percent of diploma holders find computers easy.

Chi-Square Tests

Table 14. Chi-Square test. Teacher's location versus computer ease of use

| Chi-Square Test | | | |
|---|---|---|---|
| | Value | df | Asymp. Sig.(2-sided) |
| Pearson Chi-Square | 4.118914 | 8 | 0.846 |

The Chi-Square test was performed to test for any association between teacher's location and computer ease of use. The p-value was found to be 0.846, as shown in Table 14 above. This value was larger than 0.5, we concluded that there is a strong relationship between location of teacher and ease of use.

Chi-Square tests performed for to test for association between location of teacher and various other perceptions are tabulated below.

**Table 13.** P-values for location versus perception

| Perception | P-Value | Decision |
|---|---|---|
| ICT makes teaching interesting | 0.275 | FAIL TO REJECT |
| ICT improves confidence | 0.847 | |
| ICT improves lesson presentation | 0.842 | |
| ICT boosts student's motivation | 0.831 | |
| ICT helps to clarify concepts | 0.650 | |
| ICT makes students lazy | 0.586 | |
| ICT makes teachers redundant | 0.986 | |
| Tearchers are resistant to change | 0.869 | |
| Teachers fear computer failure | 0.015 | REJECT |

From Table 13 above we can observe that location of teacher has a bearing on teachers' perceptions as regards confidence, presentation, motivation, clarity of concepts, laziness, redundancy and resistance to change, while their location has no association with their percieved views on ICT interest and fear of computer failure.

The same perceptions were also tested for association versus the gender of partcipant and the results are tabulated below:

**Table 14**. P-values for gender versus perception

| CHI-SQUARE TEST: GENDER OF TEACHER VERSUS PERCEPTION | | |
|---|---|---|
| Perception | P-Value | Decision |
| Computer ease of use | 0.546. | |
| ICT makes teaching interesting | 0.062 | FAIL TO REJECT |
| ICT improves confidence | 0.838 | |
| ICT improves lesson presentation | 0.430 | |
| ICT boosts student's motivation | 0 .578 | |
| ICT helps to clarify concepts | 0.834 | |
| ICT makes students lazy | 0.356 | |
| ICT makes teachers redundant | 0.909 | |
| Tearchers are resistant to change | 0.578 | |
| Teachers fear computer failure | 0.643 | |

Table 14 above illustrates that gender of teacher is associated with all the given perceptions

Chi-Square test to test for association between a teacher's gender and computer ease of use gave a p-value of 0.546. This shows that there is a weak association between the teacher's gender and their perceptions on computer ease of use.

The p-value was 0.727 showing that association exists between the highest qualification held and perceived ease of use.

**Table 15.** P-values for highest qualification versus perception

| CHI-SQUARE TEST: QUALIFICATION VERSUS PERCEPTION | | |
|---|---|---|
| Perception | P-Value | Decision |
| ICT makes teaching interesting | 0.804 | FAIL TO REJECT |
| ICT improves confidence | 0.891 | |
| ICT improves lesson presentation | 0.850 | |
| ICT boosts student's motivation | 0.915 | |
| ICT helps to clarify concepts | 0.450 | |
| ICT makes students lazy | 0.632 | |
| ICT makes teachers redundant | 0.731 | |
| Tearchers are resistant to change | 0.734 | |
| Teachers fear computer failure | 0.051 | |

Results shown in Table 1 suggest that as one gets more educated, so is the tendency to use ICT as it increases their interest and confidence. Their beliefs on laziness and redundancy as well as resistance to change are concurring with their level of education as shown in Table 15. All p-values are significant.

ANOVA Test of Perception Constructs

The assumptions of Analysis of Variance (ANOVA) were tested and were found to be satisfied. The table below shows the ANOVA test.

**Table 17.** Analysis of variance

| Response | | | | | |
|---|---|---|---|---|---|
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 785.385 | 23.0 | 34.147 | 30.859 | 0.000 |
| Within Groups | 1114.310 | 1007.0 | 1.107 | | |
| Total | 1899.69544 | 1030 | | | |

When we tested for equality of means for all the construct the null hypotheis was rejected, with p-value of 0.000 which is less than our significant level of 0.05 and we concluded that not all the mean constructs were the same.

Since the null hypothesis was rejected, a Post Hoc or Multiple Comparison Test was performed to identify which of the construct means were responsible for the rejection of the null hypothesis.

Multiple Comparion Test

The following constructs were found to be responsible for the rejection of $H_0$.

**Table 18.** Multi Comparison (Turkey HSD)

| Constructs | | P-value (Sig.) | Decision |
|---|---|---|---|
| Factor | Versus | | REJECT |
| Easy to use versus challenging | Takes too much time | 0.031 | |
| | Need technical help | 0.000 | |
| | ICT addictive | 0.000 | |
| Interesting | Manage class | 0.055 | |
| | Challenging | 0.000 | |
| | Takes too much time | 0.000 | |
| | Fear | 0.003 | |
| Confidence | Challenging | 0.000 | |
| | Too much time | 0.009 | |
| Presentation | Manage class | 0.028 | |
| | Challenging | 0.000 | |
| | Too much time | 0.000 | |
| | Need techinical help | 0.000 | |

| | | | |
|---|---|---|---|
| Motivation | Manage class | 0.001 | |
| | Challenging | 0.000 | |
| | Too much time | 0.000 | |
| Challenging | Ease to use | 0.000 | |
| | Interesting | 0.000 | |
| | Confidence | 0.000 | |
| | Manage class | 0.000 | |
| | Presentation | 0.000 | |
| Too much time | Career prospects | 0.000 | |
| | Prestige | 0.031 | |
| | Addictive | 0.000 | |
| Career prospects | Technical help | 0.000 | |
| | Resistant to change | 0.000 | |
| | Can install/uninstall software | 0.000 | |
| | Fear | 0.014 | |
| Clarifies concepts | Technical help | 0.000 | |
| | Resistant to change | 0.000 | |
| | Can install/uninstall software | 0.000 | |
| Prestige | Technical help | 0.000 | |
| | Fear | 0.004 | |
| | Training | 0.000 | |
| Addictive | National development | 0.000 | |
| | Redundancy | 0.000 | |
| National development | Redundancy | 0.004 | |
| | Expensive | 0.000 | |
| Redundancy | Expensive | 0.000 | |
| | | | |

The Tablle 18 above shows the constructs that were rated differently which had led to the rejection of our null hypothesis that stated that all means were the same.

Some constructs were perceived to be very important while others were perceived to be not that important resulting in them averaging differently.There were some constructs which were consistently given high scores such as computers are easy to use, generates, improves confidence, quality lesson presentation, motivating, enhances good career prospects, clarifies concepts, gives prestige, pivotal for national development and need for further training. This is consistent with Figure 3 which displays mean score plot.

Those constructs which were consistently ranked low included among others; ICT is addictive, time wasting, expensive and addictive.

Homogeneous groups

**Table 19.** Homogeneous groups

| Constructs | Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|---|
| Time wasting | 2.163 | | | |
| Expensive | 2.163 | | | |
| Challenging | 2.381 | | | |
| Technical help | 2.488 | | | |
| Install software | 2.628 | | | |
| Resistance to change | 2.651 | 2.651 | | |
| No difficult | | 2.837 | | |
| Too much time | | 3.140 | | |
| Fear of failure | | | 3.465 | |

| | | | | |
|---|---|---|---|---|
| Makes teachers lazy | | | 3.558 | |
| Redundancy | | | 3.581 | |
| Manage class | | | 3.634 | 3.634 |
| Training | | | | 3.884 |
| Ease to use | | | | 4.000 |
| Clarifies concepts | | | | 4.000 |
| Confidence | | | | 4.067 |
| Further training | | | | 4.233 |
| Career prospects | | | | 4.372 |
| Prestige | | | | 4.442 |
| Interesting | | | | 4.465 |
| Quality presentation | | | | 4.512 |
| National development | | | | 4.558 |
| Motivation | | | | 4.698 |
| P-value | 0.084 | 0.127 | 0.077 | 0.061 |

The table shows that the constructs in one group are presumed to be the same and the level at which $H_0$ was rejected are indicated in the last row. All the forty constructs reduced to four groups as shown in the resultant homogeneous groups formed. Group 1 consists of; time wasting, expensive, challenging technical help, install/uninstall software and resistance to change. The rest of the groups are as shown in Table 19 above. It is important to note that there are overlaps on resistance to change which fell in both Groups 1 and 2 while manage class is also at the intersection of Groups 3 and 4.

## CONCLUSION

We conclude from the results show that even though the majority of teachers percieve ICT in positive light, the teachers face hurdles which militate against the adoption and integration of ICT in the teaching of mathematics. Prominent hurdles which were revealed include unreliability and unavailability of electricity, unreliability of internet onnectivity and lack of relevant training in full utilization and integration of ICT in their actual teaching. Lack of administrators' support and lack of access to computer laboratories were also cited as notable hindrances. These factors need to be addressed urgently in order to fully harness the full potential of ICT in teaching mathematics.

Teacher training colleges, be they for primary or secondary teachers, must therefore introduce curricula that are tailor-made to train teachers in integrating ICT in their actual teaching of mathematics. Mathematical/statistical software usage, which were found to be be severely deficient among the participants, needs to be urgently introduced in the curriculum at the teachers's colleges. For those mathematics teachers who are already practising, professional development courses must be designed and provided to enable them to integrate ICT in their teaching..

This research is reflective of what begets the Zimbabwean education system. Further research would be to test its applicability in other educational est-ups.

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