TEACHERS' PERCEPTIONS ON USE OF MICROSOFT EXCEL IN TEACHING AND LEARNING OF SELECTED CONCEPTS IN JUNIOR SECONDARY SCHOOL MATHEMATICS SYLLABUS IN BOTSWANA

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Abstract
This article presents a summary of a larger study that explored perceptions of junior secondary mathematics teachers towards the use of Microsoft Excel in teaching selected concepts in the topic graphs. The study employed the quantitative survey approach and 85 mathematics teachers participated. Two research questions guided the study and a five-point Likert scale questionnaire with thirty items was used to collect data which was analysed through descriptive statistics. The findings of this study revealed that generally mathematics teachers have positive perceptions on the use of Excel which according to the theory of planned behaviour, could be translated into action. It also revealed that competence in using Excel, shortage of computers and limited time, influence teachers' perceptions on the use of Excel.

Key words: Excel, mathematics teachers, ICT integrations, theory of planned behaviour, teacher perceptions, Botswana syllabus

Introduction

The integration of Information and Communication Technology (ICT) in education has been used by both educators and educational researchers since the 1980s with varied success (White, 2008). This move has led the developed and developing countries to invest in infrastructure, software and training of teachers for a smooth implementation of ICT integration in School Curriculum (Light, 2009; Demiraslan &Usluel, 2008). A case in point is Australia, which started its journey of integration around the 1990s and its level of ICT integration in education is regarded as higher compared to that of other countries (Ainley, Eveleigh, Freeman &O'Malley, 2010). Chile, though a developing country, is also considered progressing in the integration of ICT in Education. The country has 94% connectivity in schools and has trained 110 000 teachers (Cancino, Donoso & Diaz, cited from Light (2009).

African countries are also determined to integrate ICT in education. This is shown by ministers of education in their respective countries being pro-active in coordinating the development of ICT infrastructure in schools and the implementation of their ICT policies

(Glen & Isaacs, 2007). Countries such as South Africa, with its ICT policy which was formulated in 1995, have initiatives put in place to integrate ICT in the education system. Other African countries like Mozambique, Ghana, Kenya, Uganda and Tanzania are still at an infant stage of implementing ICT policy in education as most of them started their policies in the late 1990s and beginning of the year 2000 (Ang'ondi, 2007; Mangesi 2007 &Muianga et.al, 2013).

Just like other African countries, Botswana is committed to integrating ICT in the education system. This incentive has since started after a comprehensive review of the education system, which resulted in a Report of the National Commission on Education (NCE) of 1993 (Republic of Botswana, 1993) from which the accepted recommendation was formulated into the country's second educational policy named; The Revised National Policy on Education (RNPE) 1994 (Republic of Botswana, 1994). The use of ICT in learning is well articulated in the national development strategy known as Vision 2016, which succinctly states that by the year 2016, "Botswana will have entered the information age on an equal footing with other nations, and all level of schooling will have access to state-of-art ICT to support learning process" (Republic of Botswana, 1997:4). This sentiment was encapsulated in the country's ICT policy which was formulated in 1998 and revised in 2006. Hence the purpose of the study was to find out teachers' views and concerns pertaining to the use of Excel in teaching selected concepts including solving simultaneous equations graphically, drawing quadratic graphs and scatter graphs, as per the demand of the new junior secondary school mathematics syllabus (Republic of Botswana, 2008).

Background

The Botswana Government through the Ministry of Education and Skills Development has made efforts to improve the state of education by introducing the use of ICT in Junior Secondary Schools in order to prepare students to compete in the world of work locally and otherwise. In the RNPE, one of the recommendations concerning ICT integration was that "each student should take a Basic Awareness Course in Junior Secondary school and in Senior schools, computer studies should be one of the optional subjects to be studied by willing students" (Republic of Botswana, 1994:21). Consequently, a Computer Awareness Course was introduced in junior schools and a computer studies course was offered at senior schools. This move is a sign that the government considers basic ICT skills an important attribute and thus has included it in the syllabus as one of the critical competencies to be taught at basic education level (Republic of Botswana, 2008). As it is stated succinctly in the country's manifesto, Vision 2016, that "Botswana will have entered the information age on an equal footing with other nations, and all level of schooling will have access to state-of-art ICT to support learning process" (Republic of Botswana, 1997:4), the government aspires that citizens should form an educated and informed nation through the study of Science and Technology.

This view of the importance of Science and Technology perpetuated the revision of the mathematics syllabus to include the use of Microsoft Excel. As a result, one of the objectives in the syllabus suggested that teachers use Excel in teaching solving simultaneous equations graphically, solving quadratic graphs and scatter graphs (Republic of Botswana, 2008). The specific objectives in the syllabus states that "The learners should be able to use spreadsheet to draw graphs of the form: $y = mx + c$ (Republic of Botswana, 2008:12-14). The other objective in Form 3 topics is that "the learners should be able to use spreadsheet to solve quadratic equations by graphical method and that the learners should be able to draw a line of best fit in scatter graphs" (Republic of Botswana, 2008: 21). In order to achieve these

objectives, junior secondary school teachers should be able to use Microsoft Excel in their lessons. The teachers are expected to teach the students the drawing of the line of best fit in scatter graphs, as well as the drawing of the quadratic equations to find the solutions by guiding the students to find out where the graph crosses the x- axis.

However, these efforts by the Botswana government to improve the status of education seem to be unfruitful as the national average performance of Mathematics subject declines yearly. The 2007 summary report by Botswana Examination Council (BEC) shows that the percentage of students who obtained grade C or better in Mathematics in 2006 was 23%, declined to 22.8% in 2007 and to 21.8% in 2008. BEC results are corroborated by 2007 TIMSS results which shows that Botswana dropped by 10% when compared to 2003 TIMSS scores. This poses a dire need to improve performance since the 2015 results show the same trend and are even worse than those of the previous years.

Even though the use of Spreadsheet Excel is not examined in Junior Certificate, the students are examined on topics of quadratic equations, simultaneous equations and scatter graphs using the traditional methods. Simultaneous equations and quadratic equations fall under the topic of Algebra, which covers an average of 22% of the exam for both multiple choice question (paper 1) and short answer and structured questions (paper 2). The topic of scatter graphs are part of Statistics and Probability which forms 12.5% of the exam for the two exam papers (Botswana Examinations Council, 2013). One of the key competencies of the use of computers in Junior Schools is that the students should be able to use productivity tools and different computer applications such as word processing, spreadsheet, database appropriately to create good projects, assignments etc. (Republic of Botswana , 2008). As case of mathematics in Junior secondary schools, the students can be able to utilise the resource to practice drawing of quadratic, simultaneous graphs and lines of best fit.

Although every Junior School has a computer laboratory with about 20 computers each, ICT integration into specific subjects has not been realised because the computer laboratories were prominently used for a Computer Awareness (CA) course. Nonetheless, there is need that all subjects including Mathematics, benefit from the infusion of ICT in education because it is indicative that the use of ICT improves mathematics performance (Neurath & Stephens, 2003) and teachers play an important role in this regard as curriculum implementers. Consequently, this study investigated the teachers' perceptions regarding the use of Excel spreadsheet in teaching and learning. In particular, the study purports to explore perceptions of mathematics teachers in Botswana Junior Secondary Schools towards the use of Excel in teaching and learning of quadratic, simultaneous graphs, and scatter graphs. The study has a potential to sensitise policy makers on possible enablers and barriers brought by the teachers' perceptions on the implementation of Excel in the teaching and learning of mathematics at junior secondary level. The questions that guided the study are:

i. What are the perceptions of junior secondary school mathematics teachers towards the use of Excel in the teaching and learning of; solving quadratic equations graphically, drawing of scatter graphs, and solving simultaneous equations?

ii. What factors influence teachers' perceptions on the use of Excel in the teaching and learning of graphs and graphing?

Theoretical framework

Integration of technology into the curriculum calls for a new culture of classroom practice. Both the teacher and student must learn new roles. As the teacher learns how to orchestrate activities for learners to manipulate, students learn to take responsibility for their own learning, be creative, innovative and critical thinkers. This new culture does not come cheap. It demands that the key players consciously, intentionally and in their own volition endeavor to change. The teachers' intention to change is crucial to policy makers and it is for this reason that this study adopted the Theory of Planned Behavior (TPB) as it focuses on factors affecting a person's intention to change their behavior. The theory states that attitude toward behavior, subjective norms, and perceived behavioral control, together shapes an individual's behavioral intentions to change. It proposes a model on which human action guide and predicts the reoccurrence of a particular behavior as well as the perceptions and attitudes that may hinder or enable people's intention to change. Since the current study deals with the teachers' perceptions and the factors influencing these perceptions, the theory of planned behavior was deemed suitable to guide the study.

The first component of TPB is attitude towards the behavior, which relates to how a person's overall evaluation of the behavior leads to its action. An individual's attitude may be positive, negative or neutral and therefore can either hinder or enable one's intention to change or act in a particular way (Ajzen, 1991). Relating to the present study, the attitude towards the behavior would be the teacher's positive and negative attitudes as well as perceptions about the introduction of using Excel in the teaching and learning of mathematics. A teacher's "attitude[s] may enable or create barriers to his or her intentions to change. Attitude here refers to a favorable or unfavorable disposition towards an action according to whether they believe it to be beneficial or not" (Peirce & Ball, 2009: 301). Thus, if teachers regard the use of Excel as beneficial, they would use it in teaching mathematics, but if they regard use of Excel as non-beneficial, they would not integrate it in their teaching.

The second component of TPB is the subjective norms about the behavior. According to TPB, the subjective norms are the individual's perceptions about the particular behavior, which are influenced by the judgment of significant others including supervisors. That is, it deals with a person's own estimate of the social pressure to perform the target behavior. It suggests that a teacher's intention to change their teaching behavior will be influenced by how they perceive the use of Excel; whether or not it fits well into the school ethos and classroom practices particularly mathematics teaching (Ball &Pierce, 2009). That is, do the supervisors expect them to use Excel to teach mathematics? A normative belief relates to ideal standards or models based on what is considered to be a normal or correct way of doing something. In this study, normative norms would relate to the objectives in the mathematics syllabus demanding teachers to use Excel in their teaching.

The third component of TPB is the perceived behavioral control which relates to a person's subjective views about the amount of direction one has over the environment. It suggests that behavioral control depends on the degree to which individuals conceptualize themselves sufficiently knowledgeable and skillful to perform some act. The behavioral control depends on the extent to which individuals feel that other factors could inhibit or facilitate behavior such as time constraints, resources or cooperation among colleagues. It deals with how much a person has control over the behavior and how confident a person feels about being able to perform or not to perform the behavior. In the current study, perceived behavioral control would relate to the training teachers receive on the use of Excel and status of the resources available as well as allocated time to teach mathematics using Excel. TPB is used to analyze the data collected in this study.

Literature review

Teachers' Perceptions on ICT integration in Education

Robbins (2008) defines perception as the processes which individuals organise and interpret their sensory impressions in order to give meaning to their environment. Macmillan English Dictionary for Advanced Learners (2007), on the other hand, defines perception as a particular way of understanding or thinking about something. In this study, teachers' perception would mean the way mathematics teachers in junior secondary schools think, view, understand and believe on the use of Microsoft Excel in the teaching and learning of school mathematics. Among the several studies conducted on teachers' perceptions on the use of ICT in teaching and learning, it was found that teachers had positive perceptions on the use of ICT as they had different beliefs and attitudes on its use in teaching (Gulbahar &Guven, 2008;Kirkscey, 2012; Rodrigues, 2012). According to TPB, if the beliefs and attitudes are positive, the persons' perceptions about the behaviour tend to be positive and when the beliefs and attitudes are negative, the person's perception becomes negative (Ajzen, 1991). It is no wonder that Gulbahar and Guven (2008) found in their study that a positive correlation existed between teachers' positive attitudes towards ICT and their positive perceptions of the advantages on the use of ICT. In similar studies by Rodrigues (2012) and Cakir and Yildirim (2013), teachers' perceptions on the use of ICT were positive as they believed that the use of Excel in teaching was useful to them in teaching linear and quadratic equations effectively. Kirkscey (2012) also points out that instructors developed positive attitudes towards the use of ICT in course content as they became more comfortable and confident in their integration of computer technology in their classrooms and course content.

Studies on the use of ICT in Africa have also yielded positive perceptions towards the use of ICT by teachers as they believe that ICT may possibly help students to perform better in their tests. The survey conducted by Oyedeko and Tella (2010) on 200 Nigerian teachers indicated that the teachers had a strong belief that ICT can make a significant contribution to the performances of pupils. Similarly, Andoh (2012) stated that teachers perceived that the use of ICT was important to students as they could enhance students' participation in class. The two studies employed the survey method using a Likert questionnaire to gather the attitudes as they wanted to view the pattern of responses in order to provide evidence to their study of the underlying attitudes (Fraenkel &Wallen, 2005), and a similar instrument was used for this study.

The teachers' perceptions towards technology are an important factor affecting the decision whether to adopt or not adopt technology (Lau& Yuen, 2013). Although the studies reviewed in the current study were showing that the teachers had positive perceptions on the use of ICT teaching and learning, some teachers mentioned that they don't believe that the use of ICT can be helpful to students (Molster &Wikan, 2011) and as a result, fewer teachers use ICT in teaching as they had both positive and negative perceptions on its use. From the literature reviewed, it seems positive perceptions towards the use of ICT in the teaching and learning of mathematics dominates negative ones because there was only one study which reported the teachers' negative perceptions. Thus, the general picture painted here is that teachers' perceptions of the application of ICT in the teaching and learning environment are positive both in developed and developing countries. What is not clear is whether such positive dispositions translate into classroom practice.

All the studies, except the two by Gebrekal (2007) and Rodrigues (2012), were focusing on the general perceptions of teachers on ICT, while the two studies by Gebrekal and Rodrigues were on the use of Excel. This shows that there are still more studies needed to focus on teachers' perception on the use of Excel. Thus, the current study focused on the teachers' perceptions on the use of Excel in teaching mathematics in order to try and close the gap on how the teachers perceive the integration of ICT in the curriculum as well as the use of Excel in mathematics teaching as there is very little research on the latter.

Challenges of integrating ICT in teaching and learning

In the literature, several challenges have been cited as impediment to the smooth integration of ICT in the school curriculum. These challenges include among others, lack of resources, infrastructure, the teacher and the context of teaching. In most developing countries, there is a shortage of computers and relevant software. The unavailability of these key resources makes it impossible for ICT integration even if specified in the syllabus (Hennessy, Kenneth &Brindley, 2005). As a result, learners of such countries are denied to be globally competitive as they would lack skills that their counterparts elsewhere possess.

The third world also is deficient in proper infrastructure to accommodate ICT integration and infusion in schools. Lack of internet infrastructure is a case in point. Isaacs (2007) has noted that lack of computer stations and connection to internet affects mostly African countries as they are hampered by lack of access to high internet speed and connectivity because of low budget (Goktas, Yildirim &Yildirim, 2009). Internet has a lot of resources that teachers could use in mathematics classrooms. If such a resource is not available, teachers can't help it but resort to traditional instructional practices.

Teacher competence in ICT and disposition also play an important part in the integration of ICT into the classroom. If teachers are incompetent in using ICT, they are unlikely to use it. This is corroborated by Hudson and Porter (2010) who said that lack of professional development in technology is one of the identified barriers why teachers fail to adapt the use of computers in the classroom. When teachers are not trained, they become uninspired (Gudmundsdottir, 2010) as their level of competency is influenced by training (Mwalongo, 2011). These observations indicate that teacher training is the cornerstone of successful integration of ICT in schools. This sentiment is shared by Mutula and Mutula (2007: 141) who said that:

> Multi-pronged approaches to address the digital divide barrier in education in Botswana are critical in order to improve information literacy among learners and such approaches include, among others, research to identify best practices of professional development activities involving the use of ICT that impact best on teachers and schools; ICT training that takes cognisance of varying levels of computer experience among teachers; ensuring that schools integrate ICT into their operations; a policy environment that mandates the use of ICT to improve learning in every subject in schools level; availability of technical support for teachers in the use of ICT; adequate access to ICT by both teachers and learners; and adequate funding from government.

In their study of 820 primary school teachers, Braak, Tondeur and Valcke (2009) came to the conclusion that teachers' educational beliefs play an important role in their decision to use or not to use ICT in teaching, thus they can be hindrances to ICT integration in mathematics education. Furthermore, the context of teaching may influence teachers' decisions to integrate ICT. If teachers believe that ICT integration consumes much of their teaching time, they may

find it difficult to include it in an environment when national examinations are offered in the fear that their students may not cover all that is required to be tested. These challenges may act as behavioural control (Ajzen, 1991) when teachers view them as conditions beyond their control therefore rendering the use of ICT unfavourable.

Studies on the use of Excel Spreadsheet in teaching and learning

Unlike other mathematics softwares, Excel is handy to all teachers and students because of its availability. No teacher can claim that it is not available because of fiscal constraints. Teachers can use it for both teaching and administrative work. Administratively, teachers can use Excel for record and monitoring students' performance by uploading the marks in spreadsheet and comparing the students' performance using measures of central tendency such as mean and standard deviation (Heo & Kang, 2009)using the built in automatic calculation (Lewis, 2001). It can be used to store and track the marks of students.

Iskiksal and Askar (2005) conducted an experimental study with the Grade 7 students on the use of Microsoft Excel, Autograph and traditional base instruction. Although there were no significant differences on the use of Autograph and Excel, students who were taught using Excel and Autograph performed better to those who were taught using the traditional method of teaching. Another study by Gebrekal (2007) on the influence of Excel in learning mathematics functions found that Excel has a positive impact on the performance of Grade11 Eritrean students. Furthermore, Wu and Wong (2007) reported that when students use Excel they gained scores through the use of spreadsheet when drawing statistical graphs. All studies cited above and others (Agyei, 2013; Neurathy and Stephens, 2003; Becta, 2003) indicate that the use of Excel in the classroom can assist in improving student performance and instructional practices. Lewis (2001) indicated that teachers can use Microsoft Excel to create charts and produce three dimensional graphics as well as numerical examples in class. This would increase the scope of learning material by affording a quick solution to complicated mathematical problems, allowing the teacher to cover more information in a short period of time. It is further reported that the use of Excel can also help the students to speed up the way they learn mathematics, especially when plotting graphs and analysing them as they may possibly upload data in the computers by inputting the equation of the line and draw the graph without manual calculations. For instance, Hennessy (2000) observed that the use of Excel speeds up the graphing process, freeing pupils to analyse and reflect the relationship between data. As students are engaged in solving problems in this manner, they develop higher order thinking skills and deeper understanding of concept results (Agyei, 2013).

The use of Excel is also believed to impact on students' disposition towards the learning of mathematics. In the study on the effects of using spreadsheets on secondary school students' self-efficiency for algebra, Topcu (2011) found that the group which received spreadsheet based instruction had significantly higher measures of self-efficiency for algebra than the group which received convectional instruction. As they collect data and manipulate it using spreadsheets and database (Becta, 2003) they internalise concepts and as opposed to memorising facts and procedures. The classroom processes will be about learning to find the information and more importantly how and where information that has been acquired can be used. Students' motivation would increase and there will be more fun in learning mathematics (Roblyer & Doering, 2012; Heo & Kang, 2009). As the students are motivated to learn by using Excel they might also access new information through group discussions with their peers, thus augmenting existing knowledge with the new one (Heo & Kang, 2009). It is for this reason that the Department of Curriculum Development introduced the use of

Excel in the curriculum and this study explores teachers' disposition towards its implementation.

Research design and methodology

Research design

The study employed a quantitative survey method to explore mathematics teachers' perceptions on the use of Excel in teaching and learning of school mathematics through the use survey approach. A sample of 85 junior secondary mathematics teachers responded to a 30 item 5 point likert scale questionnaire soliciting their views about the use of Excel in teaching and learning. Saumure & Given (2008) asserts that in convenience sample, the participants are selected on the basis of availability. Out of the 100 that were intended, only 85 teachers participated. Seventy (70) were from different parts of the country congregated at the University of Botswana for further education. All had obtained Diploma in Secondary Education (DSE) and had at least 5 years of teaching experience. The other group of participants were 15 DSE holders currently teaching in four (4) Junior Secondary schools in the radius of 80 km from the capital city Gaborone. The construction of the questionnaire used in the study was guided by the study objectives and research questions on mathematics teachers' perceptions towards the use of Excel, and so the items were derived from the literature on the same. Descriptive statistics was used to analyse data.The researchers used frequencies, mean and percentages to analyse the results.

Ethical Consideration

The permission to conduct the study was sought from the Ministry of Education and Skills Development to allow researchers to visit the schools during daytime afternoons so that the lesson and teaching may not be disturbed. Identified participants were asked for their voluntary participation through a written consent such that the participants were not coerced to take part in this study, none of them wrote their names in the questionnaire. The participants were further assured of confidentially both in writing and verbally. No harm of any sort was anticipated as the names of the participants and their schools were not disclosed; they were given codes.

Presentation and discussions of the findings

This section of the paper presents the summary of findings obtained in a study which explored teachers' perceptions on the use of Microsoft Excel in teaching and learning of quadratic graphs, simultaneous and scatter graphs. Frequencies, means, and percentages were used to analyse data.

Table 1: *Teachers' demographic background*

Factor	Frequency	Percentage (%)
Gender		
Male	40	47.1
Female	38	44.7
Teaching experience		
0-5 years	9	10.6
6-10 years	19	22.4
11-15 years	20	23.5
16-20 years	9	10.6
Over 20 years	26	30.6

Eighty five (85) teachers participated in the study and seventy eight (78) of them identified their gender while 7 did not specify their gender (see Table 1 above). The table shows that 47.1 % were male teachers while 44.7% were females. It implies that there were more male mathematics teachers than female mathematics teachers sampled in this study.

The responses of teachers' perceptions about the use of Excel in the learning of mathematics have been presented in Tables 2, 3, and 4 below. In all the tables, the responses for *Strongly Agree* and *Agree* (1 and 2) were combined together to create only one response showing *Agree* and the same has been done for *Strongly Disagree* and *Disagree* (4 and5) to represent responses for *Disagree*. The *Neutral* response was left as is. The combination of the response helped when analyzing data as there will be fewer alternatives to deal with in context. The research questions were used as subheadings of the presentation.

The first research question for this study was; *What are the perceptions of Secondary Mathematics teachers towards the use of Excel in teaching and learning of School Mathematics?* The responses to the first question are summarised in Table 2 and Table 3 below.

Teachers' positive perception on the use of Excel impact positively on students' learning

The results of the research question which asked about the perceptions of mathematics teachers on the use of Excel show that teachers have positive perceptions on the use of Excel. The questionnaire items asking about perceptions of teachers on the use of Excel in teaching were "The use of Excel delay students" of which 48% respondents neither agreed nor disagreed with the statement. Thirty eight percent (38%) of the teachers disagreed with the statement as they indicated that Excel does not delay students while 14% agreed that the use of Excel delays student as shown in Table 2 below.

Table 2: Teachers' perceptions about impact of Excel on learners
Constructs of attributes

Constructs/attributes	**Agree (%)**	**Neutral (%)**	**Disagree (%)**
About positive or negative impact on students' learning			
The use of Excel delays students in learning maths	12 (14)	41 (48)	32 (38)
Technology makes mathematics learning enjoyable	46 (54.1)	24 (28.2)	14 (16.5)
ICT engages students in real life problems	62 73)	10 (11.8)	11 (12.9)

The majority of teachers said using technology makes mathematics learning enjoyable. Eighty-four teachers responded to this statement and 54.1% of them agreed that indeed using technology makes teaching enjoyable but 28.2% were non committal on the statement while 16.5% disagreed towards the statement. Teachers' responses imply that they have positive belief on the use of technology in mathematics as it can make learning enjoyable albeit relatively a small proportion. According to Ajzen's (1991) TPB, teachers are likely to display a positive behaviour by using Excel in the classroom with the intention of making learning enjoyable.

The perception of teachers on students' use of ICT to solve real life problems were solicited by asking the teachers to respond to the statement: "ICT can be used to allow students to

engage in real life problems". Seventy three percent (73%) of teachers agree that the use of ICT can engage students in real life problems. This was the largest positive response the teachers had shown on this study the teachers had shown on this study. This implies that the teachers have a positive belief on the use of ICT by students and according to TPB they may allow the students to use ICT when solving real life problems.

Teachers' views on the use of Excel

The majority of the teachers responded positively to the statement "I think using Excel makes teaching mathematics easy" as 50.6% agreed with the statement but 14.1% disagreed with the statement while 34.1 % were undecided about the statement. It shows that fairly a high percentage of teachers agreed that using Excel makes teaching easy as compared to those who disagreed with the statement. The positive belief about the use of Excel by teachers could also be good for students since teachers might use Excel in their classrooms hence helping the students to understand mathematics better. However, 48% of those who either don't know or disagreed are worrisome as their planned behaviour could be that they would not use Excel because they perceive no value in using it.

There were a high number of teachers who said they need to be trained in the use of Excel as shown in Table 3 below. Sixty out of the eighty-five teachers is a large number that needs attention of curriculum developers. This high number of teachers who need training can imply that, the teachers are not using Excel in their teaching since they don't have any training on it and are not capable of using it. These results are corroborated by those of the next statement about teacher competency in the use of Excel. Forty-one percent (41%) of teachers indicated that they were not competent to use ICT to teach mathematics. The other 27.7% were undecided regarding their competency in using ICT. Since most of teachers said they were not competent on the use of ICT and another large number said they were not trained in teaching Mathematics using Excel, the implication is that teachers are not competent to use ICT because they are not trained on its usage, hence the likelihood of not using Excel in the classroom.

Table 3: Teachers' perceptions about teachers' concerns and benefits in the use of Excel
Constructs of attributes

Constructs/attributes	**Agree (%)**	**Neutral (%)**	**Disagree (%)**
About teachers			
I think using Excel makes it easier to teach maths lessons	43 (50.6)	29 (34.1)	12 (14.1)
I need training on how to Excel in teaching mathematics	60 (70)	6 (7)	15 (17.6)
I think I am competent in using ICT to teach mathematics	26 (31.3)	23 (27.7)	34 (41)
I need some guidelines on the use of Excel	65 (77)	10 (11.9)	9 (10.7)
Teachers are not interested in using Excel to teach	18 (9.4)	12 (14.1)	55 (64.7)

Furthermore, teachers were asked if they needed some guidelines on how they should use Excel to teach mathematics, 77% answered on the affirmative implying that they were not competent in the use of Excel in the classroom. Only 12% of teachers indicated that they don't need the guidelines. This high number of teachers who said they need guidelines might lead to use of Excel in mathematics classroom unsuccessful as they will not use it in their classes due to the unavailability of guidelines on how to use it. About 64.7% of respondents disagreed with the statement "Teachers do not have interest in teaching Mathematics using

Excel" while nine percent (9.4%) agreed that teachers do not have interest in using Excel and 14.1% of the participants remained undecided towards the statement. From the results shown in Table 3, conclusion could be drawn that teachers had hopes and interest on the use of Excel in teaching mathematics. The interest of teachers in using Excel to teach some topics might help on the integration of ICT in education as they will practice regularly and by so doing improve their skills which they will apply on the integration of ICT on education.

The second objective of this study was to find out the factors influencing teachers' perception on the use of Excel. The research question was**;** *What factors influence teachers' perceptions on the use of Excel in the teaching and learning of graphs and graphing?*

Contextual factors influencing the use of Excel in teaching

The teachers were asked if their respective schools made provision of time to teach mathematics using Excel. As shown in Table 4, most teachers indicated that their schools do not provide enough time to use Excel. Only 18.8% of teachers agreed that their school has provision of time to use Excel while 65.8% disagrees with the statement and 10.6% of them remained undecided.

Table 4: Teachers' perceptions about factors influencing teachers' decision to use of Excel

Constructs of attributes

Constructs/attributes	**Agree (%)**	**Neutral (%)**	**Disagree (%)**
Contextual factors influencing the use of Excel in teaching			
The schools provide enough time to use Excel in teaching	16 (18.8)	9 (10.6)	56 (65.8)
There is shortage of computers in school to teach math with	61 (71.7)	4 (4.7)	20 (23.5)
Available computers are only for Comp. Awareness Course	45 (54)	12 (15)	26 (31)
JC syllabuses congested to allow usage of Excel in teaching	38(44.7)	19 (22.4)	25 (29.4)

Teachers indicated that that there were inadequate computers in their respective schools to use by mathematics teachers. About 71% of the agreed with the statement "There is shortage of computers in school to teach math with", 23.5% disagreed and about 5% remained without taking sides. This inadequacy of computers in schools may influence the teachers not to utilise the available computers as they have already stated that those available were for Computer Awareness Course. Furthermore, 54% of the teachers believed that the available computers are only for Computer Awareness Course. Fifteen per cent (15%) were undecided towards the statement while thirty one (31%) disagreed with the statement. As almost half of the teachers in this study agrees that available computers are for CA, teachers might be reluctant to use them even when they are not used by Computer Awareness course students. Therefore, using computers to teach Mathematics topics might be hindered by the lack of resources as already mentioned from the findings of the responses in the item.

Still on the factors influencing the teachers' perceptions, the researcher asked the respondents if Junior Certificate syllabus was congested. The responses towards the statement "JC syllabus is congested to allow the use of Excel in teaching Mathematics" showed that 44.7%

of teachers agreed with the statement, 29.4% disagreed and the 22.4% remained undecided towards the statement.

Findings and Discussions

This section discusses the findings on the perceptions of mathematics teachers in Botswana towards the use of Excel in Mathematics Teaching. The findings from this study revealed that teachers had positive believe on the use of Excel. The teachers mentioned that the use of Excel might have positive effects on the affective domain of the students learning mathematics and the use of Excel might help students to enjoy the study of mathematics hence improve their ability to solve some practical questions.

In this study, 73% of teachers said the use of Excel to learn mathematics might help the students to engage in real life problems and 54.1 % said the use of technology would make the study of mathematics enjoyable to students. These results are supported by findings of other studies (e.g. Ittigson and Zewe, 2003; Becta, 2003; Neurath and Stephens, 2003) who also found that the teachers had positive perceptions on the use of ICT as it would help the students to improve their performance and their algebraic thinking. According to TPB if the teachers have positive attitudes about behaviour they tend to have positive perception about the same behaviour. In light of this study, the teachers are likely to use Excel in their mathematics instruction especially for making the subject enjoyable.

Furthermore, teachers in this study have voiced out their incompetence on the use of Excel as they lack training on the use of Excel. They mentioned that they need training as well as guidelines in the use of Excel. The incompetency of teachers on the use of Excel was also mentioned by Shinde, Sawant and Deshmukh (2012) who said that teachers found it difficult to use Excel in class when incompetent. In TPB the third component of behavioural controls deals with how a person feels about behaviour; if the person feels incompetent to complete behaviour they might not carry on the activities to complete the behaviour but if they are competent they might complete the behaviour. Therefore for teachers in this study being incompetent in using Excel to teach mathematics might imply that the teachers would not use Excel in the teaching of quadratic graphs, simultaneous graphs and scatter graphs.

Summary, conclusions and recommendations

The study was a quantitative survey of mathematics teachers conveniently sampled in junior secondary schools and in-service teachers in UB. Data was analysed using percentages, mean and frequency. In the sample of 85 teachers there were 40 male teachers, 38 female teachers and 7 teachers did not specify their gender. The teachers sampled were well experienced in teaching as most of them (64.7%) have been teaching for over a decade.

The findings of this study indicate that mathematics teachers perceive positively the use of Excel in teaching and learning school mathematics. Generally mathematics teachers viewed the use of Excel as interesting and have mentioned different ways which they think the use of Excel would benefit students, such as use of Excel to solve real life problems and the students' ability to improve their answering skills. Even though the findings of this study revealed that most mathematics teachers have positive perceptions on the use of Excel, it also showed that these teachers are incompetent as far as using Excel in teaching mathematics is concerned. The incompetency of using Excel is linked to lack of training on the use of Excel by teachers. The study has also indicated the shortage of computers as a challenge in trying to use Excel in teaching and learning of quadratic graphs, scatter graphs and simultaneous graph. These factors could act as barriers to ICT integration.

In conclusion, the participants showed positive perceptions towards the use of Microsoft Excel to teach graphs and graphing. Just like in other studies reviewed for this paper, participants believed that the use of Excel by students might help them to perform better in mathematics and would help them to solve real life problems. Although interested in using Excel, teachers felt incompetent in doing so as they were not initially trained on the use of Excel. Following Ajzen's theory of planned behaviour, they may plan not to use it because of their incompetence. We therefore recommend that the use of Excel (and other software) in mathematics instruction be included in the teacher training programs in Colleges of Education or teacher training institutions. This will prepare teachers to meet ICT demands as stipulated by the syllabus. Another recommendation is that in-service training be intensified to allow practicing teachers upgrade their skills in ICT integration including the use of Excel.

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