

https://dspace.org/

# Teachers' attitude to using information and communication technologies in the classroom

**Du Rand, Jacques Andre**

**2015-08-13**
http://hdl.handle.net/10539/18230

Downloaded from a DSpace repository. https://dspace.org/

Copyright Notice

The copyright of this research report vests in the University of the Witwatersrand, Johannesburg, South Africa, in accordance with the University's Intellectual Property Policy.

No portion of the text may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, including analogue and digital media, without prior written permission from the University. Extracts of or quotations from this report may, however, be made in terms of Sections 12 and 13 of the South African Copyright Act No. 98 of 1978 (as amended), for non-commercial or educational purposes. Full acknowledgement must be made to the author and the University.

An electronic version of this report is available on the Library webpage (www.wits.ac.za/library) under "Research Resources".

For permission requests, please contact the University Legal Office or the University Research Office (www.wits.ac.za).

# TEACHERS' ATTITUDE TO USING INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE CLASSROOM

---

Jacques André du Rand

A research report submitted to the Wits School of Education, Faculty of Humanities, University of the Witwatersrand in partial fulfilment of the requirements for the degree of Master of Education by combination of coursework and research

Johannesburg, 2015

## ABSTRACT

The purpose of this study was to determine the attitudes of teachers in four secondary schools in Pretoria to the use of Information and Communication Technologies in their classrooms. Digital technology has become an integral part of modern society. Participating teachers completed an online questionnaire based on the Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989) to gauge their attitude towards using technology in the classroom as well as their intentions to use the technology. Variables such as perceived usefulness, perceived ease of use, technical support, attitude towards using technology and intention to use technology were used. Results revealed that teachers had a positive attitude towards the technology being used at school and their behavioural intention to use the technology was high.

## DECLARATION

I declare that this research report is my own unaided work. It is being submitted for the degree of Master of Education at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

_____

Jacques André du Rand

16th day of February in the year 2015

## ACKNOWLEDGEMENTS

I would like to thank my supervisor, Mr Thomas Waspe for his assistance. This report would not have been possible without his valuable insight and contribution.

I would also like to thank my Principal, Mrs Caroline Nel and all the staff at my school for their support and encouragement.

Thank you to my partner and family for their support.

## Table of Contents


ABSTRACT ..... iii

DECLARATION ..... 1

ACKNOWLEDGEMENTS ..... 2

List of Figures ..... 4

List of Tables ..... 4

Abbreviations ..... 4

1. Introduction ..... 5

2. Research Problem ..... 8

2.1 Problem and purpose ..... 8

2.2 Research Questions ..... 9

2.3 Rationale ..... 10

3. Literature Review ..... 11

3.1 Introduction ..... 11

3.2 What is Educational Technology? ..... 14

3.3 Teacher Attitudes and Beliefs ..... 17

3.4 Technological Pedagogical and Content Knowledge (TPCK) ..... 22

3.5 Theory of Planned Behaviour (TPB) ..... 24

3.6 Unified Theory of Acceptance and Use of Technology (UTAUT) ..... 26

3.7 Technology Acceptance Model (TAM) ..... 28

3.8 Conclusion ..... 33

3.9 Conceptual Framework ..... 34

4. Methodology ..... 36

4.1 Method ..... 36

4.2 Sample and Ethical Considerations ..... 36

4.3 Instrument ..... 39

4.4 Validity, Reliability and Generalisability ..... 41

4.5 Data Collection Procedure ..... 43

4.6 Data Analysis Plan ..... 43

5. Results ..... 45

5.1 Descriptive Analysis of Data ..... 45

5.2 Inferential Analysis ..... 51

6. Discussion ..... 55

6.1 Summary of major results ..... 55

6.2 Limitations of this study ..... 57

6.3 Implications for further research ..... 59

6.4 Conclusion ..... 59

7. References ..... 62

APPENDIX A – Questionnaire ..... 70

APPENDIX B – Letters of Consent and Information Sheet ..... 73

APPENDIX C – Raw Data ..... 80

## List of Figures

Figure 1 - TPCK ..... 22
Figure 2 - Theory of Planned Behaviour ..... 26
Figure 3 - Framework for UTAUT ..... 27
Figure 4 - Unified Theory of Acceptance and Use of Technology ..... 28
Figure 5 - Technology Acceptance Model ..... 29
Figure 6 - Scatter Plot - Usefulness vs. Attitude ..... 50
Figure 7 - Scatter Plot - Intentions vs. Attitude ..... 51

## List of Tables

Table 1 - Questionnaire Responses ..... 37
Table 2 - Sample Demographics ..... 38
Table 3 - Descriptive Statistics ..... 45
Table 4 - Attitude according to age ..... 46
Table 5 - Pearson's Correlation Coefficient ..... 47
Table 6 - Use of ICT ..... 48
Table 7 - Regression - Technical support, PU, PEOU vs. Attitude to ICT ..... 48
Table 8 - Regression - Technical support, PU, PEOU vs. Intention to Use ..... 48
Table 9 - ANOVA - Technical support, PU, PEOU vs. Attitude to ICT ..... 49
Table 10 - ANOVA - Technical support, PU, PEOU vs. Intention to Use ..... 49
Table 11 - Coefficients - Technical support, PU, PEOU vs. Attitude to ICT ..... 49
Table 12 - Coefficients - Technical support, PU, PEOU vs. Intention to Use ... 50
Table 13 – Constructs for Question 1 ..... 52
Table 14 - Constructs for Question 2 ..... 53

## Abbreviations

| | |
|---|---|
| ICT | Information and Communication Technology |
| TPCK | Technological Pedagogical and Content Knowledge |
| TPB | Theory of Planned Behaviour |
| TRA | Theory of Reasoned Action |
| TAM | Technology Acceptance Model |
| UTAUT | Unified Theory of Acceptance of the Use of Technology |
| PU | Perceived Usefulness |
| PEOU | Perceived Ease of Use |
| ATU | Attitude towards Use |

# 1. Introduction

Human advancement through the ages occurs because society finds a way to alleviate the burden of cumbersome chores. The wheel was invented to help transport loads and Morse code changed the way we communicate over long distances. Then came the telephone, the motorcar, radio, air travel, television, computers and the Internet. Similarly, we have had technology in our classrooms all the time. There have been chalkboards and chalk, textbooks and stationery, charts on the wall, slide rules and overhead projectors. These technologies are now transparent (Graham, 2011). We now have digital technologies to deal with in education - computers, projectors, interactive whiteboards, smart phones, etc.

The government has tabled a white paper on e-education where it has laid out elaborate plans for the implementation of digital technologies in schools (2004). It is natural for governments to want this advancement in education to happen. Developing countries such as South Africa run the risk of falling into the digital divide (Wade, 2002). Developed countries have the monopoly as far as owning and developing computer hardware and software is concerned and developing countries are being convinced that they will not be able to compete on a global stage if they do not buy into acquiring digital technology. Christie (2008), Light (2001), Singh (2004) and Wade (2002) have expressed concern that many developing countries cannot afford to feed the masses, let alone pay for electricity infrastructure to operate all the computers. Many private schools in South Africa have managed to incorporate ICT in their classrooms. They can afford it. However, most government schools cannot. There are some ex-model C schools that have bridged the gap and have had parents buy in to the

whole idea of e-books and SMART boards. The majority of government schools cannot afford to bridge the gap. So, even though the government is trying to bridge the digital divide, the implementation and support of policy is lagging behind.

Teachers are the key players in any effective integration of technology in teaching and learning (Teo, 2011a). Teachers have always needed to use some form of technology in their classrooms. As mentioned, chalkboards and overhead projectors were the order of the day. Technology is changing and teachers are expected to take advantage of these advances but the problem arises when the transition between pedagogy and technology is not as seamless as it is supposed to be (Teo, 2011a). A further problem is teacher training. Teachers trained before the mid-1990s did not have any exposure to PCs and other digital technologies. Many universities now are not training their student teachers to incorporate ICT (Singh, 2004). One of the biggest problems of all is that our learners are connecting to the world in a completely different way that their teachers used to, even the ones in rural areas, thanks to mobile phones. Teachers need to embrace this phenomenon rather than ban it from the classroom. However, are teachers willing to embrace technology or are they going to resist the change for as long as they can? It is well documented that teachers do not like changing things in their classroom, especially if things are working for them. For example, Cuban (1996) said that teachers tend to resist anything new. When televisions were introduced in American schools, teachers were against it, not to mention the use of slide projectors and tape recorders.

Research has shown that teachers develop a pedagogical knowledge that incorporates the use of technology (Niess, 2011).

This technological pedagogical and content knowledge (TPACK) (Koehler & Mishra, 2009) could be a deciding factor in determining teachers' use of digital technology. Teachers who have qualified in the last 15 to 20 years have grown up with computers and so their technology knowledge should be sufficient to be able to incorporate ICT in their lessons. Teachers who have been teaching for twenty years or more may not have had the same exposure. This could be one of the reasons why the implementation of ICT is taking longer than it should. Studies have found that the level of technology acceptance depended on the level of professional development that a teacher is at (Y. Liu & Szabo, 2009, p. 20). I attempted to find out whether teachers in four Pretoria-based secondary schools had a positive or negative attitude towards using digital technologies in their classrooms. The reason for the choice of these schools in particular is discussed in Chapter 2. These findings could be used to develop better programmes at universities to train student teachers to incorporate ICT in their teaching methods. In this way newly qualified teachers will be able to start their careers with a different set of skills to the current teacher population. Education departments could use the findings to initiate more effective in-service training structures.

The research questions have been formulated bearing all of the above in mind. If it is true that teachers are negative about using technology, is this always going to be the case, or can the situation change?

# 2. Research Problem

## 2.1 Problem and purpose

The advances that have been made in digital technology and social networking have changed the way people learn and communicate. Teachers need to adapt their teaching methods so that it incorporates the use of ICT in the classroom. The education department in South Africa is very keen to digitise all public schools so that we can compete with the rest of the global market. It understands the apparent importance of ICT and the need to integrate teaching methods and ICT. To this end it is important that teachers are able to deliver lessons using technology in an efficient way. Many in-service teachers were trained before computers and other digital technologies and as such have competency problems as far as using ICT for administration and teaching. The current White Paper on e-Education (2004) attempts to address ICT integration but there are several factors hampering the government's rollout. I attempted to measure teachers' attitudes to ICT integration as well as their willingness to integrate into their teaching. These teachers were based at four secondary schools in Pretoria. The schools varied in demographics: one private school, one English-speaking ex-Model C school, one Afrikaans-speaking ex-Model C school and one township school. The profile of each school is discussed in Chapter 5. Based on the history of the country it was expected that teachers from these different schools would exhibit different attitudes and beliefs about the use of technology. There are theories that explain that beliefs, attitudes and intentions to behave in a certain way can be measured quantitatively (Fishbein & Ajzen, 1975). There are authors who have adapted this theory of planned behaviour and have shown that a Technology Acceptance Model (TAM) is a better predictor of the intention to

use ICT (Teo, 2011b, p. 10). There is also the resistance to change that many teachers exhibit throughout their careers that needs to be addressed (Cuban, 1996).

Teachers may be able to use a computer and to compile a spreadsheet of marks as well as design a PowerPoint presentation, but it does not mean that they necessarily believe that these skills will be an effective tool in the classroom (Ertmer, 2005). If teachers have had bad experiences using technology, they will have negative beliefs about their abilities using the technology in the future (Ertmer, 2005). Ertmer (2005, p. 28) showed that there was a link between teachers' pedagogical beliefs and their beliefs about how technology allows them to convert their beliefs into practice. Teachers often believe that technology is there to supplement their teaching as opposed to believing that it is a tool to ensure successful learning (Ertmer & Ottenbreit-Leftwich, 2010).

Children are "wired" differently today and they have access to social networking and the Internet all the time (Siemens, 2008). How they find information has changed compared to how their teachers did when they were at school. Teachers should be able to embrace this "new-found" phenomenon and use it to their advantage in the classroom.

## 2.2 Research Questions

2.2.1 What is the attitude of teachers in four secondary schools in Pretoria towards the integration of ICT in their teaching methods?

2.2.2 Are teachers willing to adapt their teaching methods to incorporate ICT?

## 2.3 Rationale

Why these questions? The purpose of my research was to find out whether teachers have a positive or negative attitude to using any form of digital technology in their classrooms, whether it is for administration purposes or for teaching. The government wants teaching to be transformed with the aid of digital technology (DOE, 2004). That is all well and good if the technology and the infrastructure that goes with it were provided to every public school in the country. The Gauteng Department of Education has been proactive in this regard by installing a computer centre in approximately 2000 schools in Gauteng (GPG, n.d.). The project is called Gauteng Online. However, the reality of the matter is that the centres are mostly not used due to problems with support, teacher training and school principals' reluctance to allow children to use the centres to mention a few problems (Mail & Guardian, 2013). Teachers become suspicious of technology because the "network is always down" or "the computers need a software update" or "the computers have been infected by a virus". I have heard teachers at these schools speak of "Gauteng Offline". The centres have become white elephants (Mail & Guardian, 2013).

I also attempted to find out whether teachers were willing to incorporate different digital technology into their lessons and possibly find out if they were adapting their teaching to the technology or if they were adapting the technology to their teaching. This research may be helpful to policy makers in the education department, in that they may be able to use a different approach to the way in which ICT is integrated into schools in general and into teaching methods specifically.

# 3. Literature Review

## 3.1 Introduction

As mentioned earlier, teachers do not like change. Cuban (1996, p. 1) criticised the view that if technology has been able to save the business world, it should be able to improve the way teachers teach and children learn. He argued that continued attempts to change the status quo, by authorities insisting that technology be introduced into schools, has failed to transform teaching. Teachers are slowly introducing computers into their "repertoire" (Cuban, 1996, p. 1) but reformers say that it is too slow. Cuban goes on to say that teachers have been resisting the introduction of technology for decades. Making sure that teachers have the most up-to-date equipment is not sufficient for them to adopt technology readily. He provided many examples of how radio and television did not produce the effect that was predicted. The use of these technologies was very limited (p. 1). So, it is probably fair to say that it does not matter what technology is available; teachers will stick with what they know. Teachers in the United States use computers in their teaching, but it is mostly for games and drills in their classrooms (Becker, 2001) and teachers in the United Kingdom attribute their resistance to effective integration to the lack of technical support, lack of confidence and lack of seeing the advantages of using technology (Jones, 2004). Australian teachers blame the tardiness of e-learning development on the lack of clear direction from the education department (Birch & Burnett, 2009) and in Singapore research has shown that effective integration of technology is minimal (Lim & Khine, 2006). One of the proposed reasons for this is the low level of acceptance of technology by teachers (Legris, Ingham, & Collerette, 2003). Having said this, research has also shown that if teachers find that they are comfortable with technology, there is a significant

improvement in self-efficacy beliefs towards integrating the technology with their teaching (Abbitt & Klett, 2007, p. 28). There should be more research on trying to understand how self-efficacy beliefs emerge and which factors will influence these beliefs as well as developing pre-service training programmes focussed on the integration of technology (Abbitt & Klett, 2007, p. 36). Studies have found that there is a positive effect on the intention to use technology if teachers' perceived ease of use and the perceived benefits are high (Horzum & Canan Gungoren, 2012). Horzum et al. (2012) provide evidence that showed that science and technology teachers successfully used web-based instruction programmes because their perceived difficulty levels decreased while their belief in positive results increased. It was reported that ease of use and usefulness of web-based science tools allowed science teachers to develop a positive attitude towards using the tools (Horzum & Canan Gungoren, 2012). My study intended to determine whether teachers do have positive attitudes. These findings will, in turn, go a long way to address the idea that teachers are resistant to change.

There are theorists who claim that teachers can develop their knowledge of technology and incorporate this knowledge in their pedagogy. Mishra and Koehler (2006) have adapted Shulman's (1986) model of Pedagogical Content Knowledge (PCK) to include Technology. This model is called TPACK or TPCK (Technological Pedagogical and Content Knowledge). Teachers know their subject matter, they know how to teach their subject and they know how to use technology (2006, p. 1025). Teachers can therefore develop knowledge of how to use technology to teach their subject.

If authorities want teachers to use technology, they need to think of a different way to be able to introduce it. They may consider finding out what the reasons are for this resistance and to do that they need to determine teachers' attitudes. It appears that this could be an impossible task. How can one measure the attitude that a person has towards something? The literature shows that there are a number of people who have. Ajzen and Fishbein (1975) proposed a Theory of Reasoned Action (TRA). Ajzen (1985) developed this further and called it a Theory of Planned Behaviour (TPB). This theory claims that behaviour is determined by the intention to act and that the intention predicted by one's attitude, one's subject norms and one's perceived behavioural control (Mathieson, 1991, p. 175). I will explain these concepts in more detail later in the chapter.

Davis, Bagozzi and Warshaw (1989) found that their Technology Acceptance Model (TAM) was a better predictor than TRA when it comes to predicting the use of technology (Teo, 2011b, p. 10). Teo explained that the user's acceptance of technology is determined by its perceived usefulness, its perceived ease of use and, finally, behavioural intentions. Teo (2011b) goes on to say that "Davis et al. found that both perceived usefulness and perceived ease of use directly mediated behavioural intentions (with perceived ease of use also having a direct effect on perceived usefulness). In turn, behavioural intentions were found to be a strong predictor of actual use" (Teo, 2011b, p. 10). So, if one believes that a tool is useful to one's practice, and it is believed that the tool is easy to use, it can be true that the tool will be incorporated into one's practice. Once the tool or system is incorporated the chances that it will be used are high. Mathieson reported that although TAM is a fairly new model, it does provide evidence that it predicts intention fairly well (1991, p. 175).

There are other models to determine IT acceptance. They are the motivational model, a model combining TAM and TPB, a model of PC utilisation, the innovation diffusion theory and the social cognitive theory (Venkatesh, Morris, Davis, & Davis, 2003). Venkatesh et al. (2003) also reported on a Unified Theory of Acceptance and Use of Technology (UTAUT). This model has "four determinants of intention and usage, and up to four moderators of key relationships" (2003, p. 425). The three models will be discussed in more detail later in this review. I will now look at the whole notion of using technology to teach.

## 3.2 What is Educational Technology?

There has been an attempt to define the field of educational technology from as early as the 1960s (Ely, 2008). The definition keeps changing as new technologies are introduced all the time and Ely commented that "the most recent definition of the field by a professional association incorporates most of the newer developments while maintaining the essence of the old" (2008, p. 244). There is also the problem that people think that 'educational technology' and 'instructional technology' are the same concepts. Educational technology is considered to be the use of technology in any aspect of education while instructional technology is usually the "the process of teaching and learning through the purposeful use of strategies and communication media" (Ely, 2008, p. 244). The Association of Educational Communications and Technology (AECT) has the current definition of instructional technology:

> Instructional technology is the theory and practice of design, development, utilisation, management and evaluation of processes and resources for learning. (Ely, 2008, p. 245)

This is slightly different from the new definition for educational technology. It reads as follows:

> Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources. (Richey, Silber, & Ely, 2008, p. 24)

The field of educational technology is growing worldwide and some countries have formed educational technology associations, including Australia, France, Germany, UK and the USA, and a number of countries in the Far East such as Indonesia, Japan, South Korea and Malaysia (Ely, 2008). Each association has a different view of what the field should comprise, but they do agree that the conceptual base stems from the unique link between education and culture (Ely, 2008).

Instructional technology came to the fore after World War II where there was a drive for 'concrete' learning materials to enrich the syllabus; materials such as films, recordings and other media (Ely, 2008). People like Skinner (1954) were very keen on using machines to improve learning and also move the focus from the teacher to the learner (Ely, 2008). This is one of the views of modern educational technology.

The digital technologies that have been highlighted in the measuring instrument in this study are laptops, data projectors, tablets, eBeams and SMART Boards. To use digital technology in the classroom the teacher invariably needs to have some type of computer in the room. Desktop computers are an option, however, the portability of a laptop and/or a tablet allows the

teacher to take it home and work on preparation and other school related administration. Laptop computers have evolved to such an extent that they now have built-in Wi-Fi capabilities enabling teachers to connect to the school's intranet. They are also able to connect to the Internet and access information from within their classrooms. Interactive whiteboards such as the eBeam and SMART Board have also started making their appearance in schools. The Department of Education has launched the Dinaledi programme aimed at improving mathematics and science results in high schools in South Africa (O'Connell, 2009). The various provincial departments have also provided schools with laptops, tables, eBeams and software for mathematics and science lessons. Teachers at these schools have received training in the use of the various software packages and the eBeams. The eBeam is a device that turns any whiteboard into an interactive board for teaching and demonstrating (Holtzman, 2015). A SMART Board is also an interactive whiteboard, but is a specially designed board with dedicated software. The board that is used in a classroom is usually fixed to the wall and replaces the chalkboard altogether ("SMART Education," 1991). The software available for the SMART Board becomes extremely powerful when a teacher has received training in how to use it effectively.

Other fields such as psychology, communications, systems and management started contributing and provide a basis for instructional technology, so much so that aspects from each field have been integrated to one of the five domains that make up the AECT definition. The influence of psychology allowed the field to evolve from using perception principles in the media-oriented period to using cognitivist theories and on to a constructivist approach (Ely, 2008). Communication played a big role in the field when connectivity between networks became a reality. It is my

opinion that the Internet has played a large role in the use of communication media for the evolution of educational technology.

Having said all this, apart from the American definition, it is clear that there is no accepted definition for the entire field (Ely, 2008; Richey et al., 2008). However, as can be seen from the current definition, using appropriate technology to assist with learning and improve the learners' performance is the route many education departments are taking in order to embrace the very real phenomenon of the interconnectivity of everyone and everything. The next issue is convincing teachers that they need to be part of this interconnectivity in the classroom too.

## 3.3 Teacher Attitudes and Beliefs

As mentioned, technology has been around in schools for a long time and teachers have not always been keen to accept any new ways of doing things (Cuban, 1996; Kadel, 2005). Many proponents of technology would say that you have to have the right attitude toward technology in order to use it affectively in your classroom (Kadel, 2005, p. 34). The question is, what is the right attitude? Research has shown that teachers who employ a constructivist approach to their teaching philosophy are more likely to find computers useful in their teaching practices (Henry Jay Becker & Riel, 2000). However, computer instruction is not only reserved for constructivists; behaviourists will argue that learners' behaviour can be shaped using machines too (Skinner, 1954). Other surveys conducted in the United States among teachers tried to find out what it was that made teachers either accept or reject technology (Vannatta & Fordham, 2004).

These studies looked at the philosophy of teacher-centred versus student-centred learning as well as constructivist versus traditionalist teaching. They also looked at the idea of how much

teachers believe they can make a difference to their students' academic results. Another factor that was investigated was teachers' openness to change (Kadel, 2005). Regression analysis, which is "a statistical procedure that allows the researcher to gather together a group of 'causes' and compare them to see how much they cause a particular effect" (Kadel, 2005, p. 35) was used to analyse which factors caused teachers' use of technology to increase or decrease. Three significant causes were found: the number of hours spent on technology (outside of contact time), the number of hours of technology training received and the teachers' openness to change (Kadel, 2005). Kadel argues that this means that the emphasis was more on the willingness to change rather than having to adopt a new way of teaching. If teachers can understand how new technologies relate to their teaching and how they can be utilised in their classrooms, they may be less reticent to accept the inevitable (Kadel, 2005). He also said that teachers have to invest a great amount of time for technology training and even more time after hours to learn the new technology (2005, p. 35). The consequence of this is that student teachers need to receive training in how to determine which technology to use where as well as how to use the technology. Current teachers also need this kind of training if they are going to continue in their profession until they retire.

The way student teachers perceive teacher attitudes can also affect the integration of technology in schools (Shuldman, 2004; Wang, Ertmer, & Newby, 2004). They found that if student teachers were placed in the firing line as it were (i.e. vicarious learning experiences), they demonstrated a higher degree of confidence in their abilities to integrate technology (Kadel, 2005, p. 35). Another aspect that increased confidence in their abilities was the practice of goal setting and determining what was needed to achieve these

goals (Kadel, 2005). According to this research it would seem that teachers who are already in the field need to have time and energy and they need to be open to change, whereas student teachers need to set goals and learn from others (Kadel, 2005; Wang et al., 2004). The key point here is that if teachers believe that the technology they are supposed to use is going to affect their teaching methods negatively, they will not be open to change.

A number of theories try to explain how people eventually accept any form of innovation; the Theory of Reasoned Action (Fishbein & Ajzen, 1975), the Theory of Planned Behaviour (Ajzen, 2013), the Technology Acceptance Model (Davis, 1993) and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003) are just a few. The integration of a technology goes through a number of processes before it is finally accepted (Yucel & Gulbahar, 2013). Rogers (2003) said that an innovation gets through to society over time via some form of communication. He called this the process of innovation diffusion and the communication will include information about the characteristics of the innovation so that it would influence any potential takers' perception about the innovation (Yucel & Gulbahar, 2013). For this diffusion to occur there must be innovation, a communication channel, time and a social system (Yucel & Gulbahar, 2013). Diffusion of innovation occurs in five steps: Knowledge, persuasion, decision, implementation and confirmation (Rogers, 2003). It is during the persuasion process that a user will determine the perceived usefulness of the innovation and the decision process will find the user either adopting the idea or rejecting. The innovation will then be used.

Chen (2008) reported that teachers may hold conflicting beliefs with regards to instruction and technology without realising that

this was the case. These conflicting beliefs had a greater effect on their instruction and use of technology as opposed to their pedagogical beliefs (Chen, 2008, p. 72). An example of this would be when teachers are unwilling to allow learners to use technology to investigate content on their own because there is pressure from administrators to get the work done in a certain time-frame. Teachers felt that they were responsible for covering the content and facilitating learning in order to comply with their obligations (Chen, 2008). Some teachers felt that they would be considered incompetent if they allowed learners to explore content on their own. Chen (2008) further reported that teachers felt that learners would not study properly if they did not set frequent tests and consequently the learners' independent problem-solving and self-regulated learning using technology took a back seat.

A further aspect of whether teachers will adopt technology or not, is the attitude of the administrators. Shuldman (2004) found that administrators must make an effort to gain support from teachers, school governing bodies and the community. If a districts' administrators are informed and well-trained, the teachers in the district will be more likely to adopt and integrate technology in their classrooms (Kadel, 2005). I have mentioned that the Department of Basic Education is keen to implement technological changes in our schools and I have discussed why this has not been successful. Shuldman did say that everyone must be on the same page and have the same goals and that there needs to be adequate time and funding for integration to take place (Kadel, 2005, p. 35). Another aspect of integration is the pedagogy. A study has found that teacher beliefs of their abilities and attitudes towards technology do influence the acceptance of technology and that behavioural and contextual beliefs are related to the perceived usefulness, the ease of use and the intention to use web-based

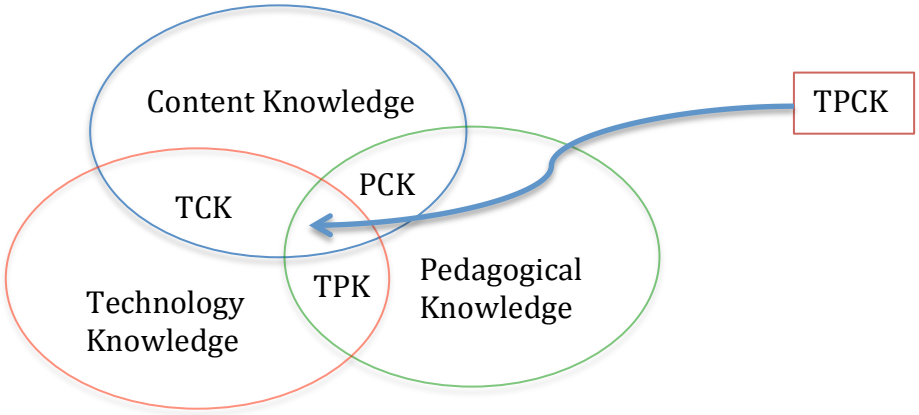
instruction (Horzum & Canan Gungoren, 2012). This study used Web Pedagogical Content Knowledge (WPCK), which incorporates Technological Pedagogical and Content Knowledge (TPCK) (Koehler & Mishra, 2009). The model looks at teachers' self-sufficiency towards the Internet (Lee, Tsai, & Chang, 2008). Using this model Horzum et al. (2012, p. 10) found that beliefs in web-based instruction reinforced acceptance of the tools used in web-based instruction and that acceptance of these tools reinforced WPCK.

It is therefore conceivable to assume that if teachers are trained to use technology in conjunction with the subject knowledge, and they are confident in the use of the various technologies in their classrooms, they would develop a more positive attitude towards the use of technology. The Technology Acceptance Model states that a person's acceptance of technology is determined by perceived usefulness, perceived ease of use and behavioural intention (S.-H. Liu, 2011). Teachers' attitudes towards technology use and their self-efficacy beliefs could affect the perceived ease of use and in turn the perceived usefulness of a technology tool. TPCK could play a significant role in how teachers can react favourably or unfavourably towards having to use technology in their classrooms. It should stand to reason that if one were uncomfortable with a tool, one would tend to shy away from using it. A study showed that TPCK can predict attitudes towards technology use and the intention to integrate technology (S.-H. Liu, 2011). I will discuss these finding later. The following is a brief discussion of Technological Pedagogical and Content Knowledge and Mishra's and Koehler's (2006) feasible argument for this knowledge to be measureable.

## 3.4 Technological Pedagogical and Content Knowledge (TPCK)

Mishra and Koehler (2006) developed a model to explain how teachers can use their acquired technology knowledge to teach their subject.

**Figure 1 - TPCK**




(Adapted from Mishra & Koehler, 2006)

As can be seen from Figure 1, the model consists of three circles intersecting to form seven distinct sections. Content Knowledge (CK) is knowledge that a teacher has with regards to the subject (2006, p. 1026)(Niess, 2011). Knowing how to teach your subject is called Pedagogical Knowledge (PK). These are the processes and methods needed to teach a subject (2006, p. 1026). Pedagogical Content Knowledge (PCK) is knowledge of how to teach the specific subject that a teacher teaches (2006, p. 1027). Teaching mathematics is different from teaching history.

Technology Knowledge (TK) is about all the technologies that a teacher uses to teach; from chalkboards, to charts, to overhead projectors and, more recently computers and interactive whiteboards (2006, p. 1027). A teacher has to know how technology and subject content can be used together (Technology

Content Knowledge or TCK). A teacher has to know how to teach using the technology (Technological Pedagogical Knowledge). Finally, a teacher has Technological Pedagogical Content Knowledge (TPACK or TPCK). This is described as follows:

> TPCK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones. (Mishra & Koehler, 2006, p. 1029)

If universities or teacher colleges can introduce programmes into the curriculum so that student teachers can develop their TPCK, it may go a long way to change attitudes and behavioural intentions to using technology. This idea is reinforced by Liu (2011) who reported that "isolated courses in teacher education programmes generate technical skills, pedagogical knowledge, and subject knowledge, and influence the knowledge and ability of pre-service teachers to technology integration" (S.-H. Liu, 2011, p. 3353). The study showed that Technology Knowledge, Pedagogical Knowledge and Content Knowledge had a direct affect on a person's TPCK (S.-H. Liu, 2011). The study also revealed that TPCK could predict a person's attitude towards using technology as well as the intention to integrate technology. Three other models have been reviewed to decide on an appropriate instrument for this study.

## 3.5 Theory of Planned Behaviour (TPB)

As mentioned earlier, Mathieson (1991) explains that behaviour is determined by the intention to perform the behaviour or act. He further explains that intention is predicted by one's attitude toward the behaviour, one's subjective norms and one's perceived behavioural control (1991, p. 175). Attitude is defined as a person's evaluation of the desirability to do something (p. 175). Intention is defined as a person's intention to do or use something. Subjective norm is "the individual's perception of social pressure to perform the behaviour" (p. 175) and perceived behavioural control is "the individual's perception of his or her control over performance of the behaviour" (p. 175). Ajzen (2013) has subsequently adapted the model. He argues that one's ***behavioural beliefs*** together with the subjective values of the expected outcome will determine one's ***attitude toward the behaviour, (A)***. He says that behavioural beliefs link the behaviour to the expected outcome. He defines "a behavioural belief as the subjective probability that the behaviour will produce a given outcome" (Ajzen, 2013). He also argues that the evaluation of a result or outcome, together with the subjective probability that the behaviour will produce the specific result, contributes to one's attitude. The attitude toward the behaviour can be measured by looking at the strength of each belief (*b*) and the evaluation of the outcome (*e*). These calculations are then added together.

A person perceives that there are behavioural expectations of other people who hold positions of power or respect, for example, a supervisor or the person's spouse. These expectations are referred to as ***normative beliefs*** (Mathieson, 1991). A person is usually motivated to comply with important individuals or groups

and so this motivation together with normative beliefs will determine the prevailing ***subjective norm, (SN)*** (Ajzen, 2013). Ajzen claims that the subjective norm can be measured by aggregating the product of each normative belief (*n*) and the motivation to comply (*m*).

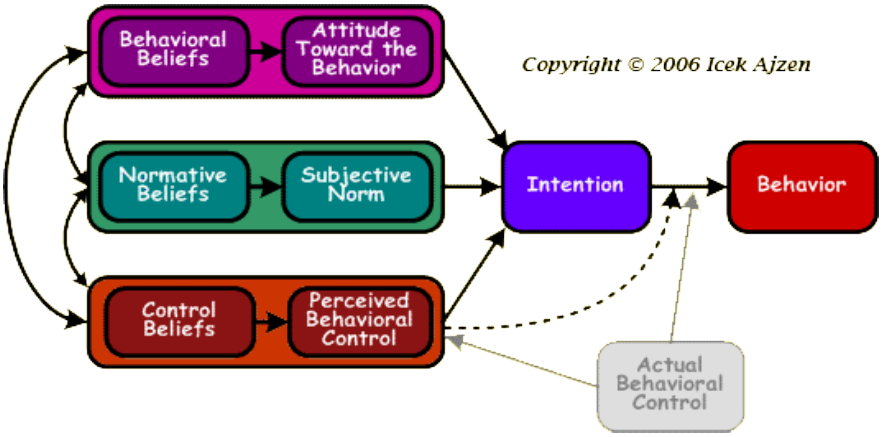
There are usually factors that may facilitate or impede the performance of a behaviour (Ajzen, 2013). These perceived factors are referred to as ***control beliefs***, which, in combination with the perceived power of each control factor, will determine the ***perceived behavioural control, (PBC)***. We all have a certain perception of whether we can perform a given behaviour or not. This is one's perceived behavioural control and it is the sum of all the control beliefs (*c*) multiplied by the perceived power (*p*).

"To the extent that it is an accurate reflection of actual behavioural control, perceived behavioural control can together with intention, be used to predict behaviour" (Ajzen, 2013). As mentioned, the intention is the indication of one's readiness to do something. If the intention is there, the behaviour will probably take place. To summarise then, the intention to behave is based on the attitude toward the behaviour, the subjective norm and the perceived behaviour control (Ajzen, 2013).

Finally, behaviour is the observable act. Ajzen says that the perceived behavioural control will moderate the effect of intention on behaviour in such a way that a good intention will produce a behaviour only when the perceived behavioural control is strong (2013). Fishbein and Ajzen (1975) showed that there was a relationship between beliefs, attitudes, intentions and behaviours, but they emphasised that it was imperative to know that different

laws apply to the concepts. Figure 2 below is a diagram to depict the model.

**Figure 2 - Theory of Planned Behaviour**



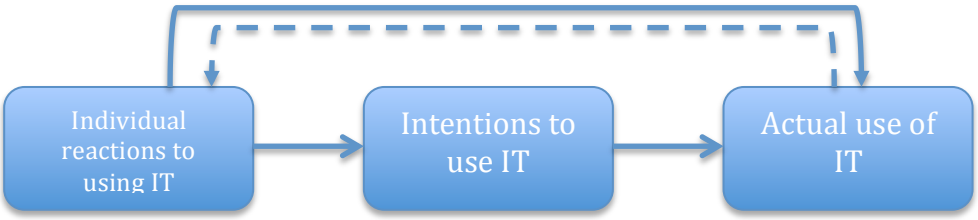

(Ajzen, 2013)

This model can be used to determine or predict a person's intention to behave in any field, not just technology. The next model is derived from the Theory of Planned Behaviour as well as number of other frameworks involving technology acceptance.

## 3.6 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh, Morris, Davis and Davis (2003, p. 427) provided a model to show the basic concept underlying acceptance models. Figure 3 presents the framework underlying how user acceptance of information technology can be measured. It is the framework that was used to form the basis of their research.

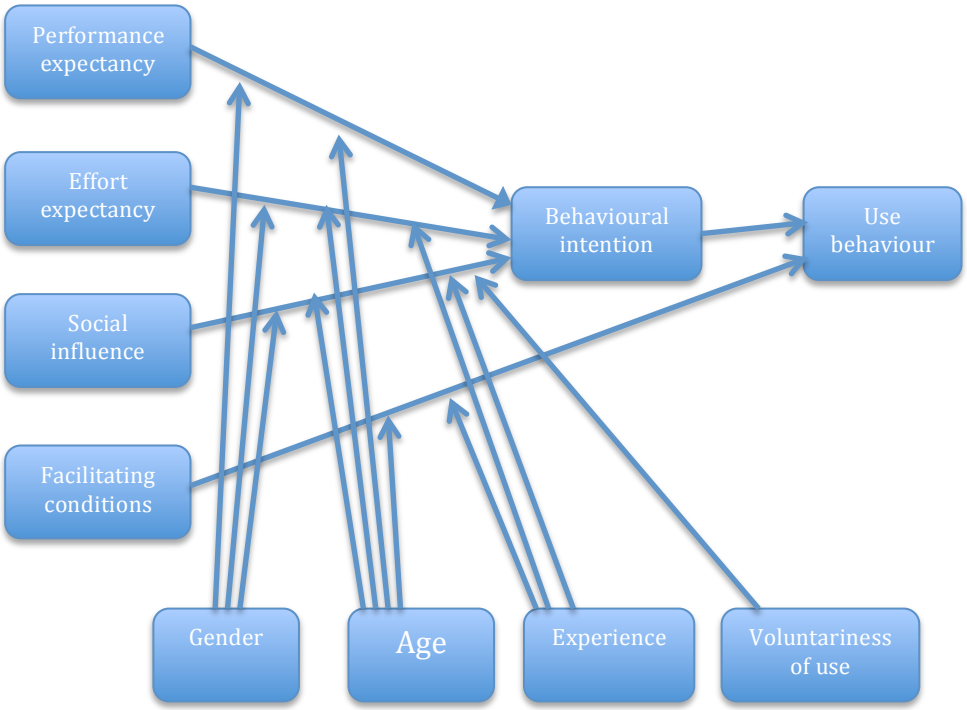
**Figure 3 - Framework for UTAUT**




(Venkatesh et al., 2003)

Venkatesh et al. reviewed and tested eight competing models of user acceptance. They were: the Theory of Reasoned Action (TRA); the Technology Acceptance Model (TAM); the motivational model (MM); the Theory of Planned Behaviour (TPB); a model combining TAM and TPB (C-TAM-TPB); the model of PC utilisation (MPCU); the innovation diffusion theory (IDT); and the social cognitive theory (SCT). They then formulated a unified theory of acceptance and use of technology (UTAUT). This model looked at four constructs and four moderators to develop the research model. The constructs were performance expectancy, effort expectancy, social influence, and facilitating conditions. The four key moderators were gender, age, experience, and voluntariness of use (Venkatesh et al., 2003, p. 447). The research model is depicted in Figure 4.

**Figure 4 - Unified Theory of Acceptance and Use of Technology**




(Venkatesh et al., 2003)

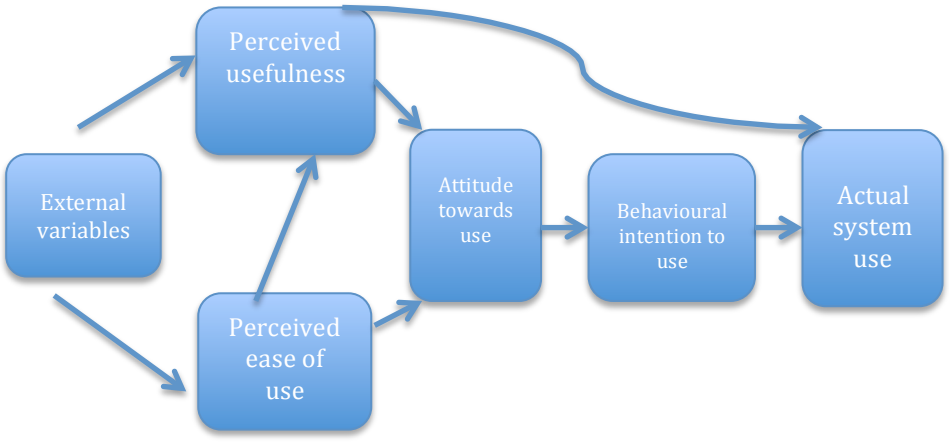
From the evidence gathered it was shown that age and gender were key moderators of the four constructs. It was found that the older generation of workers with no experience did battle with performance and effort expectancy (Venkatesh et al., 2003, p. 469). The authors of this research showed that the model was quite favourable to explain behavioural research. They suggested that further work be done on ways to explain technology adoption and usage behaviour (2003, p. 470).

## 3.7 Technology Acceptance Model (TAM)

The Technology Acceptance Model focuses on whether or not a person will accepting technology (Davis et al., 1989). This model can measure technology acceptance in any line of work and there are also instruments designed to measure teachers' attitudes.

Three factors determine a person's acceptance of technology: its perceived usefulness, its perceived ease of use and the person's behavioural intentions (Teo, 2011b). Teo showed that one's intention to use (ITU) a computer (or other digital technology) is strongly determined by the perceived usefulness (PU) of the product, its perceived ease of use (PEU) and one's attitude toward computer use (ATCU) (2011b, p. 2). Evidence also showed that PEU significantly influenced PU. Furthermore, it was revealed that PU and PEU was directly linked to ATCU and that PU and ATCU influenced one's ITU (Teo, 2011b). The TAM instrument has been used to investigate a whole range of issues with regards to user acceptance (Smarkola, 2007), for example the World Wide Web and the use of various software applications. The TAM has also been used to research educational issues such as students' acceptance of online courses and student teachers' perceptions of ICT in relation to their intention to use computers (Smarkola, as cited in Teo, 2011, p. 11). Figure 5 shows a model of TAM.

**Figure 5 - Technology Acceptance Model**




(Mathieson, 1991, p. 175)

An example of an instrument that was used based on TAM is one where Teo (2011a) investigated the factors that influence

teachers' intention to use technology. He tested nine hypotheses using TAM. They were as follows:

- Attitude towards use will significantly and positively influence teachers' behavioural intention to use technology. ($r$ = 0.504, $t$-value = 11.710 with $p$ < 0.01)
- Perceived usefulness will significantly and positively influence teachers' attitude towards use. ($r$ = 0.301, $t$-value = 7.928 with $p$ < 0.01)
- Perceived usefulness will significantly and positively influence teachers' behavioural intention to use technology. ($r$ = 0.221, $t$-value = 6.398 with $p$ < 0.01)
- Perceived ease of use will significantly and positively influence teachers' attitude towards use. ($r$ = 0.423, $t$-value = 11.842 with $p$ < 0.01)
- Perceived ease of use will significantly and positively influence teachers' perceived usefulness. ($r$ = 0.532, $t$-value = 17.199 with $p$ < 0.01)
- Facilitating conditions will significantly and positively influence teachers' behavioural intention to use technology. ($r$ = 0.130, $t$-value = 5.082 with $p$ < 0.01)
- Facilitating conditions will significantly and positively influence teachers' perceived ease of use. ($r$ = 0.439, $t$-value = 10.271 with $p$ < 0.01)
- Subjective norm will significantly and positively influence teachers' behavioural intention to use technology. ($r$ = 0.022, $t$-value = 0.972)
- Subjective norm will significantly and positively influence teachers' perceived usefulness. ($r$ = 0.123, $t$-value = 4.228 with $p$ < 0.01) (Teo, 2011a, p. 2434)

Teo reported that eight of the nine hypotheses were supported by the data (p. 2437). The only one that was not supported was that the subjective norm would influence teachers' behavioural intention to use technology. He tested four variables in his model, viz. behavioural intention to use, attitude towards use, perceived usefulness and perceived ease of use). He reported that perceived usefulness, attitude towards use and facilitating conditions had direct influences on the teachers' behavioural intention to use technology (p. 2437). Teo also reported that facilitating conditions was a large influence of behavioural intention to use technology (p. 2438). He said that when teachers felt that they had adequate technical support, they would perceive that the use of technology was relatively free from effort, which would in turn strengthen their intention to use technology. This example has been very useful in informing my decision to choose a model to base this study on. Another model that I researched was the Unified Theory of Acceptance and Use of Technology (UTAUT).

There are some problems with TAM, however. Firstly, up until 2004 a total of 145 independent studies used the TAM, and not a single study tested all the relationships (Yousafzai, Foxall, & Pallister, 2007). Secondly, many of the studies measure self-reported usage while a very small percentage measured the actual usage (Yousafzai et al., 2007). Also, Yousafzai et al. (2007) reported that other studies showed that there were potential weaknesses in the measurement of perceived usefulness (PU) and perceived ease of use (PEOU) and that perceived usefulness should be split into two dimensions, viz. perceived usefulness and effectiveness (Segars & Grover, 1993). Another important limitation of the TAM is that it focuses on perceived usefulness and perceived ease of use as determinants, but it does not show how these perceptions are created by the user, nor how they can

be manipulated to encourage the user's acceptance and increased usage of technology (Mathieson, 1991). Davis et al. (1989) argued that the main idea "of the TAM was to provide a basis for tracing the impact of external factors on internal beliefs, i.e. PU and PEOU, and to link that to actual use" (Yousafzai et al., 2007, p. 268).

Yousafzai et al (2007) propose that a number of external variables should be taken into account when measuring perceived usefulness and perceived ease of use. These are divided into four categories: organisational characteristics, system characteristics, user personal characteristics and other variables. Variables such as competitive environment, end-user support, organisational structure, peer influence and transitional support would fall under the organisational characteristics section and are proposed to affect both PU and PEOU. Accessibility, access cost, compatibility, media style, perceived attractiveness and relevance with job (to name a few) would fall into the system characteristics section. Age, cognitive absorption, computer literacy, experience, gender, self-efficacy and trust are a few examples of the variables that would fall under the user personal characteristics section. In the other variables section there would be variables such as argument for change, cultural affinity, external computing support, facilitating conditions, social influence and the vendor's cooperation (Yousafzai et al., 2007, p. 269).

Having reviewed the apparent shortcomings of the model, it remains a popular one when measuring technology acceptance. This is probably due to the following three factors:

1. It is parsimonious, IT-specific, and is designed to provide an adequate explanation and prediction of a diverse user population's acceptance of a wide range of systems and

technologies within varying organisational and cultural contexts and expertise levels;

2. It has a strong theoretical base and a well researched and validated inventory of psychometric measurement scales, making its use operationally appealing; and
3. It has accumulated strong empirical support for its overall explanatory power and has emerged as a pre-eminent model of users' acceptance of technology. (Yousafzai et al., 2007, p. 264).

Further investigation has shown that TAM is a powerful predictive model (King & He, 2006). This study showed that the measures, PU and behavioural intention (BI), are very reliable and that the "influence of perceived usefulness on behavioural intention is profound" (King & He, 2006, p. 751).

## 3.8 Conclusion

After reviewing all three models I decided to use the Technology Acceptance Model to perform my research. There are four variables that are measured as opposed to TPB that has seven and UTAUT that has eight. The TPB measures a person's intention to behave in a certain way based on behavioural beliefs, normative beliefs and control beliefs (Ajzen, 2013) and can be used in any sphere. My research questions were informed by TAM. I wanted to measure whether a person's ideas of a technology's perceived usefulness, the perceived ease of use, and the person's intention to use the technology will affect their attitude toward using the technology. In measuring these variables it was possible to gauge what attitudes teachers have toward ICT at school and also to ascertain whether they intend to use some form of digital technology in their pedagogy. The data analysis will hopefully be

useful for policy makers when it comes to implementing ICT in our schools.

## 3.9 Conceptual Framework

As I have discussed teachers have attitudes and beliefs about their teaching ability and their effectiveness in the classroom. The type of school teachers find themselves in could also form these beliefs and attitudes. Teachers receive training in the use of PowerPoint, for example, and therefore they are able to create more engaging lessons. Similarly teachers that have been trained to use a SMARTBoard are able to make the lessons more interactive and fun for the learners. The crux here is the teachers' technology knowledge. They should already have the content knowledge and pedagogical knowledge.

To improve the technology knowledge teachers must first feel that the technology is beneficial to them and their learners and they must feel that it is easy to use. These two factors go a long way to change the teachers' attitudes to using the technology, their intention to use, and ultimately in the actual use of the technology.

The TAM purports to measure the key determinants of perceived usefulness and perceived ease of use as well the intention to use technology. The model also aims to measure the external factors that affect perceived usefulness (Yucel & Gulbahar, 2013). Examples of these external factors are subjective norm, voluntariness and imagination, which fall into the social influence processes and then job relevance, output quality and result demonstrability, which fall into the cognitive influence processes (Yucel & Gulbahar, 2013). The TAM then takes teachers' prior

beliefs into account when measuring the degree of their acceptance.

This guided me in the formulation of the categories that were measured in my study. Technical support at the school is an important factor in teacher attitudes and intention to use. If there is no backup, teachers get frustrated and disinterested. The actual usefulness of the technology has to be considered. An accounting teacher will know whether tablets are useful in an accounting lesson. Another category is the ease of use of technology. The fourth category is aimed at measuring teachers' attitudes to using the technology and attending training. The final category looked at teachers' intention to use. These five categories have been informed by the constructs set out in the Technology Acceptance Model.

Regression analysis assists with predicting the outcome variables from one or more predictor variables and this allows for a linear model to summarise the data with (Field, 2009). This method of analysis together with Pearson's correlation coefficient calculations assisted in analysing the results of the data collection.

# 4. Methodology

## 4.1 Method

This study consisted of a quantitative design. Data collection for a quantitative study comprises five steps (Creswell, 2012). One needs to select the participants, obtain permission from the participants and their employees, decide what type of information to collect, choose an appropriate instrument and finally perform the collection process (Creswell, 2012, p. 141). Research in the area of technology acceptance (Smarkola, 2007; Wong & Teo, 2009) has been done using an instrument that is able to obtain numerical indices that correspond to data from the participants (McMillan & Schumacher, 2006, p. 173). A quantitative approach allowed me to use the theories that I have investigated so that I could measure attitudes and intentions of the participating teachers. The data was converted so that statistical calculations could be performed. The various item scales used in the TAM instrument allowed for a quantitative study as reliability testing and the calculation of Cronbach alpha coefficients could be performed (Smarkola, 2007, p. 69). The questionnaire has been adapted from the TAM instrument, which has been validated in a number of studies (Davis, Venkatesh et al. as cited in Smarkola, 2007).

## 4.2 Sample and Ethical Considerations

The study surveyed 108 teachers from four secondary schools in Pretoria. I am a teacher in the area and it was convenient for me to source these schools. I am also acquainted with the Principals of these schools. This fact assisted greatly with obtaining teachers' email addresses. The teachers received an information letter explaining the purpose of the research. The letter also stated that anonymity would be guaranteed. See Appendix B. I only received

email addresses of teachers who were willing to participate. Teachers from one private school, one English-speaking ex-Model C school, one Afrikaans-speak ex-Model C school and one township school were asked to participate in the study. From an historical point of view teachers from these different types of schools should have different perceptions and beliefs about technology. Private schools have been able to keep ahead of the game with the advent of digital technology and its integration in the classroom. Ex-Model C schools have had the luxury of having a functioning infrastructure and many school governing bodies have ensured that technology integration takes place. Township schools have always been at a disadvantage due to the education policies of the previous government and are struggling to keep up in very trying circumstances (Christie, 2008). The diversity of the schools will allow me to determine whether technology acceptance by teachers is positive or not in South African schools. Table 1 provides information about the number of returns from each school.

**Table 1 - Questionnaire Responses**

| School | Number of staff members | Number of responses | Rate of return |
|---|---|---|---|
| **Private School** | 45 | 36 | 80% |
| **English High School** | 53 | 34 | 64% |
| **Afrikaans High School** | 84 | 22 | 26% |
| **Township School** | 32 | 16 | 50% |
| **Totals** | 214 | 108 | 50.5% |

Permission to conduct a survey at public schools was received from the Gauteng Department of Education (Ref. No. D2015/009). Ethics clearance was obtained from the university (Protocol No: 2014ECE003M). The study was entirely voluntary and it consisted

of a random sample of between 25 and 30 teachers from each school. This would be convenience sampling (McMillan & Schumacher, 2006, p. 137) as I only surveyed the teachers who wanted to participate in the study. The participants were selected on the basis of accessibility and expediency. As mentioned the teachers from the four schools were diverse in many ways. One is an English-speaking private school, one is an ex-Model C school where the language of instruction is English, another ex-Model C school has Afrikaans as the medium of instruction and the fourth school is a township school where the language of instruction is Sepedi.

A further drawback to convenience sampling was that participants could withdraw from the study at any time which affected the size and therefore the validity of the study (McMillan & Schumacher, 2006, p. 138). I was fortunate to have 108 completed questionnaires. Table 2 below indicates five age groups.

**Table 2 - Sample Demographics**

| Age Group | Male | Female | White | Black Coloured Indian |
|---|---|---|---|---|
| **20 – 29** | 9 | 36 | 33 | 12 |
| **30 – 39** | 2 | 2 | 3 | 1 |
| **40 – 49** | 11 | 16 | 18 | 9 |
| **50 – 59** | 18 | 9 | 21 | 6 |
| **60 +** | 2 | 3 | 5 | 0 |
| **Total** | **42** | **66** | **80** | **28** |

There were a total of 72 teachers from public schools and 36 from a private school. It must be emphasised that 16 of the 28 people of colour were from the township school. Five were from the private

school and the other seven were from the English-speaking public school.

## 4.3 Instrument

The questionnaire was sent via email to teachers from the various schools. A copy of the questionnaire is included as Appendix A. The questionnaire is based on a previous questionnaire used by Smarkola (2007). The questionnaire needed to be reliable which means that the scores are stable, consistent and collected at the same time (Creswell, 2012, p. 159). According to Creswell consistency means that if a participant answers a question in one way, he/she should answer similar questions in a similar way. A questionnaire also needs to be valid which means that the interpretation of the scores matches the proposed use (Creswell, 2012). Smarkola (2007) used a questionnaire based on TAM for predicting peoples' intention to use computers. Reliability testing showed Cronbach alpha coefficients exceeding 0.9 for perceived usefulness and perceived ease of use and reliability scores for internal consistency of perceived usefulness, perceived ease of use and intentions were 0.93, 0.75 and 0.92 respectively (Teo, 2011b, p. 15). The same categories of questions were used in the questionnaire of this study to ensure reliability and validity. The questionnaire underwent an internal consistency reliability procedure (Creswell, 2012, p. 161) in that it was shown that questions were answered in a similar way throughout the questionnaire. The purpose of Smarkola's (2007) study was a computer usage intentions survey. As the scores of this study showed evidence of validity, I felt that my questions in each category would prove to be valid.

The categories used were:

1. Technical support at school

2. Usefulness of digital technology in the classroom
3. How easy is it to use digital technology?
4. Attitude towards technology in the classroom
5. Intentions to use digital technology

These categories comply with the constructs set out in the Technology Acceptance Model (Figure 5). Technical support forms part of the External Variables. Usefulness of technology forms part of Perceived Usefulness and Perceived Ease of Use incorporates how easy it is to use technology in the classroom. The fourth category is the same as Attitudes towards Use. The final category ties in with the Behavioural Intention to Use.

The first category asked questions that dealt with the process of reporting technical problems, the friendliness of technical staff and the speed at which problems were resolved. The second category looked at questions that cover the advantages of having a laptop and data projector in the classroom, whether computers make the learning experience better, and whether the teacher has greater control in the classroom. Category 4 asks questions that deal with the ease of operating a laptop and data projector as well as being able to fix hardware and software problems without technical assistance from elsewhere. It also looks at teachers' ability to use technology confidently. The final category covered questions relating to teachers' use of the Internet, their intentions to allow learners to interact with the technology and in-service training.
The questionnaire was designed using Google Forms. This service allows one to set up questions using different types of styles, for example, multiple choice, tick boxes, choosing from a list, scales and grids. The questionnaire also included questions regarding age, gender and whether the person taught at a public or private school. Most questions were asked using interval scales, which is a

popular scale used by researchers. This type of scale provides options to questions that flow easily and the options appear to have equal distances between them (Creswell, 2012, p. 167). I used the popular Likert scale, which has options from "strongly disagree" to "strongly agree".

## 4.4 Validity, Reliability and Generalisability

"Validity asks the question: are we measuring what we want to measure" (Muijs, 2010, p. 65). A concept like attitude is difficult to measure directly which means that an instrument must be developed to measure it indirectly; the latent concept must be measured using manifest variables (Muijs, 2010). There are three aspects to validity, viz. content validity, criterion validity and construct validity (Field, 2009). Content validity provides "evidence that the content of a test corresponds to the content of the construct it was designed to cover" (Field, 2009, p. 783), criterion validity means that "evidence that scores from an instrument correspond with or predict concurrent external measures conceptually related to the measured construct" (Field, 2009, p. 784) and construct validity relates to "the internal structure of an instrument and the concept it is measuring" (Muijs, 2010, p. 68). To determine content validity we need to ensure that the concepts are theoretically defined, and if this is the case the instrument design should be content-valid (Muijs, 2010). The instrument that has been used in this study has been derived from the literature on the TAM. Questions have been designed based on questionnaires from previous studies (Smarkola, 2007; Teo, 2011a).

Criterion validity means that when a measurement is decided upon, it should be related to other measures (Muijs, 2010). There are two main types of criterion validity: predictive and concurrent validity. The former refers to "whether or not the instrument you are using predicts the outcomes you would theoretically expect it to", and concurrent validity refers to "whether scores on your instrument agree with scores on other factors you would expect to be related to" (Muijs, 2010, p. 67). The instrument used in my study measures teachers' attitudes towards and intentions to use technology and the results are consistent with other studies reviewed in the literature (Smarkola, 2007; Teo, 2011a).

An instrument needs to reliable. It is obvious that when measurements are taken there will be an element of error. Reliability refers "to the extent to which test scores are free of measurement error" (Muijs, 2010, p. 71). The score of test would be measured by using the true score, the systematic error and the random error: Score = True score – Systematic error – Random error (Muijs, 2010). There are two types of reliability: repeated measurement and internal consistency. In repeated measurement we check to see if the same thing can be measured at different times, i.e. the same instrument should produce the same result with the same respondent (Creswell, 2012). In internal consistency reliability we are only concerned with instruments that have a single item (Muijs, 2010). My questionnaire had a number of questions that dealt with a single topic and there were five topics or constructs that were measured. This form of reliability tests construct validity (Muijs, 2010). Exploratory Factor Analysis (EFA) is a way to check for construct validity (Field, 2009) especially when trying to check whether there are any variables that are collinear. This means that the data is reduced by finding variables that correlate highly with a group of

other variables, but not with variables outside the group (Field, 2009). An EFA performed on the raw data of this study produced an R-matrix that showed that the number of hours spent on the Internet, the number of social media used and the different types of technology used were related. Also related were technical support, perceived usefulness and perceived ease of use. Another relationship produced by the data was the number of lessons using ICT, technical support and the perceived usefulness of the technology.

The final aspect of data collection and interpretation is whether the findings can be generalised to the population. This is discussed later in the report.

## 4.5 Data Collection Procedure

The Principals of each school were furnished with a letter explaining the survey and the process that the survey would follow. Teachers who were interested in the survey were asked to give their email addresses to the Principal or a person delegated to collect email addresses. Copies of letters to the Principals and teachers are included in Appendix B. A list of email addresses was then sent to me. A copy of the questionnaire was sent to each participant via email and most replies were received within one week. There was a cut-off period after two weeks. A total of 108 responses were returned to my inbox.

## 4.6 Data Analysis Plan

The completed questionnaires were returned to me and were automatically added to a spreadsheet in my Google Drive account. The data was then scored so that a numeric value could be assigned to each response category for each question in the questionnaire (Creswell, 2012, p. 175).

For the categorical questions the following scores were allocated:

- Private school = 1 and Public School = 2
- Ages: 20 – 29 = 1; 30 – 39 = 2; 40 – 49 = 3; 50 – 59 = 4; 60 + = 5
- Forms of technology: Only one form = 1, two forms = 2, etc.
- Social media: Only one = 1, two platforms = 2, etc.
- Hours spent using the Internet to assist with preparation of lessons: Never = 0, 1 – 2 hours = 1, 3 – 4 hours = 2 and more than 4 = 3
- Lessons incorporating technology: Never = 0, 1 – 3 = 1, 4 – 6 = 2 and every lesson = 3

The interval scale questions were assigned scores from 1 to 5 where 1 was for "strongly disagree", 2 was for "disagree", 3 was for "neither disagree or agree", 4 was for "agree" and 5 was for "strongly agree". The different categories of questions mentioned in paragraph 4.3 allowed for the scores to be summed. This is done when several questions measure the same variable (Creswell, 2012, p. 179).

The Statistical Package for the Social Sciences (SPSS) ("IBM SPSS software," 2015) was used to analyse the data. SPSS is a powerful analysis tool that can accurately predict trends and forecasts. The following statistical calculations were performed on the data:

- Descriptive statistics, i.e. mean, standard deviation
- Pearson's correlation coefficient
- Effect size
- Regression Analysis

# 5. Results

## 5.1 Descriptive Analysis of Data

There are five categories or factors. The first factor is Technical Support offered by the school. This is dealt with in TAM in the External Variable construct of the model. It consisted of five items. The first factor measures how satisfied teachers are with the technical support offered by the school. The second factor measures the perceived usefulness of digital technology in the classroom. The third factor measures perceived ease of use of the technology offered by the school. The fourth factor measures teachers' attitudes towards the technology available in the classroom and the fifth factor attempts to measure the teachers' intention to use the technology on an on-going basis.

Table 3 shows the different categories according to mean and standard deviation.

**Table 3 - Descriptive Statistics**

| Category/Factor | Mean | Standard Deviation |
|---|---|---|
| **Technical support** | 20.8 | 4.01 |
| **Usefulness of digital technology** | 25.5 | 4.69 |
| **Ease of use** | 23.7 | 5.56 |
| **Attitude toward digital technology** | 20.9 | 3.65 |
| **Intention to use technology** | 15 | 3.39 |
| **Forms of technology used** | 3.9 | 1.08 |

Table 4 indicates how the mean and standard deviation of the measure Attitude towards ICT according to age.

**Table 4 - Attitude according to age**

| Age | Mean | Std Deviation |
|---|---|---|
| **20 – 29** | 21.7 | 2.54 |
| **30 – 39** | 19.5 | 6.36 |
| **40 – 49** | 19.0 | 5.51 |
| **50 – 59** | 22.0 | 1.48 |
| **60 +** | 19.2 | 2.68 |
| **Overall** | 20.9 | 3.65 |

Various correlations were determined using Pearson's correlation coefficient (Field, 2009). A correlation coefficient checks to see "whether or not a high score on one variable is associated with a high score on the other" (Muijs, 2010, p. 142). Pearson's *r* is usually used when working two continuous variables. This coefficient subtracts the mean from each individual response for each variable and then multiplies each case together. The value of *r* varies between -1 and +1 (Muijs, 2010). The coefficient also gives an indication of the direction of relationship and the strength. The closer to 1 (positive or negative) the stronger the relationship (Creswell, 2012). This is a useful convention when evaluating the relationships between two or more variables (McMillan & Schumacher, 2006).

- Technical Support vs. Usefulness of ICT (PU)
- Usefulness of ICT vs. Attitude toward ICT (ATU)
- Ease of Use (PEOU) vs. Attitude toward ICT
- Ease of Use vs. Intention to Use ICT (BIU)
- Number of lessons vs. Attitude
- Ease of Use vs. Number of lessons
- Usefulness vs. Intention to Use
- Attitude toward ICT vs. Intention to Use

### Table 5 - Pearson's Correlation Coefficient

| | PEOU | Tech Support | PU | ATU | BIU | No of lessons |
|---|---|---|---|---|---|---|
| **PEOU** | | | | 0.736 | 0.426 | 0.599 |
| **Tech Support** | | | 0.600 | | | |
| **PU** | | 0.600 | | 0.913 | 0.672 | |
| **ATU** | 0.736 | | 0.913 | | 0.676 | 0.731 |
| **BIU** | 0.426 | | 0.672 | 0.676 | | |
| **No of lessons** | 0.599 | | | 0.731 | | |

According to SPSS calculations, all of the correlations above were significant at the level of 0.01. The criteria for significance is normally less than 0.05 (Field, 2009, p. 179).

There is a strong positive correlation between the ease of use and teachers' attitude towards ICT ($r$ = 0.736 at $p$ (two-tailed) < 0.001). A further calculation of the coefficient of determination ($R^2$) produces a value of 0.542 which suggests that the ease of use of ICT shares a 54.2% variability in teachers' attitude toward ICT (Field, 2009). This leaves 45.8% of the variability to be accounted for by the other variables. There is also a strong positive correlation between usefulness of ICT and teachers' attitude towards ICT ($r$ = 0.913 at $p$ (two-tailed) < 0.001).

Number of lessons using ICT vs. Teachers' attitude towards ICT showed the Pearson's correlation coefficient to be 0.731 at $p$ < 0.001 which is also a strong positive correlation. Ease of Use vs. Number of lessons using ICT showed a correlation of 0.599 at $p$ < 0.001. Usefulness vs. Intention to Use produced $r$ = 0.672 with $p$ < 0.001. Attitude to ICT vs. Intention to Use produced $r$ = 0.676 with $p$ < 0.001.

Table 6 gives information regarding various aspects of ICT.

**Table 6 - Use of ICT**

| | Mean | Std Dev. | Min | Max |
|---|---|---|---|---|
| **Technology Used** | 3.89 | 1.079 | 1 | 5 |
| **Social Media** | 3.39 | 1.281 | 1 | 6 |
| **Hours on Internet** | 1.17 | 0.077 | 0 | 2 |

Every teacher reported that they used a mobile phone.

Finally, a One-Way ANOVA calculation produced an $f$ – score of 0.679 between the type of school and attitude towards using ICT. The significance was 0.741 and the *df* between groups was 10.

A regression analysis was also performed on the data. This is a way of predicting an outcome variable from one or more predictor variables (Field, 2009). Two dependent variables were selected: attitude towards ICT and intentions to use ICT. The predictor variables were technical support, perceived usefulness and ease of use.

**Table 7 - Regression - Technical support, PU, PEOU vs. Attitude to ICT**

| R | $R^2$ | Adj $R^2$ | Std Error | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | $R^2$ change | F change | *df*1 | *df*2 | Sig. f change |
| **0.933** | 0.871 | 0.867 | 1.3324 | 0.871 | 233.3 | 3 | 104 | .000 |

**Table 8 - Regression - Technical support, PU, PEOU vs. Intention to Use**

| R | $R^2$ | Adj $R^2$ | Std Error | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | $R^2$ change | F change | *df*1 | *df*2 | Sig. f change |
| **0.714** | 0.509 | 0.495 | 2.4099 | 0.509 | 35.977 | 3 | 104 | .000 |

### Table 9 - ANOVA - Technical support, PU, PEOU vs. Attitude to ICT

| | Sum of squares | *df* | Mean square | F | Sig. |
|---|---|---|---|---|---|
| **Regression** | 1242.455 | 3 | 414.152 | 233.301 | .000 |
| **Residual** | 184.619 | 104 | 1.775 | | |
| **Total** | 1427.074 | 107 | | | |

### Table 10 - ANOVA - Technical support, PU, PEOU vs. Intention to Use

| | Sum of squares | *df* | Mean square | F | Sig. |
|---|---|---|---|---|---|
| **Regression** | 626.800 | 3 | 208.933 | 35.977 | .000 |
| **Residual** | 603.968 | 104 | 5.807 | | |
| **Total** | 1230.769 | 107 | | | |

### Table 11 - Coefficients - Technical support, PU, PEOU vs. Attitude to ICT

| | Unstandardised coefficients | | Std. coeff. | t | Sig. | 95% Confidence interval for B | |
|---|---|---|---|---|---|---|---|
| | B | Std error | Beta | | | Lower bound | Upper bound |
| **Constant** | 1.685 | 0.777 | | 2.169 | 0.032 | 0.144 | 3.225 |
| **PU** | 0.565 | 0.039 | 0.725 | 14.473 | 0.000 | 0.487 | 0.642 |
| **PEOU** | 0.142 | 0.032 | 0.216 | 4.403 | 0.000 | 0.078 | 0.205 |
| **Tech. support** | 0.071 | 0.042 | 0.078 | 1.693 | 0.093 | -0.012 | 0.155 |

Table 12 - Coefficients - Technical support, PU, PEOU vs. Intention to Use

| | Unstandardised coefficients | | Std. coeff. | t | Sig. | 95% Confidence interval for B | |
|---|---|---|---|---|---|---|---|
| | B | Std error | Beta | | | Lower bound | Upper bound |
| **Constant** | 0.908 | 1.405 | | 0.646 | 0.519 | -1.878 | 3.695 |
| **PU** | 0.411 | 0.071 | 0.568 | 5.827 | 0.000 | 0.271 | 0.551 |
| **PEOU** | -0.077 | 0.058 | -0.127 | -1.331 | 0.186 | -0.193 | 0.038 |
| **Tech. support** | 0.264 | 0.076 | 0.313 | 3.471 | 0.001 | 0.113 | 0.415 |

Figures 6 and 7 are scatter plots that were obtained.

Figure 6 - Scatter Plot - Usefulness vs. Attitude

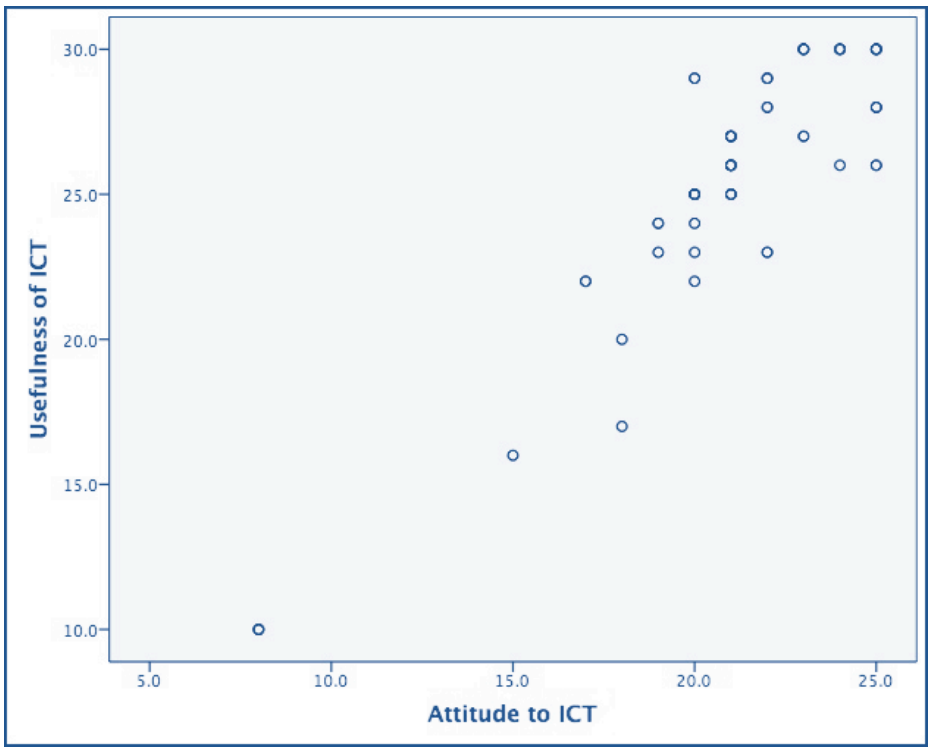
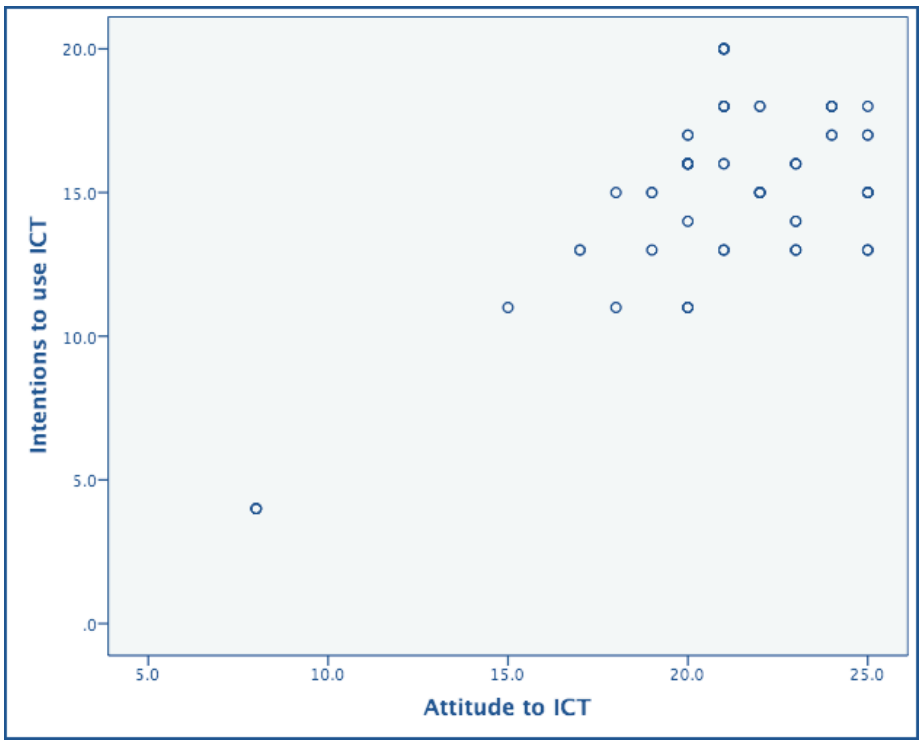


Figure 7 - Scatter Plot - Intentions vs. Attitude




The complete set of data is included in Appendix C.

## 5.2 Inferential Analysis

The first research question is: *What is the attitude of teachers at four secondary schools in Pretoria towards using technology in the classroom?* The regression analysis performed and shown in Tables 7, 9 and 11, as well as the following Pearson's correlation coefficients were used to answer this question.

The value of $R^2$ indicates that the three variables account for 87.1% of variance in teacher attitudes to using technology. The F-ratio of 233.3, which is significant at $p < 0.001$, tells us that there is less than a 0.1% chance that an F-ratio this large would happen if a null hypothesis were true (Field, 2009, p. 207). It can be concluded that the model predicts that technical support, perceived usefulness and ease of use influence attitudes to use.

**Table 13 – Constructs for Question 1**

| | Attitude towards ICT in the classroom |
|---|---|
| **Usefulness of ICT** | $r = 0.913$ with $p < 0.01$ |
| **Ease of Use** | $r = 0.736$ with $p < 0.01$ |
| **Number of Lessons using ICT** | $r = 0.731$ with $p < 0.01$ |

These correlation coefficients seem to indicate that there is a strong positive correlation between the usefulness of the technology, the perceived ease of use and the number of lessons that would taught with teachers' attitudes to using technology. This ties in with similar research done regarding teachers' attitudes to technology acceptance (King & He, 2006; Teo, 2011a; Yousafzai et al., 2007).

Teo (2011a) used the structural equation modelling approach to test for data normality. His second hypothesis was that the perceived usefulness of technology would significantly and positively influence teachers' attitude towards using technology ($r = 0.301$)(p. 2437). My findings are also statistically significant ($r = 0.913$) and the regression analysis further supports the predictions.

The fourth hypothesis posited by Teo was that the perceived ease of use of technology would significantly and positively influence teachers' attitude towards technology ($r = 0.423$)(2011a, p. 2437). It would seem that the evidence provided by teachers in this survey would confirm that ease of use is a factor in determining teachers' attitude towards using technology ($r = 0.736$).

Table 11 provides *b*-values, which indicate the gradients of the regression lines. The significance for PU and PEOU is less than

0.05, which indicates that these two variables significantly predict teachers' attitude to using technology. Technical support shows a significance of 0.093, which is greater than 0.05, indicating that technical support is not such a good predictor (Field, 2009).

The second research question is: *Are teachers willing to adapt their teaching methods to incorporate ICT?* The regression analysis performed and shown in Tables 8, 10 and 12, as well as the following Pearson's correlation coefficients were used to answer this question.

The value of $R^2$ indicates that the three variables account for only 50.9% of the variance in the teachers' intention to use technology. The F-ratio is 35.977 significant at $p < 0.001$.

**Table 14 - Constructs for Question 2**

| | Intention to Use |
|---|---|
| **Usefulness** | $r = 0.672$ with $p < 0.01$ |
| **Ease of Use** | $r = 0.426$ with $p < 0.01$ |
| **Attitude to ICT** | $r = 0.676$ with $p < 0.01$ |

These results seem to suggest that there is a strong positive correlation between Usefulness, Ease of Use and Attitude towards ICT with teachers' intention to use technology in their classrooms. These results are also statistically significant as the value of $p$ is less than 0.05.

Teo's first hypothesis was that teachers' attitude towards technology will influence their behavioural intention to use technology ($r = 0.504$) (Teo, 2011a, p. 2437). This corroborates the evidence provided by my findings ($r = 0.676$).

The third hypothesis recorded by Teo was that the perceived usefulness of technology would significantly and positively influence teachers' behavioural intention to use technology ($r$ = 0.221) (p. 2437). The result produced by this study would suggest that there is a strong positive correlation between the usefulness of technology and teachers' intention to use it ($r$ = 0.672).

Table 12 provides $b$-values, which indicate the gradients of the regression lines. The significance for PU is less than 0.05, which indicates that these two variables significantly predict teachers' intentions to use technology. Technical support shows a significance of 0.001, indicating that technical support is not such a good predictor of teachers' intention to use technology (Field, 2009). PEOU shows a significance of 0.186 which is greater than 0.05. This indicates that perceived ease of use does not predict that teachers will use the technology.

# 6. Discussion

## 6.1 Summary of major results

From the data that was received from the participants it is clear that all teachers in the schools that were surveyed use a mobile phone and at least two other forms of technology in the classroom (Table 6). It is also evident that most teachers use at least three forms of social media with the majority using Facebook, followed by Whatsapp. A possible reason for this could be that 45% of the participants were between 20 and 40 years of age. Regression analysis produced an $R^2$ of 0.185 suggesting that age accounted for 18.5% of the variation in use of social media. The F-ratio was 24.082 significant at $p < 0.01$. The proliferation of social media apps on mobile devices has made it easier for people to connect with friends and family without having to switch on a computer and connect to the Internet.

The type of school surveyed did not seem to make a difference with regards to attitude towards or the intention to use technology. It was expected that there would have been a more dramatic difference. The private school teachers do seem to have easier access to technology, but the three government schools also seem to have made inroads in supplying their staff with the necessary tools to use technology in their classrooms. The support offered by these schools scored a mean of 20.8 where the minimum was 7 and the maximum was 25. This suggests that the schools do make an effort to ensure that the technology on offer is maintained properly.

The literature suggests that teachers display a resistance to accept technology (Chen, 2008; Cuban, 2003; Ertmer & Ottenbreit-Leftwich, 2010; Pajares, 1992; Wade, 2002). However, the results

of this study indicate that teachers are generally positive towards using technology in their classrooms as long as there is support and sufficient in-service training. Questions 6, 8 and 9 of the questionnaire provide evidence of this (Table 2). There is a strong correlation between the usefulness of the technology, the ease of use and the number of lessons using ICT with the teachers' attitude toward using the technology.

There is also evidence that shows that if the teachers' attitudes are favourable, they will tend to want to use the technology (Regression analysis results: $R^2 = 0.457$, $F = 89.044$ and $b = 0.627$ significant at $p < 0.001$). The results also show that teachers who are using technology have indicated that they would like to become more proficient in certain aspects of the technology, for example, the majority of teachers surveyed expressed a desire to have an interactive white board installed in their classrooms (Min = 1; Max = 5; Mean = 3.796; SD = 1.109).

Facilitating conditions play a part in predicting teachers' intention to use technology. Teo (2011a) reported that this is not as high as the other results reported by him. However, this study produced a Pearson's correlation coefficient of $r = 0.58$ with $p < 0.01$, which would suggest that technical support at school is a key factor in predicting teachers' intention to use.

My problem statement indicated that teachers are not changing their teaching methodology fast enough to incorporate technology. I highlighted various possible reasons for this. The evidence provided by the data obtained has allowed me to answer my research questions:

6.1.1 Question 1: What is the attitude of teachers in four secondary schools in Pretoria towards the integration of ICT in their teaching methods?

From the data and analysis performed it can be said that teachers in secondary schools in Pretoria have a positive attitude towards using technology in their classrooms.

The schools chosen are from the east of Pretoria, which is an affluent area. It stands to reason that teachers in these schools enjoy an advanced level of technological knowledge and support, which is a reason why the findings are produced such positive results.

6.1.2 Question 2: Are teachers willing to adapt their teaching methods to incorporate ICT?

From the various tests that were performed on the raw data it can be concluded that teachers will incorporate ICT in their teaching methods if there is technical support, the technology is perceived useful and it is perceived to be easy to use.

This once again contradicts the literature that suggests that teachers are not willing to adapt their teaching methods. Teachers in the schools that were surveyed show that there is technical support and there is a willingness to engage in the technology available to them.

## 6.2 Limitations of this study

This study was able to measure the attitudes and intentions of 108 teachers from four schools in Pretoria. It would have been desirable to have more participants return the questionnaire. Only

33% of the returns were from a private school and 15% from the township school. A total of 72 teachers were from public schools and, of these only 16 returns were from teachers at the township school. This may have been a determining factor for the largely positive results obtained. Many township schools battle with infrastructure delivery and technical support, and it is not clear if this was the case with the school that was approached to assist with the study. It would be interesting to see what the results would have been like if all the teachers in every high school in Gauteng were to participate in a similar survey. The racial profile and the type of school would certainly play a different role, bearing in mind that many of the schools are not as financially secure, as they would like.

The very nature of online questionnaires means that there will be a high non-return rate. The risk of the school manager not supplying teachers with the information sheets to inform them about the study is also high. The time delay between presenting a school with information about the survey and receiving lists of email addresses was a concern, but I was fortunate to receive the number of completed questionnaires that I did. It must be stressed that the questionnaire used should be scrutinised by other researchers for further validation and possible weaknesses.

The issue of generalisability also limits this study. The results have shown that most findings are statistically significant. However, the very nature of the types of schools that were selected may have produced idiosyncrasies, which make it difficult to generalise these findings (Muijs, 2010). I would still like to believe that these findings have some bearing on the extent of the technology acceptance issue in our schools.

## 6.3 Implications for further research

The schools' governing bodies are largely responsible for maintaining the infrastructure and ensuring that the teachers are able to keep the digital divide between them and their learners closed. The governing bodies therefore have huge influence on whether the teachers will be positive about technology and whether they will use it (Teo, 2011a). The education departments are trying to introduce technology into schools and there are various reports that indicate that there has been limited success (GPG, n.d.). The various education departments could implement surveys of this nature so that they can get a better idea of what is needed in schools to improve ICT incorporation.

Universities together with education departments could improve the training of teachers by including courses on how to teach with technology. It is important for teachers to develop professionally by keeping up to date with current trends and new ideas of teaching and learning using technology (Teo, 2011a). Learners are changing the way they access information and are easily distracted when their teachers use antiquated methods to deliver lessons (Sugar, Crawley, & Fine, 2004).

## 6.4 Conclusion

The results of this study show that the Technology Acceptance Model was a good instrument to measure the attitude and behavioural intentions of teachers in four schools in Pretoria. It is possible that TAM and the other models discussed could be redesigned to produce a tool that is specific to the South African scenario. The instrument could be used to determine whether student teachers have the same concerns regarding technology implementation that qualified teachers have, a sentiment echoed by Teo (2011a, p. 2438).

Despite all the evidence by various authors that technology is not being adopted by teachers as fast as it is in other professions (Abbitt & Klett, 2007; Becker, 2001; Cuban, 1996; Ertmer & Ottenbreit-Leftwich, 2010), there is also evidence that teachers are starting to use digital technology more and more. The more teachers improve their technology knowledge, the more they will be able to incorporate the technology in their pedagogy (Schmidt et al., 2009). It appears that teaching is moving in the right direction in as far as using the technology to keep learners engaged. Engaged learners mean fewer discipline issues, which in turn mean that the learning process that is supposed to be taking place can actually occur. It is hoped that the results of this study would be useful for further research into teacher attitudes towards using technology in the classroom.

The basis for this research was that teachers are reticent to changing their mind-set as far as adopting any new way of teaching. I have shown that the government is eager for e-learning to be implemented in our schools and I have commented that there are various extenuating circumstances why this has not proceeded, as it should have. There is a discrepancy between my results and this suggested problem. It is obvious that whether a person accepts or rejects technology is more complex than measuring one or two variables and there are actually many more variables that contribute to this acceptance (Yucel & Gulbahar, 2013).

The evidence of other studies (Davis et al., 1989; King & He, 2006; Legris et al., 2003; Smarkola, 2007; Teo, 2011a; Yucel & Gulbahar, 2013) has shown that the TAM can explain and predict why users accept technology. Legris et al. (2003) reported that TAM is a useful model in assisting researchers in understanding usage

behaviour. The empirical evidence and the instruments used are of a good quality and results are statistically reliable (Yousafzai et al., 2007). It is therefore hoped that further research in South African schools can determine whether or not this evidence is biased due to geographical location or some other factor which I did not make provision for. Teachers who change their beliefs about technology could find that they have a more captive audience in the classroom and learner performance could improve because of it. The idea that technology improves learning is a topic for further debate and research.

## 7. References


Abbitt, J. T., & Klett, M. D. (2007). Identifying influences on attitudes and self-efficacy beliefs towards technology integration among pre-service educators. *Electronic Journal for the Integration of Technology in Education*, *6*(1), 28–42.

Ajzen, I. (2013). Theory of Planned Behavior. Retrieved October 6, 2013, from http://people.umass.edu/aizen/tpb.html

Becker, H. J. (2001). How are teachers using computers in instruction. In *Annual meeting of the American Educational Research Association, Seattle, WA*. Retrieved from http://www.msu.edu/course/cep/807/zOld807.1998Gentry/snapshot.afs/*cep240studyrefs/beckeraera2001howtchrsusing.pdf

Becker, H. J., & Riel, M. M. (2000). Teacher Professional Engagement and Constructivist-Compatible Computer Use. Teaching, Learning, and Computing: 1998 National Survey. Report# 7. Retrieved from http://eric.ed.gov/?id=ED449785

Birch, D., & Burnett, B. (2009). Bringing academics on board: Encouraging institution-wide diffusion of e-learning environments. *Australasian Journal of Educational Technology*, *25*(1), 117–134.

Chen, C.-H. (2008). Why do teachers not practice what they believe regarding technology integration? *The Journal of Educational Research*, *102*(1), 65–75.

Christie, P. (2008). *Opening the doors of learning: Changing schools in South Africa*. Heinemann Johannesburg. Retrieved from http://web.uct.ac.za/depts/educate/download/openingthedoors.pdf

Creswell, J. W. (2012). *Educational research: planning, conducting, and evaluating quantitative and qualitative research*. Boston: Pearson.

Cuban, L. (1996). Computers in the classroom: Revolutions that fizzled. *The Washington Post. Washington DC R*, *1*.

Cuban, L. (2003). *Oversold and Underused: Computers in the Classroom*. Cambridge, Mass.: Harvard University Press.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies*, *38*(3), 475–487. doi:10.1006/imms.1993.1022

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, *35*(8), 982–1003. doi:10.1287/mnsc.35.8.982

DOE. (2004). White Paper on e-Education. Retrieved October 6, 2013, from http://www.westerncape.gov.za/legislation/white-paper-e-education

Ely, D. (2008). Frameworks of educational technology*. *British Journal of Educational Technology*, *39*(2), 244–250.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, *53*(4), 25–39.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher Technology Change: How Knowledge, Confidence, Beliefs, and Culture Intersect. *Journal of Research on Technology in Education*, *42*(3), 255–284. doi:10.1080/15391523.2010.10782551

Field, A. (2009). *Discovering Statistics Using SPSS* (3rd ed.). SAGE.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: an introduction to theory and research*. Reading, Mass.: Addison-Wesley Pub. Co.

GPG. (n.d.). Gauteng Online Media Briefing Statement. Retrieved October 6, 2013, from http://www.gautengonline.gov.za/GPG-ICT-Summit/Pages/GautengOnlineMediaBriefingStatement.aspx

Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education*, *57*(3), 1953–1960. doi:10.1016/j.compedu.2011.04.010

Holtzman, R. (2015). Luidia Inc.: Interactive Whiteboard Solutions for Any Classroom or Meeting Room. Retrieved February 2, 2015, from http://www.e-beam.com/home.html

Horzum, M. B., & Canan Gungoren, O. (2012). A Model for Beliefs, Tool Acceptance Levels and Web Pedagogical Content Knowledge of Science and Technology Preservice Teachers towards Web Based Instruction. *Turkish Online Journal of Distance Education*, *13*(3), 50–69.

IBM SPSS software. (2015). Retrieved January 8, 2015, from http://www-01.ibm.com/software/analytics/spss/

Jones, A. (2004). A review of the research literature on barriers to the uptake of ICT by teachers. Retrieved from http://dera.ioe.ac.uk/1603/1/becta_2004_barrierstouptake_litrev.pdf

Kadel, R. (2005). How Teacher Attitudes Affect Technology Integration. *Learning & Leading with Technology*, *32*(5), 34–35.

King, W. R., & He, J. (2006). A meta-analysis of the technology acceptance model. *Information & Management*, *43*(6), 740–755.

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60–70.

Lee, M.-H., Tsai, C.-C., & Chang, C.-Y. (2008). Exploring teachers' self-efficacy toward the web pedagogical content knowledge in taiwan. In *Annual Meeting of the American Educational Research Association, New York City. Retrieved August* (Vol. 18, p. 2010). Retrieved from http://www.ntnu.edu.tw/acad/rep/r97/a2/a201-1.doc

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, *40*(3), 191–204.

Light, J. S. (2001). Rethinking the digital divide. *Harvard Educational Review*, *71*(4), 709–734.

Lim, C. P., & Khine, M. (2006). Managing teachers' barriers to ICT integration in Singapore schools. *Journal of Technology and Teacher Education*, *14*(1), 97–125.

Liu, S.-H. (2011). Modeling pre-service teachers' knowledge of, attitudes toward, and intentions for technology integration. In *World Conference on Educational Multimedia, Hypermedia and Telecommunications* (Vol. 2011, pp. 3350–3355). Retrieved from http://www.editlib.org/p/38335/

Liu, Y., & Szabo, Z. (2009). Teachers' attitudes toward technology integration in schools: a four-year study. *Teachers and Teaching: Theory and Practice*, *15*(1), 5–23.

Mail & Guardian. (2013, February 23). Gauteng Online battle [Blog]. Retrieved October 6, 2013, from http://mybroadband.co.za/news/general/71074-gauteng-online-battle.html

Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information Systems Research*, *2*(3), 173–191.

McMillan, J. H., & Schumacher, S. (2006). Research in education: Evidence-based inquiry. Retrieved from http://www.lavoisier.fr/livre/notice.asp?id=O3OWAKAAA2OOWY

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *The Teachers College Record*, *108*(6), 1017–1054.

Muijs, D. (2010). *Doing Quantitative Research in Education with SPSS* (Second Edition edition.). Los Angeles: SAGE Publications Ltd.

Niess, M. L. (2011). Investigating TPACK: Knowledge Growth in Teaching with Technology. *Journal of Educational Computing Research*, *44*(3), 299–317. doi:10.2190/EC.44.3.c

O'Connell, B. (2009). *The Dinaledi Schools Project*. National Business Initiative.

Pajares, M. F. (1992). Teachers' Beliefs and Educational Research: Cleaning up a Messy Construct. *Review of Educational Research*, *62*(3), 307–332. doi:10.3102/00346543062003307

Richey, R. C., Silber, K. H., & Ely, D. P. (2008). Reflections on the 2008 AECT Definitions of the Field. *TechTrends*, *52*(1), 24–25.

Rogers, E. M. (2003). *Diffusion of Innovations, 5th Edition* (5th edition.). New York: Free Press.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological Pedagogical Content Knowledge (TPACK) The Development and Validation of an Assessment Instrument for Preservice Teachers. *Journal of Research on Technology in Education*, *42*(2), 123–149.

Segars, A. H., & Grover, V. (1993). Re-examining perceived ease of use and usefulness: a confirmatory factor analysis. *MIS Quarterly*, 517–525.

Shuldman, M. (2004). Superintendent conceptions of institutional conditions that impact teacher technology integration. *Journal of Research on Technology in Education*, *36*(4), 319–343.

Siemens, G. (2008). Connectivism: A learning theory for the digital age. *URL:(http://www. Itdl. org/Journal/Jan_05/article01. htm),[Accessed*

*August, 2011]*. Retrieved from http://itdl.org/journal/jan_05/article01.htm

Singh, A. M. (2004). Bridging the digital divide: the role of universities in getting South Africa closer to the global information society. *SA Journal of Information Management*, *6*(2). Retrieved from http://sajim.co.za/index.php/SAJIM/article/viewFile/303/294

Skinner, B. F. (1954). The science of learning and the art of teaching. *Cambridge, Mass, USA*, 99–113.

Smarkola, C. (2007). Technology Acceptance Predictors among Student Teachers and Experienced Classroom Teachers. *Journal of Educational Computing Research*, *37*(1), 65–82.

SMART Education. (1991). Retrieved February 2, 2015, from http://education.smarttech.com/?WT.ac=homepage_ed

Sugar, W., Crawley, F., & Fine, B. (2004). Examining Teachers' Decisions To Adopt New Technology. *Educational Technology & Society*, *7*(4), 201–213.

Teo, T. (2011a). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education*, *57*(4), 2432–2440. doi:10.1016/j.compedu.2011.06.008

Teo, T. (2011b). *Technology acceptance in education research and issues*. Rotterdam: SensePublishers. Retrieved from http://dx.doi.org/10.1007/978-94-6091-487-4

Vannatta, R. A., & Fordham, N. (2004). Teacher dispositions as predictors of classroom technology use. *Journal of Research on Technology in Education*, *36*(3), 253–271.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, *27*(3), 425–478. doi:10.2307/30036540

Wade, R. H. (2002). Bridging the digital divide: new route to development or new form of dependency. *Global Governance*, *8*, 443.

Wang, L., Ertmer, P. A., & Newby, T. J. (2004). Increasing preservice teachers' self-efficacy beliefs for technology integration. *Journal of Research on Technology in Education*, *36*(3), 231–250.

Yousafzai, S. Y., Foxall, G. R., & Pallister, J. G. (2007). Technology acceptance: a meta-analysis of the TAM: Part 1. *Journal of Modelling in Management*, *2*(3), 251–280.

Yucel, U. A., & Gulbahar, Y. (2013). Technology Acceptance Model: A Review of the Prior Predictors. *Ankara University, Journal of Faculty of Educational Sciences*, *46*(1), 89–109.

# APPENDIX A – Questionnaire

## Questionnaire - Using ICT at school and in the Classroom

This questionnaire is designed to determine your attitude toward using digital technology in the classroom. Please answer all questions truthfully. There are no incorrect answers. Your responses are anonymous. Thank you for your participation.

*Required

1. Please state your age. *

2. Please indicate whether you are male or female. *

3. Please indicate the type of school you teach at. *

4. Please indicate your race. *

5. Please indicate whether you use the following: *

   Choose as many as are applicable
   Mobile phone (no internet access)
   Mobile phone (smartphone)
   Desktop Computer
   Laptop Computer
   Tablet (iPad, Galaxy, etc.)
   Interactive Whiteboard (SMART, eBeam, etc.)
   Data Projector

6. Please indicate whether you subscribe to the following: *

   Choose as many as are applicable
   Facebook
   Twitter
   Pinterest
   Tumblr
   WhatsApp
   Mxit
   Google+

7. This section deals with technical support at the school *
   There are five options for each statement:

   Strongly disagree, Disagree, Neither disagree or agree, Agree, Strongly agree

   a. The school has a dedicated person/team to deal with technical problems.

   b. The process required to report a technical problem is quick and easy.

   c. The technical problem is resolved within two days of me reporting the problem.

   d. The support person/team is friendly.

e. The support person/team is patient and understanding of my problem.

8. This section deals with the usefulness of digital technology in your classroom. *

a. Having a laptop and a data projector in my classroom allows me to teach more efficiently.

b. Using digital technology in class engages more learners in my lesson.

c. Using computers enhances my learners' learning experience.

d. Using computers makes it easier for learners to understand the learning material.

e. I have greater control in my classroom when I use digital technology.

f. I find that my lessons are more interesting.

9. This question deals with how easy it is to use digital technology. *

a. Learning to operate my laptop together with the data projector was easy for me.

b. I find it easy to develop lessons using PowerPoint or similar programs.

c. I am able to troubleshoot my hardware if a problem occurs while I am teaching.

d. I regard myself as skillful when it comes to setting up my computer and teaching with it.

e. I am confident in creating spreadsheets to enter marks and calculating averages for my classes.

f. The admin system used by the school is easy to use.

10. This question deals with your attitude toward technology in the classroom. *

a. Using digital technology in the classroom is fun.

b. Using digital technology in the classroom is a good idea.

c. Digital technology in the classroom provides an attractive learning environment.

d. Overall, I enjoy using digital technology in my classroom.

e. I try to keep up to date with trends in technology.

11. This section deals with your intentions to use digital technology. *

a. I would like to use the Internet more productively in the classroom.

b. I intend to involve my learners more when using technology in the classroom.

c. I would like some form of interactive whiteboard installed in my classroom

d. I want to receive training in improving my proficiency using PowerPoint (or similar program).

12. On average, how many hours per day do you spend on the Internet to assist you in preparing your lessons? *

13. On average, how many lessons per week do you incorporate technology? *

## APPENDIX B – Letters of Consent and Information Sheet

658 William Nicol Street
ERASMUSKLOOF
0181
15 May 2014

The Principal

Dear Sir/Madame

**REQUEST TO CONDUCT RESEARCH AT YOUR SCHOOL**

My name is Jacques du Rand. I am a Masters student in the School of Education at the University of the Witwatersrand.

I am doing research on Teachers' Attitudes to Using ICT in the Classroom

My research involves at least twenty-five teachers in your school. They will need to complete a questionnaire that will be in the form of an online survey. The questionnaire addresses their use of digital technology and social media. It also looks at their current level of skill using various forms of digital technology together with the software applications needed to perform their duties as a teacher. The questionnaire also addresses their perceived ease of use of the technology in the classroom and whether there are any frustrations that they experience using technology in their teaching. I want to determine what attitudes teachers have toward using various forms of ICT in their classrooms. This questionnaire will not be used to assess them in any way and will not be used in any appraisal system that the school utilises.

I was wondering whether you would mind if the teachers could spend not more than 15 minutes completing the online survey and then submit it when they have completed it. They do not have to complete the survey during school time; it can be completed at home in their own time.

The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission at any time during this project without any penalty. There are no foreseeable risks in participating in this study. The participants will not be paid for this study.

The names of the research participants and identity of the school will be kept confidential at all times and in all academic writing about the study. Your

individual privacy will be maintained in all published and written data resulting from the study.

All research data will be destroyed between 3-5 years after completion of the project.

Please let me know if you require any further information. I look forward to your response as soon as it is convenient.

Yours sincerely
Jacques du Rand

**Wits School of Education**

27 St Andrews Road, Parktown, Johannesburg, 2193 Private Bag 3, Wits 2050, South Africa
Tel: +27 11 717-3064 Fax: +27 11 717-3100 E-mail: enquiries@educ.wits.ac.za Website: www.wits.ac.za

Student Number:
8484374
Protocol Number:
**2014ECE003M**

03 April 2014

Dear Jacques Du Rand

**Application for Ethics Clearance: Master of Education**

Thank you very much for your ethics application. The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate has considered your application for ethics clearance for your proposal entitled:

**Teachers' Attitudes to Using ICT in the Classroom**

The committee recently met and I am pleased to inform you that clearance was granted.

Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

**The Protocol Number above should be submitted to the Graduate Studies in Education Committee upon submission of your final research report.**

All the best with your research project.

Yours sincerely

M Mabeta

Matsie Mabeta
Wits School of Education

**011 717 3416**

Cc Supervisor: Mr. Tom Waspe

**GAUTENG PROVINCE**
Department: Education
REPUBLIC OF SOUTH AFRICA

**For administrative use:**
**Reference no: D2015 / 009**

# GDE RESEARCH APPROVAL LETTER

| | |
|---|---|
| **Date:** | **22 April 2014** |
| **Validity of Research Approval:** | **22 April to 3 October 2014** |
| **Name of Researcher:** | **Du Rand J.A.** |
| **Address of Researcher:** | **P.O. Box 255** |
| | **Newlands** |
| | **0049** |
| **Telephone Number:** | **012 347 9888 / 082 569 2608** |
| **Fax Number:** | **086 675 1911** |
| **Email address:** | **jdurnad@lantic.net** |
| **Research Topic:** | **Teacher attitudes to using ICT in the classroom - protocol no. 2014ECE003M** |
| **Number and type of schools:** | **THREE Secondary Schools** |
| **District/s/HO** | **Tshwane South** |

## *Re: Approval in Respect of Request to Conduct Research*

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

**The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:**





**Office of the Director: Knowledge Management and Research**
9th Floor, 111 Commissioner Street, Johannesburg, 2001
P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506
Email: David.Makhado@gauteng.gov.za
Website: www.education.gpg.gov.za

1. *The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
4. *A letter / document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
5. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
6. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
7. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
8. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
9. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
10. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
11. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
12. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
13. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
14. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

pp .....

Dr David Makhado
Director: Education Research and Knowledge Management

DATE: 23/04/2014





**Office of the Director: Knowledge Management and Research**
9th Floor, 111 Commissioner Street, Johannesburg, 2001
P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506
Email: David.Makhado@gauteng.gov.za
Website: www.education.gpg.gov.za

**INFORMATION SHEET TEACHERS**

15 May 2014

Dear Teacher

My name is Jacques du Rand and I am a Masters student in the School of Education at the University of the Witwatersrand.

I am doing research on Teachers' Attitudes to Using ICT in the Classroom

My research involves you completing a questionnaire that will be in the form of an online survey. The questionnaire addresses your use of digital technology and social media. It also looks at your current level of skill using various forms of digital technology together with the software applications needed to perform your duties as a teacher. The questionnaire also addresses your perceived ease of use of the technology in the classroom and whether there are any frustrations that you experience using technology in your teaching. I want to determine what attitudes teachers have toward using various forms of ICT in their classrooms. This questionnaire will not be used to assess you in any way and will not be used in any appraisal system that the school utilises.

The reason why I have chosen your school is because it has made inroads in implementing digital technology in the classroom.
I was wondering whether you would mind spending not more than 60 minutes completing the online survey and submitting it when you have completed it.

Your name and identity will be kept confidential at all times and in all academic writing about the study. Your individual privacy will be maintained in all published and written data resulting from the study.

All research data will be destroyed between 3-5 years after completion of the project.

You will not be advantaged or disadvantaged in any way. Your participation is voluntary, so you can withdraw your permission at any time during this project without any penalty. There are no foreseeable risks in participating and you will not be paid for this study.

Please let me know if you require any further information.
Thank you very much for your help.

Yours sincerely,



Jacques Du Rand
8484374@students.wits.ac.za
0825692608

# APPENDIX C – Raw Data

| | Age | Type of School | No of technologies | No of social media | Dedicated person | Reporting | Resolution of problem | Friendly support | Patient and understanding | teach efficiently with | learners engaged | enhances learning | easier to understand | better class control | lessons interesting | easy to operate DP | PowerPoint easy to use | troubleshoot easy | skillful setting up | spreadsheets easy | admin system easy | ICT fun | ICT good idea | Attractive learning environment | Enjoy using ICT | Keep up to date | Want to use Internet better | Intend to involve learners more | Want SMARTBoard | Would like training |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 5 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 |
| 2 | 1 | 1 | 4 | 3 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 1 | 1 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 1 | 1 |
| 4 | 1 | 1 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 2 | 2 | 2 |
| 5 | 1 | 1 | 4 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 3 |
| 6 | 1 | 1 | 4 | 6 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 3 | 3 |
| 7 | 1 | 1 | 2 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 2 | 1 |
| 8 | 1 | 1 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 |
| 9 | 1 | 1 | 5 | 3 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 2 | 2 |
| 10 | 1 | 1 | 4 | 6 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 3 | 3 |
| 11 | 1 | 1 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 |
| 12 | 1 | 1 | 2 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 1 |
| 13 | 1 | 1 | 4 | 6 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 |
| 14 | 1 | 1 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 |
| 15 | 1 | 2 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 3 | 3 |
| 16 | 1 | 2 | 4 | 3 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| 17 | 1 | 2 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 1 |
| 18 | 1 | 2 | 2 | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 1 | 1 |
| 19 | 1 | 2 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 3 |
| 20 | 1 | 2 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 2 | 2 |
| 21 | 1 | 2 | 4 | 6 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 |
| 22 | 1 | 2 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 3 |
| 23 | 1 | 2 | 3 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | 4 |
| 24 | 1 | 2 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 |
| 25 | 1 | 2 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 |
| 26 | 1 | 2 | 4 | 3 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 |
| 27 | 1 | 2 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 1 |
| 28 | 1 | 2 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| 29 | 1 | 2 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 4 |
| 30 | 1 | 2 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 1 |
| 31 | 1 | 2 | 2 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 1 |

| | Age | Type of School | No of technologies | No of social media | Dedicated person | Reporting | Resolution of problem | Friendly support | Patient and understanding | teach efficiently with | learners engaged | enhances learning | easier to understand | better class control | lessons interesting | easy to operate DP | PowerPoint easy to use | troubleshoot easy | skillful setting up | spreadsheets easy | admin system easy | ICT fun | ICT good idea | Attractive learning environment | Enjoy using ICT | Keep up to date | Want to use Internet better | Intend to involve learners more | Want SMARTBoard | Would like training |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 1 | 2 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 3 |
| 33 | 1 | 2 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 2 |
| 34 | 1 | 2 | 4 | 6 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 |
| 35 | 1 | 2 | 3 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| 36 | 1 | 2 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 |
| 37 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 38 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 5 | 3 | 4 | 5 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 39 | 1 | 1 | 5 | 2 | 4 | 2 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 |
| 40 | 1 | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 |
| 41 | 1 | 2 | 5 | 4 | 2 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 |
| 42 | 1 | 2 | 5 | 2 | 4 | 2 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 43 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 44 | 1 | 2 | 5 | 4 | 2 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 |
| 45 | 1 | 2 | 5 | 2 | 4 | 2 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 3 | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 |
| 46 | 2 | 2 | 5 | 2 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 |
| 47 | 2 | 2 | 5 | 2 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 |
| 48 | 2 | 1 | 3 | 3 | 4 | 2 | 5 | 5 | 5 | 3 | 2 | 2 | 2 | 2 | 4 | 5 | 1 | 5 | 5 | 5 | 4 | 4 | 1 | 3 | 2 | 5 | 3 | 3 | 3 | 2 |
| 49 | 2 | 2 | 3 | 3 | 4 | 2 | 5 | 5 | 5 | 3 | 2 | 2 | 2 | 2 | 4 | 5 | 1 | 5 | 5 | 5 | 4 | 4 | 1 | 3 | 2 | 5 | 3 | 3 | 3 | 2 |
| 50 | 3 | 1 | 3 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 51 | 3 | 1 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 5 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 3 | 5 | 5 | 5 |
| 52 | 3 | 1 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 3 | 4 |
| 53 | 3 | 1 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 54 | 3 | 2 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 55 | 3 | 2 | 4 | 1 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 |
| 56 | 3 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 57 | 3 | 2 | 4 | 5 | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 3 | 4 |
| 58 | 3 | 2 | 3 | 3 | 1 | 1 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 2 | 4 | 4 | 4 | 2 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 |
| 59 | 3 | 2 | 3 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 60 | 3 | 2 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 3 | 5 | 5 | 5 |
| 61 | 3 | 2 | 4 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 4 | 3 |
| 62 | 3 | 2 | 4 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 4 |

| | Age | Type of School | No of technologies | No of social media | Dedicated person | Reporting | Resolution of problem | Friendly support | Patient and understanding | teach efficiently with | learners engaged | enhances learning | easier to understand | better class control | lessons interesting | easy to operate DP | PowerPoint easy to use | troubleshoot easy | skillful setting up | spreadsheets easy | admin system easy | ICT fun | ICT good idea | Attractive learning environment | Enjoy using ICT | Keep up to date | Want to use Internet better | Intend to involve learners more | Want SMARTBoard | Would like training |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 3 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 5 | 4 | 5 | 5 | 5 | 5 |
| 64 | 3 | 2 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 3 | 4 |
| 65 | 3 | 2 | 3 | 3 | 4 | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 2 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 |
| 66 | 3 | 1 | 1 | 3 | 4 | 2 | 2 | 4 | 4 | 5 | 4 | 4 | 3 | 4 | 3 | 3 | 5 | 2 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| 67 | 3 | 2 | 5 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 2 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| 68 | 3 | 2 | 3 | 1 | 5 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 69 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 70 | 3 | 2 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 3 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| 71 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| 72 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| 73 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| 74 | 3 | 2 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 2 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 3 | 4 |
| 75 | 3 | 2 | 3 | 1 | 5 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 3 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 76 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| 77 | 4 | 1 | 5 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 78 | 4 | 1 | 5 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 3 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 79 | 4 | 2 | 5 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 80 | 4 | 2 | 3 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 3 | 3 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 81 | 4 | 2 | 5 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 82 | 4 | 2 | 5 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 83 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 3 | 3 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 84 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 3 | 3 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 85 | 4 | 2 | 5 | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 86 | 4 | 1 | 3 | 2 | 5 | 4 | 5 | 5 | 5 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 87 | 4 | 1 | 5 | 3 | 5 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 3 | 3 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 4 | 5 |
| 88 | 4 | 1 | 3 | 2 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 4 |
| 89 | 4 | 1 | 5 | 3 | 5 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 3 | 3 | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 |
| 90 | 4 | 1 | 4 | 4 | 4 | 2 | 1 | 4 | 4 | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 2 |
| 91 | 4 | 1 | 5 | 3 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 3 | 3 | 4 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 4 | 5 |
| 92 | 4 | 1 | 3 | 2 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 3 | 2 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 4 | 5 | 5 | 4 | 4 |
| 93 | 4 | 1 | 5 | 3 | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 3 | 3 | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 |

| 108 | 107 | 106 | 105 | 104 | 103 | 102 | 101 | 100 | 99 | 98 | 97 | 96 | 95 | 94 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | Age |
| 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | Type of School |
| 4 | 4 | 4 | 4 | 5 | 3 | 4 | 5 | 3 | 3 | 3 | 4 | 5 | 3 | 4 | No of technologies |
| 3 | 3 | 3 | 3 | 2 | 2 | 4 | 3 | 2 | 2 | 2 | 4 | 3 | 2 | 4 | No of social media |
| 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 5 | 5 | 4 | Dedicated person |
| 5 | 5 | 5 | 5 | 4 | 4 | 2 | 4 | 4 | 5 | 4 | 2 | 4 | 5 | 2 | Reporting |
| 5 | 5 | 4 | 4 | 5 | 4 | 1 | 4 | 4 | 5 | 4 | 1 | 4 | 5 | 1 | Resolution of problem |
| 5 | 5 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 4 | Friendly support |
| 5 | 5 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 5 | 4 | Patient and understanding |
| 4 | 4 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 4 | 5 | teach efficiently with |
| 2 | 2 | 3 | 3 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | learners engaged |
| 3 | 3 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | enhances learning |
| 3 | 3 | 3 | 3 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | easier to understand |
| 2 | 2 | 3 | 3 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | better class control |
| 3 | 3 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | lessons interesting |
| 4 | 4 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 5 | easy to operate DP |
| 4 | 4 | 1 | 1 | 4 | 3 | 5 | 5 | 3 | 4 | 3 | 5 | 5 | 4 | 5 | PowerPoint easy to use |
| 3 | 3 | 1 | 1 | 2 | 2 | 5 | 3 | 2 | 2 | 2 | 5 | 3 | 2 | 5 | troubleshoot easy |
| 4 | 4 | 2 | 2 | 4 | 2 | 4 | 3 | 2 | 4 | 2 | 4 | 3 | 4 | 4 | skillful setting up |
| 4 | 4 | 2 | 2 | 5 | 3 | 5 | 4 | 3 | 2 | 3 | 5 | 4 | 2 | 5 | spreadsheets easy |
| 4 | 4 | 4 | 4 | 5 | 3 | 5 | 5 | 3 | 4 | 3 | 5 | 5 | 4 | 5 | admin system easy |
| 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | ICT fun |
| 3 | 3 | 4 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 4 | 5 | ICT good idea |
| 3 | 3 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | Attractive learning environment |
| 4 | 4 | 3 | 3 | 5 | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | Enjoy using ICT |
| 4 | 4 | 3 | 3 | 4 | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | Keep up to date |
| 4 | 4 | 3 | 3 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 4 | 5 | Want to use Internet better |
| 4 | 4 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 3 | Intend to involve learners more |
| 3 | 3 | 3 | 3 | 5 | 4 | 3 | 5 | 4 | 4 | 4 | 3 | 5 | 4 | 3 | Want SMARTBoard |
| 4 | 4 | 2 | 2 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 2 | Would like training |