International Journal of Education Sciences (IJES)
Received on 03. 10. 2014/28. 11. 2014
REF. NO. IJES-550
(Always refer our Reference No. for all correspondence)
Secondary School Mathematics Teachers' Perceptions of the Use of Information and Communication Technology (Ict) In Constructing Mathematical Meaning
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KEYWORDS Perceptions, mathematical meaning, ict, educational technology, technology supported learning.

ABSTRACT The purpose of this paper was to determine teachers' perceptions of integrating instructional technology in mathematics classrooms. The study was conducted in Limpopo, South Africa. The sample for the study consisted of 91 randomly selected mathematics teachers. A self-constructed questionnaire was used to solicit teachers' perceptions about the use of ict in teaching mathematics. Teachers' perceptions were compared based on gender, age, teaching experience and education level. The data was analysed using Statistical Package for the Social Sciences (SPSS), version 22.0. Hypotheses were formulated to test the information that was generated. A t-test for the difference between means of the perceptions levels of males and females, and ANOVA for testing differences among educational levels, teaching experience and age were used as statistical analyses to measure responses. Research results indicate that most math teachers do not use educational technology to teach mathematics. In addition, t-test and ANOVA results revealed few differences in using educational technology in their classes in terms of math teachers' gender, age, experience and level of education. The analysis of this study further reveals that the use of ICT in the classroom is based on traditional transfer model characterised by a teacher-centred approach. The results reveal that teachers continue to rely on old standbys

such us lectures, textbook reading, and fill-in-the-worksheets practices that reduce students to passive recipients of information and fail to develop their thinking skills. The findings are expected to inform policy makers on how to include ICT in both pre-service and in-service teacher training programmes.

INTRODUCTION

South Africa faces many challenges in incorporating information and communication technology (ICT) in its education system. The challenges include limited access to technology, a lack of teacher computer literacy, and methodologies to help students use technology (Isaacs 2007). The country is ranked lowly (143rd) for its ICT skills in maths and science education. Improving the quality of teaching and learning is an important concern for the South African Department of Education (Department of Basic Education 2011). The field of educational technology attempts to overcome these challenges by developing new approaches and frameworks (Januszewski & Molenda 2008). Information and communication technologies (ICTs) represent a new approach for enhancing the dissemination of information and helping to meet these challenges (Goktas & Yildrim 2009). Teachers' readiness and competence are key factors in implementing new ICTs. They need to understand how ICTs can be used to teach mathematics content in rich and meaningful ways.

Information and communication technology (ICT) is becoming an alternative mode of instruction in most classrooms (Cassim 2010). It enables teachers and learners to access computer systems to develop skills, interact with their peers, colleagues, and the global society. However, a study conducted by Brown, Thomasz, van der Merwe and van Dyk (2008) reported that most teachers are still in the phase of using ICTs to merely transmit subject content rather than utilise the technologies to enhance learning. A similar study conducted by Lundell et al (2000) in South African schools revealed that the problem with ict lies with how teachers use the available educational tools in their teaching. Even though teachers know the value of ICT in teaching and learning, the pedagogical use of ICT in South African schools remains limited.

The use of ICT can be used to advance cognitive skills such as comprehension, reasoning, problem-solving and creative thinking (Department of Education 2003). ICT is expected to improve educational outcomes and enhance the quality and effectiveness of teaching and

learning (Jaffer, Ng'ambi & Czerniewicz 2007). The role of ITC in the Curriculum and Assessment Policy Statements (CAPS) curriculum review has not changed but even re-emphasized to support learners and teachers improve the quality of teaching and learning in schools (Assan and Thomas 2012).Effective integration of technology in the teaching of mathematics depends on many factors, but the most important factor is the teachers' competence and ability to shape instructional technology activities to meet students' needs. Many studies showed that technology when is used regularly in class, it brings positive effects on students' cognitive and attitudinal outcomes (Wintz 2009; Handal, MacNish, Petocz 2013; Sankey 2013).Despite this strong evidence and the fact that governments are putting resources in place, technology has not been adequately adopted in schools (Hismanoğlu 2010).

There is a need to define what we mean by ICT in the teaching and learning of mathematics. ICTs are regarded as artificial and symbolical technologies implemented in schools to facilitate the teaching and learning process (Bosco 2004). Technological tools such as graphing calculators, geometric software, multimedia tools and the Internet are useful tools in teaching and learning mathematics (Handal, MacNish, and Petocz 2013). According to the White Paper on e-Education (South Africa 2004), ICTs represent the convergence of information technology and communication technology and the combination of networks, hardware and software, as well as the means of electronic communication. The pedagogical use of ICTs refers to the methods and practices involved in using ICTs for teaching and learning processes (Law et al. 2008). Technology enables learners to master routine and basic mathematics processes such as measuring, calculating, tabulating and graphing (Ruthven et al. 2002). Though ICT can add value to the teaching and learning of mathematics, it is only effective when teachers perceive in the same way. Teachers' instructional beliefs have become a central issue in education. It has been argued that those beliefs have a strong impact on teaching and learning (Handal, Bobis and Grimison 2001). Teachers' beliefs have been conceptualized as a set of assumptions that teachers hold on various educational processes such as curriculum, schooling, students, teaching and learning, and knowledge (McDougall 2010). According to Handal, Cavanagh and Wood (2011) these beliefs also act as mental models driving teachers' practice and processing of new information. These instructional beliefs seem to act as mediators between curriculum goals and their actual implementation since teachers are to make curricular decisions based on their own affective and cognitive schemes.

A number of reasons have been offered as an explanation for teachers' low take-up of ict in their classrooms. They include teachers' beliefs, traditional teaching practices, lack of teacher training, limited instructional preparation time, unavailability of adequate educational software and hardware in general, among others (Handal and Herrington 2003). However, Lagrange et al. (2003) noted that bringing ICT in teaching and learning adds complexity to an already complex process. Mously et al. (2003) also posit that technological advances bring about opportunities for change in pedagogical practice, but do not by themselves change essential aspects of teaching and learning. There is a claim among researchers that for technologies to be effectively used in classroom activities teachers need to see ICTs as learning resources and not as ends in themselves (Laurillard 2013). Moreover, learning activities involving technologies must be properly designed to build on and further develop mathematical concepts. Hence, an adequate preparation is essential for teachers to cope with technology-rich classrooms, so that using computers not merely consists on a matter of becoming familiar with software.

Kriek and Stols (2011) point out that explaining teachers' behaviour in using or not using technology goes beyond popular explanations that tend to blame teachers. Research explains how and why individuals adopt new information technologies (Venkatesh, Morris, Davis and Davis, 2003), but these is still a gap in knowledge on what exactly influences teachers to use or not to use technology in their classrooms. Hew and Brush (2007), Sabzian and Gilakjani (2013) identified teachers' attitudes and beliefs as barriers to using technology for instruction while Debuse et al. 2008 cited social influence.

The purpose of this paper is to investigate mathematics teachers' perceptions of ICT and of their usefulness in promoting a meaningful learning. The researchers believe that the analysis of the experience could promote a fruitful discussion about the need to foster the development of a more suitable and effective awareness of the usage of ICT in mathematics teaching and learning. The research also sought to inform teachers of the necessity to understand how the potential offered by technology can help in overcoming of the everyday didactical practice problems.

PROBLEM STATEMENT

A small number of teachers integrate ICT into subject teaching in a way that motivates pupils and enriches learning. The integration technologies in the teaching of mathematics present challenges to teachers and thus requires innovators to understand and engage in conversations with teachers about their work culture, the technologies that sustain it and the implications of new approaches for those technologies. Problems can emerge when teachers' beliefs are ignored, because beliefs and values that teachers hold drive many of the choices they make the classroom. Kriek and Stols (2010) argue that beliefs influence what and how teachers choose to teach and what innovations they endorse or reject. They further argued that teachers' beliefs and principles are contextually significant to the implementation of innovations. Therefore there is a need for a deeper understanding of the nature of beliefs that influence the behaviour of a teacher and how these beliefs are manifested. This study therefore seeks to investigate whether teachers use ICT in teaching mathematics, and which reasons may prevent them from using it.

OBJECTIVES OF THE STUDY

This paper sought to investigate mathematics teachers' perceptions of the integration of ICT into their teaching. In summary the study sought to:

i. Investigate mathematics teachers' perceptions on the use of ICT during teaching and learning.
ii. Investigate the barriers faced by teachers during the integration of ICT into mathematics lessons and their perception of the usefulness during teaching and learning.
iii. Assesse the level of ICT usage by mathematics teachers during in instructional sessions
iv. Investigate relationships between teachers' perception of educational technology in relation to gender, age, experience, and educational level.

RESEARCH QUESTIONS

The research sought to address the following questions:

i. What are secondary school teachers' perceptions on the use of ICT in mathematics teaching and learning?
ii. How mathematics teachers' perceived beliefs impact of their use of ICT in mathematics teaching?

iii. How do teachers differ in the extent to which they integrate instructional technology based on demographic variables such as gender, age, teaching experience, and educational level?

HYPOTHESES

Using the current literature as a guide, this study attempted to test the following assertions:

H_1: There is a significant difference in mathematics teachers' perceptions of ict use based on gender.

H_2: There is a significant difference in the mathematics teachers' perceptions of educational technology based on demographic variables (teaching experience and educational level).

THEORETICAL FRAMEWORK

The study is guided by Vygotsky's (1978) socio-cultural theory of learning. The theory postulates that all human action is mediated by tools and learners learn effectively when they interact with the tools and artefacts of their culture. The most pervasive tool of modern education is the computer. Thus, it is hypothesized that greater interaction with ICT in the classroom environment will enhance the learner experiences. Vygotsky stressed that knowledge is constructed socially as learners interact with more knowledgeable significant others. That "more-knowledgeable-other" could be anyone in the classroom including cultural artefacts like the computer and other forms of technology.

Subject cultures impact heavily on how ICT is used in the classroom. Teachers and students interact in a classroom culture that is influenced by school, local, national and global factors. The manner and frequency with which ICT is used in the classroom would be determined by such factors. A subject's culture seems to facilitate the integration of ICTs in teaching and learning, while some seem to militate against such integration. Research has shown that it is possible to incorporate ICT into teaching and learning of mathematics (Sutherland et al., 2004). The ways in which students use ICTs at school are heavily influenced by out-of-school cultures of use (Rampersad, 2011). ICT tools are not static and continue to evolve with a rapidity that is nothing short of awe-inspiring. Students are generally more up-to-date than their teachers with the latest advances in technology (Athukorala et al. 2013).

Some insights pertaining to ict use may be derived from theories of mediated action which describe how cultural tools are used to extend learners' cognitive capability. According to Mueller et al. (2008) ict tools can introduce both constraints and affordances to a learning situation. The use ict helps to decontextualize learning, to make explicit that which is implicit and to emphasise that which is often unnoticed. They uniquely offer new ways to express and make visible key relationships and structures within the subject matter (Hennessy et al. 2005).

However the use of ICT has the potential to change the system of constraints and affordances which frame activities such as writing, mathematical problem solving and scientific enquiry.

RESEARCH DESIGN AND METHODOLOGY

Research design

A quantitative descriptive research design was utilised in this study. According to Denscombe (2010), descriptive research is designed to provide a picture of a situation as it naturally happens. It may be used to justify current practices and make judgments and also to develop theories. For the purpose of this study, descriptive research was used to obtain a picture of teachers' perceptions of the use of technology in constructing mathematical meaning with a view to improving the standard lesson delivery and student retention.

Population

The population for this study consisted of secondary school mathematics teachers in Sekhukhune District, Limpopo, South Africa.

Sample

A purposively selected sample of 91 teachers from the public schools of the Department of Education in Sekhukhune District responded to a questionnaire prepared to gather perceptions of teachers about the use of technology in their mathematics lessons. Of the 120 teachers who received the survey, 91 returned the survey for a 75.8 % response rate.

Instrument

A questionnaire was used to solicit data for this study. The questionnaire consisted of forty items divided into five categories: cost and time constraints, barriers to ict use, general ict use learner variables and retention. Responses were based on a five-point Likert-scale (1=strongly disagree, 2=disagree, 3=Neutral, 4=Agree, 5= strongly agree).

Data Collection

Teachers' perceptions of the use of ICT in constructing mathematical meaning were gathered using a questionnaire. The responses to the questionnaire were analysed based on demographic variables: gender, age, experience, and educational level using t-tests and ANOVA.

Data Analysis Procedures

Descriptive statistics in the form of frequency distribution tables was used to summarise demographic data. The data were analysed using the SPSS version 22. T-test and ANOVA were used to analyze each item to compare potential relationships in ratings based on gender, age, experience, and educational level. An alpha level of 0.05 was used to test hypotheses.

Reliability of the Questionnaire

Cronbach's alpha coefficient was used to determine the internal consistence reliability of the questionnaire. As shown in Table 1 below, the overall Cronbach's alpha reliability coefficient for the whole questionnaire was 0.893.The Cronbach's alpha reliability coefficient for the other constructs are shown in Table 1.

<Insert Table 1 here>

The alpha (α), correlation coefficient measure for unidimensionality for the whole data set confirms that the sample of items was one-dimensional. However, the correlation coefficients for the sub-constructs of teachers' perceptions were below the required minimum value (0.7).This could be the small number of items in the categories. The overall alpha coefficient is less than the acceptable maximum (0.9) suggesting that items are not redundant.

RESULTS AND DISCUSSION

The main purpose of the study was to investigate teachers' perceptions of using educational technology based on gender, age, experience, and educational level. Results of quantitative statistical analysis and interpretation of data collected from twenty math teachers are presented in Table 2.

<Insert Table 2 here>

Descriptive statistics

Demographic data about the respondents shows that 56 (61.5%) were females and 35(38.5%) were females. The majority 52(57.1%) of the participants were in the 30-40 years age category. The majority 36 (39.6%) of the participants had 11-15 years of teaching experience.

The majority 30(32.9%) of the participants were undergraduate degree holders while 27(29.7%) hold post-graduate degrees in mathematics. Thirty (30) participants had diplomas and had other qualifications other than mathematics but were teaching the subject.

FINDINGS AND DISCUSSION

The findings of this study are discussed according to the following constructs: the use of information and technology in the teaching and learning of mathematics, cost and time constraints, barriers to information and technology use, learner variables and effectiveness of icts in constructing mathematical meaning.

<Insert Table 3 here>

Teachers' perspectives about the use of information and technology during classroom instruction are shown in Table 3 above. Forty (40(34%)) agreed that information technologies are useful for teaching mathematical concepts while 41(45.3%) disagreed. This observation is consistent with findings by Li (2007) that provide evidence that technology can enhance students' understanding of mathematics concepts. Fifty–four (59.3%) of the participants confirmed that they experience difficulties in designing and developing a math lessons using ict. Fasano and Casella (2001), made similar obsrevations and recommended teachers to create a teaching methodology that integrates technology. This is supported by 60(65, 9%) participants who agreed that some didactical competences are needed in order to properly use ict. Sixty-six (72.6%) of the participants indicated that they were not well-versed with instructional technology for mathematics teaching. This observation concurs with Powers and Blubaugh (2005) who pointed out that the use of computers for instructional purposes in mathematics still lags behind.

<Insert Table 4 here>

Teachers' perspectives about the use of information and technology in relation to time and cost constraints are shown in Table 4 above. The participants 67(73.6%) indicated that the time allocated for teaching mathematics is too short to integrate technology. Simelane et al. (2014) also made a similar obsrvation, pointing out that the time allocated for the each period was too short to accommodate technology. They also indicated that it takes time and effort to prepare and test the effectiveness of the information and technology devices in driving home the concept under discussion. Forty-two (46.6%) of the participants indicated that the presence of icts in mathematics classes depends on their availability. Participants also

confirmed that teacher variables such as confidence and technical know-how and assessment skills are important determinants of the availability of icts in mathematics classrooms. Hennessy (2010) made a similar report that many teachers face the frustration of not understanding the peculiarities of the software, how the computer works, or how to alter their teaching styles to accommodate the new tool.

<Insert Table 5 here>

Teachers' perspectives about the barrier to the use of information and technology are shown in Table 5 above. There is a general trend among the participants that teachers have insufficient skills for integrating technology in the teaching of mathematics. Sixty- two (68.1%) participants indicated that lack of professional development workshops in ict is most hindrance to ict use in their classrooms. Another noticeable concern raised by mathematics is the fear of taking risks of trying alternative instructional methods. Participants also indicated that schools lack and cannot afford ict resources such as software, hardware and supporting gadgets. Middleton et al. (2014) made similar observations and recommended staff development is a key, but cited lack of financial package for technology infusion.

<Insert Table 6 here>

Teachers' perspectives about the use of information and technology on learners' retention of mathematics concepts are shown in Table 6 above. Fifty-one (56.1%) participants indicated that the use of ict is a potential cause of confusion for learners. Mikre (2011) echoed the same sentiments arguing that ict integration is often seen as a separate development activity, not connected closely to general curriculum implementation. Fifty- seven (62.7%) participants also indicated that students sometimes struggle to establish ict and intended reference relation. A similar observation was made by Hennessy et al. (2010) who noted that the beneficial attributes of using ICT in learning are difficult to measure, particularly when using traditional methods of assessment so improvement may go unrecognised by the system. Sixty-four (70.4%) indicated that the use of ict may prevent students from learning abstract thinking skills. This observation supports findings by Chigona et al. (2010) who noted that the use of ict deprives learners the opportunity to develop abstract thinking skills.

<Insert Table 7 here>

Teachers' perspectives about the usefulness of information and technology in teaching mathematics are shown in Table 7 above. Sixty-three (69.1%) of the participants were not in

support of the use of ict to introduce new mathematical concepts. However participants concurred that the use of ict can help reinforce concepts and improve students' fine motor skills. This is consistent with the suggestions of proponents of using technology to teach mathematics who pointed out that technology can support and enhance problem-solving environments (Garofalo et al. 2000).

T-tests: Comparing Means

<Insert Table 8 here>

A t-test was conducted to compare gender differences in teachers' perceptions of the use of ict mathematics instruction. Results are shown in the table 8 above. Results in table 8 indicate that the mean score for male teachers' perspectives about the use of ict was *Mm* = 2.898 with (N = 35, sd = .5512), which was slightly lower than the mean score of *Mf* = 3.079with (N = 56, sd = .4736) obtained from female participants. However t-test results (df = 89, t= -1.664 p=0,100) indicate that there are no significant gender differences in perceptions between male and female participants. The same conclusion holds for the other constructs since their p-values are all greater than p=0.05. Levene's test for equality of variances was also conducted to test the variability of the gender categories. This test determines if the two groups have the same or different amounts of variability between scores. All the values in the sig. column (general ict use:p= 0.343; time & cost constrain:p=0.283; barriers to ict use: p= 0.343; effects on learners p=0.210; effects on retention:p=0.528) greater than p= 0.05 which indicates that variability in the two groups is not significantly different. These results are consistent with Yuan's (2012) findings that show no gender difference on perceptions towards the use of technology in teaching mathematics. However in Plomp and Voogt's (2009) study gender differences with respect to technology use was evident.

<Insert Table 9 here>

An analysis of variance (ANOVA) test was conducted to test for significant differences in the mathematics teachers' perceptions of the use of educational technology based on a teaching experience. The results for the test are shown in table 9 above. All the constructs do not show significant differences in teachers' perspectives (p >0.05). Thus teaching experience has no effect on teachers' perspective about the use icts in constructing mathematical meaning. This is in sharp contrast with Gorder's (2008) study in which differences existed for technology use and integration based teaching experience.

<Insert Table 10 here>

An analysis of variance (ANOVA) test was conducted to test for significant differences in mathematics teachers' perceptions of the use of educational technology based on academic qualifications. The results for the test are shown in table 9 above. All the constructs do not show significant differences in teachers' perspectives(s >0.05). Thus academic qualifications have no effect on teachers' perspective about the use icts in constructing mathematical meaning. The findings are consistent with Ng'eno, Githua & Changeiywo (2013) who found that there was no statistical significant difference by qualification.

CONCLUSION

The findings of this paper indicate that secondary school mathematics teachers do not integrate technology during content presentation. Different ict-related variables have been highlighted in the study as important for promoting/barring teachers' use of information technologies in mathematics education. There are mixed and varied perceptions about the effectiveness of icts in mathematics content delivery. Despite the shortage if ict resources in schools coupled with limited human skills,respondents subscribed to the idea that icts may serve as important tools for improving student proficiency in mathematics and the overall learning environment . However, if teachers are not aware of the potential usefulness and effectiveness of ICT as a methodological resource that can enable them to facilitate the construction of mathematical meaning they would not recognise the need for integrating technologies in classroom activities. Thus there is a need for teachers to be skilled in using technology for their teaching. Teachers need didactical knowledge about the use of technology.

RECOMMENDATIONS

The findings of this study led the researchers to suggest that an adequate training on ict use in mathematics teaching is essential for teachers to cope with and integrate technology as teaching resource. Researchers believe that, if teachers become aware of the potential usefulness and effectiveness of ICT as a methodological resource they would integrate it in the classroom activities.

IMPLICATIONS

Several implications emerged as data collection and analyses were taking place. All revolve around the fact that if technology is to be adopted in the classroom then curriculum designers need to take in account teachers' beliefs, attitudes and skills in any implementation process. Discrepancies between teachers' opinions and the ideas underpinning a technology-based curriculum innovation need to be foreseen, analysed and addressed.

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LIST OF TABLES

Table1: Cronbach's Coefficient Alpha

Cronbach's Coefficient Alpha		
Variable(s)	**Number of items**	**Alpha**
General ICT use	9	.663
Cost and time constraints	9	.556
Barriers to Ict use	8	.489
Learner Variables	7	.493
Retention	13	.659
Overall Questionnaire	46	.762

Table 2: Demographic variables

Variables		**Frequency**	**Percentages (%)**
Gender	Female	56	61.5
	Male	35	38.5

Age	Below 30 years	12	13.2
	30-40 years	52	57.1
	41-50 years	21	23.1
	51 years and above	6	6.6
Teaching Experience	Less than 5 years	24	26.4
	5- 10 years	3	3.2
	11-15 years	36	39.6
	16-20 years	7	7.7
	21 years and above	21	23.1
Educational Level	Certificate	4	4.4
	Diploma	15	16.5
	Undergraduate Degree	30	32.9
	Post-Graduate Degree	27	29.7
	Other Qualifications	15	16.5

Table 3: The use of information and technology

Description	Frequencies(percentages)				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
New technologies are useful for mathematical concepts.	22(24.4)	19(20.9)	10(11.0)	26(28.6)	14(14.4)
Computers can be used in classroom activities to develop mathematical concepts.	7(7.7)	17(18.7)	10(11.0)	22(24.2)	35(38.5)
I experience difficulties in designing and developing a math lessons using ict	4(4.4)	26(28.)	16(17.6)	20(22)	34(37.3)
Some didactical competences are needed in order to properly use ict	15(16.5)	12(13.2)	4(4.4)	20(22)	40(43.9)
The use of ict can somehow change the dynamics among actors in the teaching/learning situations.	12(13.2)	24(26.4)	26(28.6)	11(12.1)	18(19.8)
There are benefits of using technology in mathematics lessons	28(30.8)	12(13.2)	11(12.1)	15(16.5)	25(27.5)
TeTe is useful in teaching mathematics concepts.	29(31.9	20(22)	4(4.4)	18(19.8	20(22)

	)			)	
Am quite familiar with instructional technology for mathematics teaching.	30(33)	36(39.5)	7(7.7)	18(19.8)	9(9.9)
The use of technology for instructional purposes in mathematics is highly recommended.	21(23.1)	26(28.6)	5(5.5)	20(22)	19(20.9)

Table 4: Cost and time constraints

Description	**Frequencies**				
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Time allocated for instruction (teaching/learning) is too short to include ICT.	18(19.8)	4(26.4)	11(12.2)	23(25.3)	44(48.3)
Time for preparation of the use of ICT is limited.	21(23.1)	16(17.6)	13(14.3)	18(19.8)	23(25.3)
Time to test the effectiveness of ICT use is limited.	17(18.7)	19(29.9)	13(14.3)	21(23.1)	21(23.1)
Cost or availability of ICT determines their presence in the class.	26(28.6)	18(19.8)	5(5.5)	22(24.2)	20(22)
Activities involving ICT require more time that could be better utilized with other instructional approaches.	28(30.8)	22(24.2)	3(3.3)	19(20.9)	19(20.9)
Mathematics classrooms should be fitted with computers	26(28.6)	14(15.4)	10(11)	20(22)	21(23.1)
Teacher's ICT skills determine their use in mathematics activities.	15(16.5)	12(13.2)	5(5.5)	20(22)	39(42.9)
Teachers lack confidence to operate ICT and software	12(13.2)	14(26.4)	18(19.8)	26(28.6)	30(19.8)
Teachers are able use ICT to monitor learners' progress	28(30.8)	12(13.2)	11(12.1)	15(16.5)	25(27.5)

Table 5: Barriers to ict use

Description	Frequencies				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Teachers have insufficient ICT skills about the use of technology in teaching mathematics.	10(11)	8(8.8)	3(3.3)	51(56)	19(20.9)
Teachers have insufficient knowledge to develop and implement ICT-related activities	9(9.9)	11(12.1)	3(3.3)	42(46.2)	26(28.6)
Schools offer little support to develop ICT-related skills	15(16.5)	13(14.3)	13(14.3)	21(32.1)	29(31.9)
Teachers fear to take risks to try new approaches	12(13.2)	9(9.9)	14(15.4)	35(38.5)	21(23.1)
Teachers lack of confidence in using ict when teaching mathematics	11(12.1)	10(11.0)	22(24.2)	22(24.2)	26(28.6)
Teachers have limited access to technology	7(7.7)	13(14.3)	9(9.9)	38(41.8)	24(26.4)
There is lack of ict professional development in ict	10(11)	15(16.5)	4(4.4)	30(33)	32(35.1)
Schools lack of ict resources such as software and hardware	16(17.6)	17(18.7)	8(8.8)	25(27.5)	25(27.5)

Table 6: Effects on learners

Description	Frequencies				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The use of ict is potentially confusing to the learners if lacking appropriate guidance and instruction from the teacher.	19(20.9)	11(12.1)	10(11.0)	11(12.1)	40(44.0)

The use of ict is a potential cause of classroom management and control problems.	11(12.1)	26(28.6)	10(11.0)	28(30.8)	16(17.6)
ICT and intended reference relation is not easy to establish.	5(5.5)	12(13.2)	17(18.7)	33(36.3)	24(26.4)
Class sizes are too large to be taught using ict.	23(25.3)	33(36.3)	18(19.8)	9(9.9)	8(8.8)
The use of ict may prevent students from learning abstract thinking skills.	2(2.2)	10(11.0)	15(16.5)	34(37.4)	30(33.0)
The use of ict could cause students to become too accustomed to the activities of the lesson and forget the actual lesson.	36(39.6)	29(31.9)	9(9.9)	8(8.8)	9(9.9)
Not all ict can be used to meet curriculum expectations.	24(26.4)	22(24.2)	7(7.7)	18(19.8)	20(22.0)

Table 7: The importance of ict in teaching mathematics

Description	Frequencies				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The use of ict can be used to introduce concepts.	34(37.4)	29(31.7)	16(17.6)	4(4.4)	8(8.8)
The use of ict can help children to grasp concepts or reinforce them.	9(9.9)	6(6.6)	10(11)	28(30.8)	38(41.8)
The use of ict helps to improved children‘s fine motor skills.	2(2.2)	6(6.6)	19(20.9)	39(42.)	25(27.5)
The use of ict helps to provide opportunities for collaborative learning and peer tutoring to occur.	21(37.4)	32(36.3)	14(16.5)	4(4.4)	10(5.5)
The use of ict addresses multiple intelligences and caters for all learning abilities.	22(23.1)	30(35.2)	19(15.4)	11(11.0)	9(9.9)
Instruction that does not involve ict use is understood better than one involving ict materials.	7(7.70)	10(11.0)	14(15.4)	16(17.6)	44(48.4)
Ict help relieve boredom in students.	15(16.5)	28(30.8)	33(36.3)	9(9.9)	6(6.6)

Table 8: Tests of Hypotheses

	Gender	N	Mean	Std. Deviation	Std. Error Mean	Levene's Test for Equality of Variances		T-test for Equality of Means		
						F	Sig.	t	df	Sig.
General ict use	Male	35	2.898	.5512	.0932	.909	.343	-1.664	89	.100
	Female	56	3.079	.4736	.0633					
Cost & Time	Male	35	2.946	.5532	.0935	1.165	.283	-.035	89	.113
	Female	56	2.950	.5996	.0801					
Barriers to ict use	Male	35	2.157	.6693	.1131	.909	.343	-.222	89	.972
	Female	56	2.185	.5293	.0707					
Effects on learners	Male	35	2.645	.6345	.1073	1.594	.210	.326	89	.972
	Female	56	2.605	.5317	.0711					
Effects on Retention	Male	35	2.591	.6181	.1045	.402	.528	1.598	89	.824
	Female	56	2.398	.5207	.0696					

Table 9: ANOVA**:** Teaching Experience

		Sum of Squares	df	Mean Square	F	Sig.
General ict use	Between Groups	.901	4	.225	.862	.490
	Within Groups	22.473	86	.261		
	Total	23.374	90			
Cost & Time	Between Groups	.614	4	.153	.446	.775
	Within Groups	29.567	86	.344		
	Total	30.180	90			
Barriers to ict use	Between Groups	1.261	4	.315	.922	.455
	Within Groups	29.391	86	.342		
	Total	30.652	90			
Effects on learners	Between Groups	2.180	4	.545	1.730	.151

	Within Groups	27.094	86	.315		
	Total	29.274	90			
Retention	Between Groups	1.370	4	.342	1.077	.373
	Within Groups	27.335	86	.318		
	Total	28.705	90			

Table 10: ANOVA**:** Academic Qualifications

Table 9: ANOVA:		Sum of Squares	df	Mean Square	F	Sig.
General ict use	Between Groups	.810	3	.270	1.042	.378
	Within Groups	22.564	87	.259		
	Total	23.374	90			
Cost & Time	Between Groups	.423	3	.141	.412	.745
	Within Groups	29.757	87	.342		
	Total	30.180	90			
Barriers to ict use	Between Groups	.423	3	.141	.406	.749
	Within Groups	30.229	87	.347		
	Total	30.652	90			
Effects on learners	Between Groups	.230	3	.077	.229	.876
	Within Groups	29.045	87	.334		
	Total	29.274	90			
Retention	Between Groups	.133	3	.044	.135	.939
	Within Groups	28.572	87	.328		
	Total	28.705	90			