The Adoption of Web 2.0 Tools in Teaching and Learning by In-service Secondary School Teachers: The Mauritian Context

by

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ABSTRACT

With the current rapid increase in use of Web 2.0 tools by students, it is becoming necessary for teachers to understand what is happening in this social networking phenomenon, so that they can better understand the new spaces that students inhabit and the implications for students' learning and investigate the wealth of available Web 2.0 tools, and work to incorporate some into their pedagogical and learning practices. Teachers are using the Internet and social networking tools in their personal lives. However, there is little empirical evidence on teachers' viewpoints and usage of social media and other online technologies to support their classroom practice. This study stemmed from the urgent need to address this gap by exploring teachers' perceptions, and experience of the integration of online technologies, social media, in their personal lives and for professional practice to find the best predictors of the possibility of teachers' using Web 2.0 tools in their professional practice.

Underpinning the study is a conceptual framework consisting of core ideas found in the unified theory of acceptance and use of technology (UTAUT) and technology pedagogy and content knowledge (TPACK) models. The conceptual framework, together with a review of relevant literature, enabled the formulation of a theoretical model for understanding teachers' intention to exploit the potential of Web 2.0 tools. The model was then further developed using a mixed-method, two-phase methodology. In the first phase, a survey instrument was designed and distributed to in-service teachers following a Postgraduate Certificate in Education course at the institution where the researcher works. Using the data collected from the survey, exploratory factor analysis, correlational analysis and multiple regression analysis were used to refine the theoretical model. Other statistical methods were also used to gain further insights into teachers' perceptions of use of Web 2.0 tools in their practices. In the second phase of the study, survey respondents were purposefully selected, based on quantitative results, to participate in interviews. The qualitative data yielded from the interviews was used to support and enrich understanding of the quantitative findings.

The constructs teacher knowledge and technology pedagogy knowledge from the TPACK model and the constructs effort expectancy, facilitating conditions and performance expectancy are the best predictors of teachers' intentions to use Web 2.0 tools in their professional practice. There was an interesting finding on the relationship between UTAUT and TPACK constructs. The constructs performance expectancy and effort expectancy had a significant relationship with all the TPACK constructs – technology knowledge, technology pedagogy knowledge, pedagogical content knowledge (PCK), technology and content knowledge and TPACK – except for content knowledge and pedagogical knowledge. The association between the TPACK construct PCK with the UTAUT constructs performance expectancy and effort expectancy was an unexpected finding because PCK is only about PCK and has no technology component.

The theoretical contribution of this study is the model, which is teachers' intention of future use of Web 2.0 tools in their professional practice. The predictive model, together with other findings, enhances understanding of the nature of teachers' intention to utilise Web 2.0 tools in their professional practice. Findings from this study have implications for school infrastructure, professional development of teachers and an ICT learning environment to support the adoption of Web 2.0 tools in teaching practices and are presented as guiding principles at the end of the study.

DECLARATION

I hereby declare that this dissertation entitled, “The Adoption of Web 2.0 Tools in Teaching and Learning by In-service Secondary School Teachers: The Mauritian Context” is my own work and that all the sources quoted have been acknowledged by means of complete referencing.

Date:

Signature:

Marday Pyneandee

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TABLE OF ABBREVIATIONS

AACE	Association for the Advancement of Computing in Education
IDT	Innovation diffusion theory
BI	Behavioural intention
CERI	Centre for Educational Research and Innovation
DOI	Diffusion of innovation
EFA	Exploratory factor analysis
EHRSP	Education & Human Resources Strategy Plan
ICT	Information and communication technology
IT	Information technology
KMO	Kaiser-Meyer-Olkin
KTT	Knowledge of teaching with technology
MIE	Mauritius Institute of Education
MM	Motivational model
MOEHR	Ministry of Education and Human Resources
MPCU	Model of PC utilisation
PCA	Principal component analysis
PCK	Pedagogical content knowledge
PGCE	Postgraduate Certificate in Education
PSAC	Primary School Achievement Certificate
SCT	Social cognitive theory
SN	Subjective norms
TPACK	Technology pedagogy and content knowledge
TRA	Theory of reasoned action
UTAUT	Unified theory of acceptance and use of technology
VIF	Variance inflation factor

Chapter 1 Introduction

1.1 Introduction

This chapter sets the background, context and purpose of the study, before identifying the specific gap in knowledge and corresponding research questions which were identified to address it. It provides a brief overview of the theoretical and methodological approaches adopted in this study, followed by an outline of the chapters in this dissertation.

1.2 Background

Today, the Web is no longer just an information source or a place to look for resources. The Web is shifting from being a medium in which information is transmitted and consumed, into being a platform in which content is created, shared, remixed, repurposed, and exchanged (Yuen & Yuen, 2010). Web 2.0, sometimes referred to as the "read/write Web", provides online users with interactive services, where they have control over their own data and information (Alexander, 2008; Tyagi, 2012). The current Web 2.0 technology is offering more options for classroom collaboration to transform learning (Alexander, 2008; Merchant, 2012). Web 2.0 tools, such as blogs, Wikis, social networking and bookmarking tools, with their ease of use and user-friendly interfaces, may be just the tools that will enable teachers to adapt pedagogy into the 21st century. These new technologies make sharing content among users much easier than in the past and change the way documents are created, used, shared, and distributed (Balubaid, 2013). The "digital native" students have already found many Web 2.0 tools integral to their daily life. "Our students have changed radically. Today's students are no longer the people our educational system was designed to teach" (Prensky, 2001 p.1). The progression of Web 2.0 tools and social software are changing the way students communicate, collaborate, access, learn and seek new information (Campbell, Wang, Hsu, Duffy, & Wolf, 2010; Greenhow, Robelia, & Hughes, 2009). Today's students communicate through instant messaging, Internet chatting, smart phones, email, webcams, digital media players and other network and digital devices. These devices are integral in students' everyday lives. This generation lives, works and studies in technology-rich cultures for accessing information and communicating with others as an integral part of their everyday lives (Jones & Shao, 2011).

The Web 2.0 applications hold profound potential in education because of their open nature, ease of use and support for effective collaboration and communication (Yuen & Yuen, 2010). The affordances of Web 2.0 should offer a wide range of online activities that support teachers and students in breaking down the boundaries of space and time for teaching and learning and provide access to vast information sources for learning, anytime and anywhere (Crook, Cummings, et al., 2008; McLoughlin & Lee, 2010). Teachers and students can then use class time to do the more difficult work of assimilating basic knowledge and translating it into problem solving, discussion or debates (Brame, 2013). The growth of Web 2.0 technology and increasing ease of collaborating, communicating and co-creating provides an opportunity to move away from a traditional teacher-centred transmission method of teaching to a student-centred one, where knowledge can be created, and students can be entrusted with their own learning (Yuen, Yaoyuneyong & Yuen, 2011). Adjusting pedagogy and curriculum to integrate the tools used by students on a regular basis has been a challenge for teachers (Chai, Koh, & Tsai, 2013; Harris, & Hoffer, 2011). According to Crook, (2012, p. 2): "We are living in a time of participatory tools, participatory attitudes and participatory aspirations; yet educational practice does not seem to be easily bringing these elements into an expected alignment." At present, teachers are seldom incorporating Web 2.0 technologies extensively in their classrooms, showing the existence of a gap between the potential offered by Web 2.0 technologies and actual pedagogy and practice (Ajjan& Hartshorne, 2008; Bertolo, 2008; Conole & Alevizou, 2010; Crook et al., 2008).

1.3 Statement of problem and purpose of study

From his experience as a teacher educator the researcher has noted that teachers are not using ICT as a teaching and learning support tool even though they claim that these technology tools are important for instructional purposes. Teachers do not know how to use Web technologies as a pedagogical tool though they report using the Web in their personal lives (Yuen & Yuen, 2010). Rapid changes in the 21st century, due in part to technological innovations, have dictated a need for educational reform. Skills promoted as 21st-century learning skills are critical thinking, problem solving, communication, collaboration and innovation (Prensky, 2006). Technology integration in classrooms can

reform current instructional practices, which will enable students to develop 21st-century learning skills (Larson & Miller, 2011). In order to be able to successfully integrate technologies into instruction, teachers need to prepare their work in relationship to the curriculum requirements, students' learning needs, available technologies' affordances and constraints, and the realities of school and classroom contexts (Harris & Hofer, 2011).According to Ertmer and Ottenbreit-Leftwich (2010), teachers need help in order to understand how to use technology required for 21st-century teaching and learning to facilitate meaningful learning so that students are able to construct knowledge which can be applied to real situations. The issue is how to help teachers learn to use these tools in the classroom learning environment and motivate them to use these technologies more frequently or make full use of them. The problem to be investigated is how and why teachers struggle to adapt their pedagogy for effective use of Web 2.0 tools in the classroom.

The purpose of this study is to facilitate teachers learning about, adopting and integrating Web 2.0 technologies into their professional practice by investigating teachers' views of these Web 2.0 technologies and determining the predictors to Web technology adoption in teaching and learning. When justifying the topic of the study, the researcher has sought to investigate an area which may have, initially, a positive effect on his teaching, and his students' learning and ultimately may be able to influence stakeholders in education. Cohen, Manion and Morrison (2011) agree that this is a good approach, stating that "research needs to choose a significant topic that will actually make an important contribution to our understanding and practice" (p. 107) and it is important therefore to: "Identify what benefit the research will bring, and to whom, as this will help to focus the research and its audience". (p. 107). The researcher believes that Web 2.0 technology is a significant topic and that an investigation into this field could provide insights which may make a difference to teachers' practice. If children are now digital technology "natives" and enjoy using ICT at home, there exists a good possibility of engaging a class and influencing their learning using new ICT tools, like Web 2.0 tools.

1.4 Research problem

With the current rapid increase in use of these technologies by students, it is becoming necessary for teachers to understand what is happening in this social networking phenomenon, so that they can better understand the new spaces that students inhabit and the implications for students' learning (Greenhow & Lewin, 2016) and consider the wealth of Web 2.0 tools available, and work to incorporate some into their pedagogical and learning practices (Franklin & Van Harmelen, 2007; Grant & Mims, 2009; Greenhow, Robelia & Hughes, 2009; Lee & McLoughlin, 2008; Yuen et al., 2011). Teachers are using the Internet and social networking tools in their personal lives (Yuen & Yuen, 2010). However, there is little empirical evidence on teachers' viewpoints and use of social media and other online technologies to support their classroom practice. Perceptions help provide useful information on areas for improving teaching performance (Boyles, 2015); however, little research has been done to determine the perception of teachers on integrating Web technology into their professional practice. Therefore, this research study set out to address this gap by exploring teachers' attitudes towards, and experience of the integration of online technologies, social media, in their personal lives and for professional practice. To investigate the reasons for this and determine the best possible predictors of Web 2.0 tools adoption this study will explore the following research questions.

Research Question 1:

What are the reasons for teachers using or not using Web 2.0 tools in their professional practice?

Research Question 2:

What are teachers' perceptions towards the use of Web 2.0 technologies in teaching and learning?

Research Question 3:

To what extent does teachers' expertise influence their intention to use Web 2.0 technology in their practice?

Research Question 4:

What are the best predictors of Web 2.0 technology acceptance and teachers' intention to use Web 2.0 tools in their professional practice?

1.5 Objectives of the study

The objectives of the study are to:

- Assess teachers' use of Web 2.0 tools in their professional practice;
- Look into the reasons for teachers' using or not using Web 2.0 tools in their professional practice;
- Assess teachers' perceptions of the pedagogical uses of Web 2.0 technologies in teaching and learning; and
- Determine the best predictors of Web 2.0 technology acceptance and future intention to use Web 2.0 tools by in-service teachers in their professional practice.

1.6 Education system in Mauritius

In Mauritius, children join primary school at the age of 5+, usually after at least one year of pre-primary schooling. Primary education lasts six years (from Grade 1 to Grade 6). Pupils then take a written assessment at the end of Grade 6 and modular assessments during Grades 5 and 6 to obtain the Primary School Achievement Certificate (PSAC) to enter the secondary education. There is an extended four-year cycle for pupils who do not make the grade for the PSAC. Secondary schooling is of seven years duration, the first years (Grade 7 – Grade 11) leading to the Cambridge School Certificate; and two more years (Grade 12 and Grade 13) leading to the Cambridge Higher School Certificate. At the end of Grade 9 pupils take The National Certificate of Education which is a combination of written and school-based assessments

PSAC pupils take (i) a written assessment at the end of Grade 6, and (ii) modular assessments during Grades 5 and 6

1.7 ICT initiatives in the second decade of the 21st century

The Education & Human Resources Strategy Plan (EHRSP) is a document developed in 2008 by the Ministry of Education and Human Resources (MOEHR) in which a set of strategic goals and objectives, with targets and indicators and activities for 2008–2020 has been formulated. It is in line with the vision of providing a quality education for all and developing a human resource base to transform Mauritius into an intelligent nation state in the vanguard of global progress and innovation through the development of a culture of achievement and excellence. The belief that technology can positively impact student learning has led many governments to create programs for the integration of technology into their schools (Hew & Brush, 2006). According to the EHRSP document, by 2015 support technologies will be embedded in the primary education system, ICT will be used as a tool for teaching and learning in the classroom, and instructional materials will be reviewed and developed to meet the changing technological needs. In the EHRSP document it is also stated that by 2015, ICT facilities will be made available for all teachers at secondary education level for use on a regular basis for teaching and learning, provision for a wider use of online materials will be made, and all students leaving at a secondary level will be equipped with ICT skills to adapt to the requirements of future needs of independent learning. Furthermore, it is also mentioned in the EHRSP that the ministry would continue to allocate resources for schools to be technologically equipped for the implementation of ICT programmes. ICT in schools would be used to develop basic computer literacy skills, to support learning and as a tool for school management. Auckbur (2013) claimed that use of a variety of pedagogical tools in teaching and learning is likely to have a positive and long-term impact on the performance of students, thus improving the educational system of Mauritius.

1.7.1 The Sankoré project

Interactive projectors have been introduced at upper primary level through the Sankoré project. The Sankoré project is a Franco-British partnership which targets educating some

16 million African children from Anglophone and Francophone countries. The Sankoré project aims to help Africa achieve education for all by empowering teachers and other stakeholders in the education sector to create, use and share digital educational resources. Mauritius was chosen as the platform for the Franco-African countries for the Sankoré project. The project was launched in April 2011 with the donation of a first batch of 326 items of equipment, interactive projectors and laptops, offered by France. A second set of 250 projectors and laptops was received in April 2012 (Republic of Mauritius, 2013.). With the implementation of the Sankoré project in the primary schools, Mauritius has laid the groundwork for a digital culture with the support of the Mauritius Institute of Education (MIE). MIE is responsible for the development of educational content and training of teachers on the use of ICT to boost their practices in teaching and learning. Also, ICT support officers have been recruited by the MOEHR to assist in the promotion of a digital culture in primary schools. Implementation of the Sankoré project has led to the digitisation of classrooms and teaching materials and the use of innovative technological methods. The rationale is to provide students with the necessary digital skills and experiences for them to become confident learners in a technological world. Since 2011, under the Sankoré project, 1,615 interactive projectors and laptops have been provided to Grade 4, Grade 5 and Grade 6 classrooms (MOEHR, 2014a). The Sankoré project has also being extended to the prevocational stream in secondary schools (MOEHR, 2014a).

1.7.2 The tablet personal computer project

Since 2013, MOEHR in collaboration with the Ministry of Information and Communication Technology embarked on a project for the distribution of the tablet personal computer (TPC) to Grade 10 students and teachers with the idea of supporting teaching approaches in class. A total of 24,111 TPCs were dispensed to students and teachers during the period of March 2014 and June 2014 with the help of school administrations for the registration and allocation of each tablet to individual students (MOEHR, 2014b). The main objectives of the TPC project were to induce a paradigm shift in the teaching and learning process at secondary level and improve students' learning by providing them with anytime, anywhere opportunities to become independent learners through technology (MOEHR, 2014b). The use of TPCs was not adequately exploited by teachers at lower secondary level in the

educational system of Mauritius though it was a quite a good experience for students. Jugee and Santally (2016) conducted a survey with 76 students and 253 teachers at secondary level to understand the current situation of the TPC initiative. They found that 31.23% of the teachers rarely used their tablet in the classroom while some 22% of the teachers would use their tablet daily and the others would make casual usage of the tablet either in the classroom or in the school neighbourhood. Most of the teachers have not yet implemented the use of tablets in their teaching due to the fact that this can affect the completion of the syllabus in time (Jugee & Santally, 2016). Lack of time for using the tablets, low battery capacity and no WIFI access points or data access points to download resources and to interact with other tablets were among the common challenges perceived by teachers (Jugee & Santally, 2016). However, students showed enthusiasm and motivation to use the tablet due to the potential portability of the device and other features such as music players, calculators, dictionaries and others that did not require an Internet connection when used at school, and were easily accessed on the tablet through the navigation applications menu (Jugee & Santally, 2016).

The extension of Sankoré project and the acquisition of touchpad tablets for secondary school students are consistent with the vision to transform Mauritius into a centre of knowledge to enhance education as an instrument to face the challenges of globalisation.

1.8 Significance of the study

The study intended to produce empirical evidence on teachers' perceptions of the use of Web 2.0 tools in education, teachers' intentions to use Web 2.0 technologies in teaching and learning, as well as factors that are hindering or accelerating the use of Web 2.0 tools in education. This evidence is expected to lay the foundation for an increased level of Web technologies usage in secondary schools and may enhance the way teachers teach and learners learn. By providing useful information that will enable administrators and teacher educators to better understand teachers' use and perceptions of Web 2.0 technologies in teaching and learning this study will have educational significance for teachers' professional development and classroom practice. The implications of the study can provide stakeholders with information on how to best prepare staff development

opportunities that guide teachers in implementing the Web 2.0 tools in the classroom, as well as give ideas on how to support the teachers through the professional development process. The study has attempted to highlight the predictors of use of Web technologies by teachers in their professional practice, as well as the factors that are hindering – instead of advancing – their use. In addition, this study adds information to the body of knowledge relating to the use of the Web technologies in education and to developing a model for increased use of Web technologies in secondary schools. Finally, this study might provide insight into the development of new policies and it could assist nearby African countries in starting to integrate Web technologies into their educational programs.

1.9 Theoretical frameworks

Various theoretical models have been devised to investigate technology acceptance in the education literature. The framework conceptualised for this study has drawn on findings from relevant prior research based on the technological, pedagogical, and content knowledge (TPACK) framework (Koehler & Mishra, 2009) and the Unified theory of acceptance and use of technology (UTAUT) model (Venkatesh, Morris, Davis, & Davis, 2003) to explore teachers' perceptions of Web 2.0 tools and determine the best predictors of teachers' intention towards technology integration in professional practice.

1.9.1 TPACK framework

Most previous research has focused on empowering teachers with technological skills, but not much on teaching them how and why to adjust their pedagogy to their content knowledge to make the best use of the tools (Harris & Hofer, 2011). TPACK is the knowledge of the dynamic, transactional negotiation among technology, pedagogy and content and how that negotiation impacts student learning in a classroom context (Cox & Graham, 2009; Koehler, Mishra & Cain, 2013). TPACK's essential features are the use of appropriate technology (a) in a content area; (b) as part of a pedagogical strategy (c) within a given educational context; and (d) to develop students' knowledge of a topic or meet an educational objective or student need (Cox & Graham, 2009). The TPACK framework provides an approach to examining the technological, pedagogical and content knowledge needed to understand and develop practices that address the learning of content using

technology (Baran, Chuang & Thompson, 2011). The TPACK framework has provided a valuable tool, both for designing teacher education experiences and for assessing teacher knowledge in technology integration in both in-service and pre-service teachers (Baran et al., 2011). Several studies have used PCK, technology pedagogy knowledge, technology and content knowledge and TPACK constructs from the TPACK model to measure teachers' perceptions of preparedness to teach with technology (Archambault, 2011; Chai, Koh, Ho, & Tsai, 2011; Lee and Tsai, 2010;) and attitudes towards use of technology in teaching (Avidov-Ungar & Eshet-Alkalai, 2011), The TPACK framework, which has been used to frame other constructs believed to influence technology integration, such as self-efficacy and confidence beliefs (Graham, Borup & Smith, 2012), has also been used as a lens for understanding how teacher candidates make decisions about the use of information and communication technology in their teaching (Graham et al., 2012).

1.9.2 UTAUT framework

UTAUT is a technology acceptance model that was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain information systems usage behaviour (theory of reasoned action, technology acceptance model, motivational model, theory of planned behaviour, a combined theory of planned behaviour/technology acceptance model, model of personal computer use, diffusion of innovations theory and social cognitive theory). The UTAUT aims to explain user intentions to use an information system and subsequent usage behaviour. The theory postulates that four key constructs (performance expectancy, effort expectancy, social influence and facilitating conditions) are direct determining factors of usage intention and behaviour (Venkatesh et al., 2003).

The variables of gender, age, experience and voluntariness of use moderate the key relationships in the model (Venkatesh et al., 2003). The moderating factors have influence on the four key constructs. Gender and age influence performance expectance, effort expectance and social influence. Age and experience moderate the facilitating conditions. Experience moderates effort expectancy, social influence and facilitating conditions. Voluntariness of use moderates the effect of social influence in UTAUT. The combinations

of the constructs and moderating factors have increased the predictive efficiency to 70%, a major improvement over previous technology acceptance model (Venkatesh et al., 2003).

Several studies (Baltaci-Goktalay & Ozdilek, 2010; Deng, Yong, &Yuanyuan, 2011; Verhoeven, Heerwegh, & De Wit, 2010) have shown that UTAUT provides a useful tool by which to evaluate the potential for success of new technology initiation and helps identify factors likely to influence adoption of technology. The UTAUT constructs (performance expectancy, effort expectancy, social influence and facilitating conditions) have been used in the study of teachers' receptiveness towards technology in education and their intention to make use of it (Teo, & Noyes, 2014; Sang, Valcke, van Braak, &Tondeur, 2010; Wong, Teo, & Russo, 2013).

There is a large body of research regarding computer-supported education, perceptions of computer self-efficacy, computer anxiety and the technological attitudes of teachers and teacher candidates. However, there is a scarcity of studies conducted on the correlation between TPACK and effect of the UTAUT constructs (performance expectancy, effort expectancy, social influence and facilitating conditions) and attitude to technology and which additionally explain their relationship to each other. The TPACK and UTAUT frameworks are discussed in more detail in Chapter Two.

1.10 Research methodology

This study examined teachers' perceptions of Web 2.0 technologies in teaching and learning and the predictors of in-service teachers' intention to use Web 2.0 technology their professional practice.

1.10.1 Research design

A research design is the researcher's plan of inquiry (Bogdan & Biklen, 2006) on how to proceed in gaining an understanding of a phenomenon in its natural setting (Denzin & Lincoln, 2000) The purpose of a research design is to provide, within a suitable approach of inquiry, the most valid and precise answers possible to the research question (Denzin & Lincoln, 2000)

This study used a mixed-method design, which is a procedure for collecting, analysing and "mixing" both quantitative and qualitative data at some stage of the research process within a single study, to understand a research problem more completely (Creswell, 2013).

Proponents of mixed-methods research believe that the use of both quantitative and qualitative research allows the researcher to experience a deeper understanding of the topic. Using both methods removes the limitations established using a single method of research and draws from the strengths of both while minimising their respective weaknesses (Creswell, 2013; Sale, Lohfeld, & Brazil, 2002). The reasoning behind implementing a mixed methodology is that neither quantitative nor qualitative methods by themselves adequately encapsulate the fine details of the circumstances, such as examining teachers' perceptions of integration of technology in education and teachers' intention to use technology in a teaching and learning environment. The quantitative aspect will measure which variables have the greatest impact on teachers' intention to use Web technology in their professional practice, while the qualitative approach will explore the perceptions and opinions of different teachers in depth.

1.10.1.1 Quantitative approach

The purpose of this study is to explain how certain variables affect teachers' intention to use Web technologies in their professional practice. The quantitative research approach made use of structured questionnaires. These questionnaires were developed from the literature using proven questionnaire design principles. These questionnaires were then compared with the work of prominent academics in this field.

1.10.1.2 Qualitative approach

An important characteristic of qualitative research is its ability to achieve an understanding of social and human activities by exploring the situation in depth by seeking to establish the meaning of a phenomenon from the views of participants (Creswell, 2013). This study investigated in-depth factors difficult to capture through a quantitative approach. The qualitative research approach used for this in-depth study was in the form of structured personal interviews. An extensive literature search on integration of technology in

education and various factors pertaining to educational theories was undertaken. This was accomplished by consulting a wide range of journals, electronic databases and research publications. The literature review on technology in education and factors relating to educational theories is discussed in Chapter Two.

1.11 Data collection

The data used in this study will be collected by using the methods listed below.

- Hand-delivered questionnaires; and
- In-depth interviews.

1.11.1 Population

The population of this research comprises 200 in-service teachers following the Postgraduate Certificate in Education (PGCE) (part-time) courses at a local teacher training institution. The total population was used as the sample, because it was within adequate distance for the researcher to personally hand-deliver and collect all the questionnaires and responses from the interviewees.

1.11.2 Pilot study

A pilot study of the quantitative and qualitative questionnaire was also carried out to remove any ambiguities or misunderstandings. Refinement of the questionnaires is further discussed in Chapter Three.

1.11.3 Data analysis

1.11.3.1 Analysis of the quantitative data

In the first phase of the study, the numerical, or quantitative, data was collected first, by means of a survey, and then analysed. The purpose of the quantitative phase was to identify the possible predictive power of chosen variables on intention to use Web technologies in a teaching and learning environment and to contribute in the purposive selection of participants for the succeeding phase. Exploratory factor analysis (EFA), correlational analysis and multiple regression analysis were used to find any associations between the variables. The statistical package SPSS®, version 17.0 for Windows, was used to capture and analyse all the quantitative data.

1.11.3.2 Analysis of the qualitative data

In the second phase, an approach of using qualitative multiple case study was used to gather textual information through individual semi-structured interviews which provided insight into the results obtained in phase one. The reason for this approach is that the quantitative data and results provide a more generalised view of the research problem – what independent variables predict use of Web 2.0 technology by in-service teachers for teaching purposes – while the qualitative data and its analysis provide a more refined explanation of the statistical results by exploring participants' views more deeply. During the qualitative analysis stage, data collection and its analysis are conducted in parallel (Merriam, 1998). In the second, qualitative phase of the study, the textual information obtained through interviews were coded and analysed for themes. To interpret the data for themes and patterns, an interpretational analysis was undertaken. Content analysis was used to search for patterns in the data. A visual representation of the data was created to show the developing conceptual outline of the trends and relationships in the data (Miles & Huberman, 1994). Finally, the researcher had resort to reflective analysis to explain the situation.

Data collection and data analysis procedures are discussed further in Chapter Three.

1.11.4 Validity and reliability of the data

The research tool must ensure face validity by quantifying what it is planned to measure: in this case the teachers' perception of integration of Web 2.0 tools in education and their intention to use Web 2.0 tools in their professional practice. Extensive literature search has been conducted to ensure that valid constructs are used in this study.

Internal consistency (Cronbach's Alpha Coefficient) was computed on items in the questionnaire as a reliability estimate to ensure that all items grouped together on an instrument are measuring the same construct consistently. A reliability coefficient of 0.70 or higher is considered adequate (Barclay, Higgins, & Thompson, 1995). Further elaboration on validity and reliability of data is given in Chapter Three.

1.11.5 Establishing credibility

Judging a qualitative study differs in its criteria from judging quantitative research. In qualitative methodology, the researcher is in search of believability, based on coherence, insight, and the instrument's usefulness and trustworthiness (Guba & Lincoln, 1994) by verifying findings rather than using traditional measures of validity and reliability. To validate the findings or determine the credibility of the data and whether it was paralled in the real world (Merriam, 1988), different procedures were adopted in the qualitative phase of the study. Further elaboration on establishing credibility of findings is discussed in Chapter Three.

1.12 Structure of dissertation

This study is organised into seven chapters.

Chapter One introduces the study, which includes the background study, problem statement and purpose of this study.

Chapter Two presents a review of the related literature on Web 2.0 tools and its applications in education, teachers' attitudes and perceptions towards technology use in teaching and learning and on predictors that can be used to assess intention to use a technology innovation. Chapter Two will also describe the theoretical frameworks used, namely the TPACK framework and the UTAUT model.

Chapter Three presents the methodology used in the study, which includes research questions, research methods, target population, sampling plan, research instruments, data collection procedure and data analysis.

Chapter Four presents the results and findings of the quantitative data.

Chapter Five presents the results and findings of the qualitative data

Chapter Six provides an explanation on conclusions drawn from the findings of the data

Chapter Seven summarises the results obtained and makes recommendations for further studies

1.13 Conclusion

This chapter has outlined its content in terms of what is the fundamental sketch of the background, context and purpose of the study. It outlines the theoretical and methodological approaches which were adopted, before concluding with the significance and limitations/assumptions of the study.

The next chapter focuses on the relevant literature review for this study.

2 Literature review

A review of literature on studies related to Web 2.0 tools in education and the theoretical frameworks used for this study are discussed in this chapter. Topics related to Web 2.0 technologies and their use in education, learning theories associated with Web 2.0 technologies, barriers to the integration of Web 2.0 tools in education, teachers' perceptions of Web 2.0 technologies and teachers' intention to use Web 2.0 technologies in their professional practice are also reviewed. The conceptual framework for this study, based on two theoretical frameworks, the UTAUT framework (Venkatesh et al., 2003) and the TPACK framework (Koehler & Mishra, 2009), is also examined in this chapter. From the review of literature related to the above topics, the researcher has also identified the gaps in the current literature pertaining to the barriers to Web 2.0 integration by teachers, teachers' perceptions on Web 2.0 technologies and teachers' intention to use Web 2.0 technologies in their professional practice.

2.1 Digital natives and digital immigrants

A digital native refers to an individual who has grown up surrounded by and using computers, cell phones and other tools of the digital age. The term "digital native" was coined by Marc Prensky in 2001. Students who are labelled "digital natives" are said to have a "natural affinity with technology, and seemingly, are able to effortlessly adopt and adapt to change in the digital landscape" (Waycott, Bennett, Kennedy, Dalgarno, & Gray, 2010, p. 1202). Prensky contrasted "digital natives" to "digital immigrants", that is, people who were born before the widespread use of digital technology. A digital immigrant is someone who was not raised in a digital environment but still uses and adopts many aspects of technology (Prensky, 2001). These terms gained significance in education when Prensky (2001) made claims that the current systems of education were not meeting the needs of digital native students. The claim made for the existence of a generation of "digital natives" is based on two main assumptions in the extant literature, firstly that young people of the digital native generation possess sophisticated knowledge of and skills with information technologies and secondly that as a result of their upbringing and experiences with technology, digital natives have particular learning preferences or styles that differ

from earlier generations of students (Bennett, Maton, & Kervin, 2008). Emerging research has started to question the digital native phenomenon, claiming a lack of empirical and theoretical evidence of Prensky's assertions (Bennett et al., 2008; Guo, Dobson & Petrina, 2008). In 2009, Prensky conducted another study where he re-examined and questioned the relevance of the debate between digital native and digital immigrant. He suggested that it may no longer be relevant as when moving further into the 21st century and nearly everyone is online. He introduced an alternative term, digital wisdom, which goes beyond age. The digitally wise person not only understands how to use technology but is able to use it to improve thinking processes (Prensky, 2009).

Growing up initially with computers, followed by the Internet and the current explosion of mobile devices, digital natives learn and use technology as a cultural tool (Jones, 2011; Jones & Shao, 2011). While students today consider technology as an essential tool of life (Lei, 2009), their predecessors, digital immigrants, view technology differently. Having grown up without computers, the Internet and other mobile devices, digital immigrants have a traditional approach by today's standards to accomplishing the same task by comparison to digital natives (Bennett et al., 2008). Today's technology-global culture is exposing digital immigrant teachers to the new technology world surrounding them (Guo et al., 2008). Being comfortable in completing tasks without technology tools, digital immigrant teachers naturally view the need for and use of technology differently than their students, who are digital natives (Prensky, 2001; Tapscott, 2008). Yet for digital immigrant teachers to become skilled technology users, according to Jones (2011), it is essential that they be provided access to and opportunity to obtain technology competency and technology integration training along with ongoing support.

The people who have entered pre-service teaching programs and begun careers as teachers during the last decade are digital natives. Since digital natives are fervent users of technology, it would be sensible to assume that they are more prepared to use technology for teaching than previous generations of teachers (Lei, 2009). Lei examined digital native teachers' beliefs, attitudes, and technology proficiencies, in addition to identifying the strengths and weaknesses in their technology knowledge and skills. The results revealed that these digital native teachers were proficient with technologies and

that their use of technology was mainly related to their social and communication activities. Lei concluded that the digital native teachers lacked the knowledge, skills and experience to integrate technology into classrooms to help their students learn, even though they were fully aware the importance of doing so.

All the participants in the present study were born after 1980 and can be classified according to Prensky (2001) as digital natives.

2.2 Web 2.0 technologies in education

2.2.1 What is meant by Web 2.0 technology?

Web 2.0 is a term used to express the second generation of Web tools that differ from the first generation of Web tools, Web 1.0 (Cormode & Krishnamurthy, 2008). Web 1.0 technology is characterised by a one-way communication style, such as just reading a Web page or viewing an image (Lee & McLoughlin, 2007). Users, who were mostly receivers of information, would read content which was created by persons who had the technical expertise to write and post content on the Internet and communicated through email, chat rooms, and discussion boards (McLoughlin & Lee, 2007). Web 2.0 refers to the Internet services that are available for users to create content over the Web, consume content created by others, remix content created together and communicate with other users (Lee & McLoughlin, 2007; Schneckenberg, Ehlers, & Adelsberger, 2011). Some of the significant aspects of Web 2.0 technologies are that they are collaborative, open sourced, networked, and participatory (Popescu, 2014). Web 2.0 tools are sometimes called the "Read/Write Web", since they enable people to move beyond simply reading or seeing content to being able to write or create content Popescu, 2014). Blogs, Wikis, Google (not only as a search engine, but also as an instrument for document sharing with Google Docs, document storage with Google Drive and to communicate with Gmail), Skype, Facebook, Flickr and YouTube are examples of popular Web 2.0 tools (Pieri & Diamantini, 2014). Web 2.0 tools are popular mainly because of the ease of creating content over the Internet with them (Hsu, Ching, & Grabowski, 2009). With Web 2.0 tools, it is not necessary for the Internet users to have a significant amount of technical skills to create and manipulate content over the Internet (Hsu et al., 2009; Schneckenberg et al., 2011). Prior to the

introduction of Web 2.0 technology, creating content over the Internet was impossible for users who did not have a significant amount of technical skills (Hsu et al., 2009). Another reason for the popularity of Web 2.0 tools is their availability. Web 2.0 tools, most of them being available freely or at low cost, can be accessed with any digital device that has an Internet connection and are thus available 24 hours a day (Schneckenberg et al., 2011).

2.2.2 Why use Web 2.0 technologies in education?

The increasingly omnipresent availability, easiness of use and flexibility of emerging Web 2.0 technologies have made them much more appealing as pedagogical tools (Ajjan & Hartshorne, 2008). Due to their read/write nature, Web 2.0 tools offer better learning settings based upon their user-centred, collaborative and social networking features (Jimoyiannis, Tsiotakis, Roussinos, & Siorenta, 2013). Web 2.0 technologies offer considerable opportunities for teachers to improve communication, productivity and sharing within their classes (Brown, 2010; Greenhow, Robelia, & Hughes, 2009). Web 2.0 tools can help learners to take more control of their learning through producing content for their learning community and exposing learning materials for re-use by others (Crook & Harrison, 2008). Students can create, consume and share independently produced information, remixing content in creating new content (Greenhow, 2009). With the availability of these new learning environments, a new "prod-user" identity is emerging, depicting learners as co-producers of knowledge rather than merely consumers of information (Brown, 2010). Web 2.0 tools provide better learning avenues by reinforcing students' ability to think critically and encouraging students to share information and engage in social learning (Jimoyiannis et al., 2013). Web 2.0 tools enable students to work at theoretical level of understanding, develop critical thinking, build their own knowledge and collaboratively build knowledge (den Exter, Rowe, Boyd, & Lloyd, 2012). All these Web 2.0 affordances enable the development of a participatory culture which allows for sharing, and creating of information and knowledge in the 21st century (Mcloughlin & Lee, 2011).

2.2.3 Some popular Web 2.0 tools used in teaching and learning

2.2.3.1 Blogs

Blogs are among the many commonly used technologies for teaching and learning (Pardamean & Susanto, 2012). A blog, a log on the Web or otherwise known as Weblog, is a Web-based journal or online diary that an individual user can use to provide a personal comment on a subject and can function as a personal online diary and link content with other Web resources (Duffy, 2008; Hsu, Ching, & Grabowski, 2009; Hung, 2011). The dated entries or posts in a blog appear in a chronological manner with latest posts appearing at the top (Duffy, 2008; Hsu et al., 2009). Data is entered into a blog through a simple form and submitted by the blogger. Updating of a blog necessitates little or no technical background (Duffy, 2008). Other Web users can look through blog posts and add comments on the content (Hung, 2011). Blogs can be used by students to maintain reflective journals and provide feedback to their peers. Teachers can use blogs to share ideas and resources with their students and monitor their progress, while providing feedback and authentic assessment can be done on learners' blogs (Hung, 2011; Dabbagh & Kitsantas, 2012). Blogs, being available online at any time and in any place, offer a participatory environment that can be effectively used for interaction among other users (Hung, 2011). Blog platforms provide writing spaces for easy use and usually allow the blogger to invite users to share the content of blogs (Duffy, 2008). The facility for users to comment in an interactive environment is an important feature of blogging that enables students to learn collaboratively and socially (Duffy, 2008). Blogs are useful for facilitating interactions among learners and interactions between learners and teachers (Saeed & Yang, 2008; Wang, Chang, Yeh, Shih & Chen, 2008).

2.2.3.2 Wikis

A Wiki is an online workspace that allows users to collaboratively create a series of Web pages, edit and revise their and others' work, provide feedback, keep track of the changes and publish information online using no more complicated technology than a Web browser (Ahmadi & Marandi, 2014). Some of the pedagogical affordances of Wikis are multiple authoring, publishing and sharing resources in a learning community Kumar, 2008). Wikis

are used as group authoring tools in carrying out projects, and allow group members to build and edit a document on a single page (Quek & Wang, 2014). Wikis can be used as tools that facilitate peer interactions in a learner-centred learning environment in which learners engage in brainstorming and decision making on given topics, leading to coproduction of resources (Quek & Wang, 2014). Adapting this concept to the educational setting, students using Wiki tools can establish an effective knowledge-creating platform that facilitates brainstorming activities, enhances project outcomes, promotes collaborative problem solving and stimulates critical inquiry, which are the hallmarks of constructivist learning (Kai Wah Chu, Siu, Liang, Capio & Wu, 2013). Wikis are useful for collaborative writing and providing feedback, and could be used for improving the interaction among learners and the interaction between learners and teachers (Huang & Nakazawa, 2010). The use of Wikis for facilitating interactions among learners improves the quality of teaching and learning (Wheeler et al., 2008). Wikis also contain the feature of version control. This feature could be used to keep track of the changes applied to the Web pages by different authors (Hsu et al., 2009). Wikis could be used by learners for brainstorming and ongoing documentation and by teachers to trace how learners develop content for the purpose of assessment (Franklin & Van Harmelen, 2008).

2.2.3.3 Social networking sites

Social networking sites are progressively gaining attention in relation to education, with significant implications for changing and adjusting teaching and learning (Greenhow et al., 2014; Manca & Ranieri, 2013). A social networking site is an online platform that is used by people to build social relations with other people who share similar personal or professional interests (Iqbal, Rehman & Khushi, 2016). Social networking sites, such as Facebook, offer a platform where students can interact with one another socially (Iqbal et al., 2016). Despite its growing popularity, being the most popular social networking site, with 1.3 billion mobile active users monthly (Facebook, 2016), the views on the educational value of Facebook are inconsistent, with some researchers highlighting its pedagogical affordances and others warning against its use for educational purposes. The advent of social networks has generated abundant research which has tried to look into the possible educational uses of these platforms (Rodríguez-hoyos, Salmón & Fernández-díaz, 2015).

Manca and Ranieri (2013) conducted a comprehensive literature search to provide a critical overview of current studies focusing on the educational uses of Facebook and to analyse the extent to which its pedagogic potential was being put into practice. They identified 23 relevant articles which were then analysed and obtained a set of emerging categories. Their findings show that the pedagogical uses of Facebook have only been partly employed and that there are still some hindrances such as teacher and student educational practices and institutional issues that may prevent a full acceptance of Facebook as a learning environment. Several researchers have stressed the benefits of Facebook in education. With tools like Facebook, students can engage in group projects and continue their schoolwork outside of the classroom (Carter, Foulger & Ewbank, 2008; Grisham, 2014).

Capo and Orellana (2011) have found that teachers perceived that social media would improve student–teacher communications, whereas Hunter-Brown (2012) established that some students prefer using Facebook groups to easily get in touch with their teacher. Fewkes and McCabe (2012) have argued that collaboration between both student–teacher and student–student, and extra help from the teacher concerning homework or revision work are possible when using Facebook in the classroom. They have also contended that engagement with social media can help students to develop associations with peers, form a virtual community of learners and ultimately increase their overall learning. However, some teachers are using Facebook in ways that take little advantage of its social affordances. For instance, they are just posting reminders to students about homework and upcoming class tests on Facebook; however, the same task could be achieved by using email (Henderson, Snyder & Beale, 2013).

2.2.3.4 Video-sharing sites

Web 2.0 based multimedia repositories such as YouTube are increasingly becoming widespread among Internet users. Since its launch in 2005, YouTube has become the most popular free video-sharing website where users are able to upload, view, and share video clips (Duffy, 2008). One of the benefits of using YouTube in education is that it provides online access to vast quantities of free videos on a large range of topics (Snelson, Rice, &

Wyzard, 2012). YouTube can be used by learners for uploading content such as oral presentations to be reviewed by the peers and teachers and be used by teachers for distributing materials (Franklin & Harmelen, 2008; Luo, 2010). The use of videos in the classroom can be the starting point for class discussions where students use the media and visual potential of YouTube to engage with new and varied themes both within and beyond the classroom (Tan & Pearce, 2012). According to Willmot, Bramhall and Radley (2012), the use of videos in student-centred learning activities can also encourage and engage students to enhance their learning. More recently, Ahmad and Lidadun (2017) conducted a study with 111 undergraduate students in Malaysia. Their findings demonstrated that the use of videos in English as Second Language helped in motivating and enhancing students' experiences and skills in communication skills development, especially in terms of oral presentation skills.

2.3 Learning theories of Web 2.0 technologies

The most common learning theories associated with use of Web 2.0 technologies in education are the active learning theory, social learning theory, constructivism and connectivism.

2.3.1 Active learning theory

Active learning theory emphasises decentralised learning – collaborative, networked interaction, rather than top-down knowledge dissemination (Lee & Mcloughlin, 2007). It is centred around the student, who is in control of his or her own learning processes (Prensky, 2005). An ideal active learning environment alternates between rich experiences and thoughtful reflection on those experiences (Armstrong, 2008). Web 2.0 tools work well with active learning theory as they facilitate collaboration and group work (Armstrong, 2008). Lee and McLoughlin argue that Web 2.0 tools with their diverse participatory and collaborative nature can be integrated into the core concepts of active learning theory, because active learning theory puts emphasis on distributed and decentralised educational environments – collaborative, connected and interactive – rather than traditional teacher-centred knowledge dissemination systems.

2.3.2 Social learning theory

The major insights into how social technologies representing Web 2.0 tools and social interactions that affect teaching and learning experiences can be found starting from social learning theory (Lee, Williams & Kim, 2008). According to social learning theory by Bandura (1977), human beings can learn from observations that can occur in relation to a comprehensive model that could account for the wide range of learning experiences that occur in the real world. The critical factor of Bandura's social learning theory is reciprocal determinism, which states that the learner is not a passive recipient of information and that cognition, environment and behaviour all mutually influence each other. Moreover, Bandura also affirms that students learn when they can interact, collaborate and cooperate in their learning. This explains, in part, students' interest in Web 2.0 tools like Wikis and blogs when working together in groups on educational projects (Meyer, 2010).

2.3.3 Constructivism

Constructivism is a learning theory which lays emphasis on the active participation of the learner in the process of acquiring knowledge (Baxter et al., 2011). Constructivism is based on the premise that knowledge is not transmitted but is constructed by the individual, and thus learning is an active process of integrating information with pre-existing knowledge (Ullrich, Borau, Luo, Tan, Shen & Shen, 2008). Constructivism places great importance on the role a learner's environment plays in his or her learning. Under constructivism, learners construct knowledge based on their beliefs and experiences, making knowledge unique to the individual (Bofill, 2013). According to Armstrong (2011), in a constructivist teaching approach, instructors should build on knowledge that students already have in order to engage them in new concepts. In constructivist activities learners perform tasks which involve collecting and selecting data and information, and then transforming them into meaningful skills and knowledge (Lee et al., 2008). This aspect of constructivism can be found in social media where learners are able to create educational media by using Web 2.0 tools for educational purposes, editing, creating, and sharing their work (Lee et al., 2008). As such, constructivism as a learning theory also offers a background for this

research and helps to explain the factors that affect teachers' intentions to use Web 2.0 tools in teaching and learning.

2.3.4 Connectivism

Connectivism is a learning theory in which knowledge exists outside of the learner, and the learner makes connections between information to build knowledge. The connections that learners make help them create their own learning network. Connectivism has emerged for use in the digital age (Bell, 2011).

The main ideas of connectivism can be listed as:

- Learning and knowledge rest in diversity of opinions;
- Learning is the process of connecting specialised nodes or information sources;
- Learning may reside in non-human appliances;
- Capacity to know further is more critical than what is currently known;
- Nurturing and maintaining connections are needed to facilitate learning;
- The ability to identify connections between concepts is important;
- Maintaining current and accurate knowledge is the purpose in connectivist activities; and
- Decision making is a learning process as information can change and what is viewed as correct one day may be incorrect the next (Siemens, 2005).

Learning in connective education systems is a process of creating connections, interacting with other entities and expanding more connections with open, participatory and collaborative natures of Web 2.0 environments (Lee et al., 2008). Digital media have caused knowledge to be more distributed than ever, and it is now more important for students to know where to find knowledge they require, than it is for them to internalise it (Siemens, 2005). The affordances of Web 2.0 technologies provide a new instructional framework for adapting connectivism (Kop & Hill, 2008).

Connectivist key ideas can be summarised as the interaction between individuals and information, based in the uses of Web 2.0 tools, and social technology (Bell, 2011). With

this connected interaction learners need to know how to obtain knowledge using Web 2.0 technology in order to be able to generate knowledge anytime and anywhere.

2.4 Barriers to using Web 2.0 tools in teaching

Teachers face several barriers when integrating technology into their instruction. Barriers, as defined by Ertmer (2005), can be any dynamic inhibiting or restricting teachers' use of technology in the classroom. Ertmer categorises the difficulties of technology integration as having: first-order and second-order barriers. First-order barriers prevent teachers from using technology due to a lack of access to technology, time to learn and use technology, training and support, and professional development (Goktas, Gedik, & Baydas, 2013). Second-order barriers include attitudes and beliefs towards the uses of technology in education, and the teaching approaches used by schools (Goktas et al., 2013). First-order barriers are easier to recognise and remove, whereas second-order barriers may require teachers to transform their beliefs in teaching and learning (Ertmer, 2005). Other researchers have argued that second-order barriers are more important to teachers' acceptance and use of technology than first-order barriers (Ertmer, Ottenbreit-Leftwich, Sadik, &Sendurur, 2012; Zhao, Zhang, & Li, 2011). Tsai and Chai (2012) suggested that there exists an important third-order barrier to technology integration in classrooms, namely, design thinking by teachers. Design thinking is a teacher's ability to "create learning materials and activities, adapting to the instructional needs for different contexts or varying groups of learners" (Tsai & Chai, 2012, p. 1058).

In a comparative study on enablers and barriers to ICT integration conducted from 2005 to 2011, Goktas et al. (2013) identified the common barriers as lack of resources, lack of knowledge of technology and pedagogical use of technology, lack of support (for example technical or administrative), lack of professional development and lack of time.

2.4.1 Lack of resources

Access to technology resources plays an important role in motivating teachers to use technology. Several researchers (Ogwu & Ogwu, 2010; Lacina, Matthews & Nutt, 2011; Hutchison & Reinking, 2010) have shown that the lack of availability of the technological

tools and resources to facilitate learning is a barrier that prevents teachers from integrating technology in the classroom.

2.4.2 Lack of knowledge of technology and pedagogical use of technology

Several studies (Blackwell, Lauricella & Wartella, 2014; Ertmer, et al., 2012; Inan & Lowther, 2010; Ottenbreit-Leftwich, Glazewski, Newby & Ertmer, 2010) have reported inadequate technology skills as an issue in the use of technology in classrooms. According to Hew and Brush (2007) one main barrier hindering teachers' use of technology in the classrooms is the lack of "specific technology knowledge and skills, technology-supported-pedagogical knowledge and skills, and technology-related-classroom management knowledge and skills" (p. 227). This view is supported by An and Reigeluth (2011) who argue that teachers lack "knowledge about ways to integrate technology into learner-centred instruction" (p. 59). In a study attempting to identify secondary school teachers' attitudes towards the use of Web 2.0 technologies in their teaching, Kale and Goh (2014) reported that teachers faced difficulties in their efforts to integrate their use of Web 2.0 applications in their classroom teaching. These teachers were familiar with at least one Web 2.0 application but their attempts at integrating it into classroom teaching were hindered because of a lack of clear ideas on how these applications could be effectively used to support their students' learning (Kale & Goh, 2014). Similar results were obtained by Archambault and Crippen (2009) who conducted a study with 596 teachers from 25 different states in America. The results of their study have shown that teachers had a high level of knowledge of pedagogy and their subject areas but a low level of technology knowledge.

In China, Zhou et al., (2011) found that in-service teachers' use of technology in teaching was very low since they lacked the necessary skills required to integrate technology in their teaching. Recently, Lindberg, Olofsson and Fransson (2017) conducted a study on the use of ICT for teaching and learning in three upper secondary schools in Sweden. They reported that despite having advanced technology skills teachers often experienced difficulties in keeping pace with the rapid development of technology.

2.4.3 Professional development

A lack of training has been frequently quoted as a barrier to teachers' integration of technology in their professional practices (An &Reigeluth, 2011; Ertmer and Ottenbreit-Leftwich 2010; Johnson et al., 2013; Kopcha, 2012). In the past decade, researchers (Ertmer, 2005; Lawless & Pellegrino, 2007) have argued that professional development regarding technology use in education needed to lay emphasis on curriculum-related applications, active involvement of teachers in hands-on technology use and of diverse learning experiences that are linked to student learning, technical and administrative support, appropriate resources and built-in evaluation. In this decade, researchers (Beauchamp, Burden, & Abbinett, 2015; Schrum & Levin, 2013) have added that professional development needed to be a continuing process with job-embedded support, and continuous program adjustments to keep pace with ever-evolving technology. This agrees with the argument of Wright (2010) that it is a mistake to believe that because teachers who are skillful in using technology will automatically be able to bring their technology skills into use in the classroom and transform their teaching practices. Twenty-first century teachers need to have more than just access to technology tools and devices.

There will probably be a need for changes in teachers' knowledge, self-efficacy and pedagogical beliefs to empower them to use technology in ways that sustain 21st century goals (Ertmer & Ottenbreit-Leftwich, 2010). According to Tondeur, van Braak, Sang, Voogt, Fisser, and Ottenbreit-Leftwich (2012)., because of their strong pedagogical beliefs, developed from their experiences as secondary school students and earlier classroom teaching practices, in-service teachers are likely to resist change. However, Koehler and Mishra (2005) argue that a change is to be expected when professional development takes into consideration the teachers' curricular needs. Several studies (Lau & Yuen, 2013; Peeraer & Van Petegem, 2012; Pan & Franklin, 2011; Tondeur, Siddiq, Scherer & van Braak, 2016) have shown that due to professional development there has been consistent increase of technology integration in the classroom.

2.4.4 Lack of time

Findings from recent studies (Biancarosa & Griffiths, 2012; Buckenmeyer, 2010; Kopcha, 2012; Wachira & Keengwe, 2010) have reported about the time constraints for using Web 2.0 tools in their classroom practices. Buckenmeyer (2010) conducted a survey with 144 secondary school teachers and reported that teachers would need time to learn how to use the Web 2.0 tools and then how to plan and effectively implement these technologies in their classrooms. According to Biancarosa and Griffiths (2012) teachers would not have time for more or new activities to be added into their already overloaded curriculum. Other researchers (Buabeng-Andoh, 2012; Kale & Goh, 2012) have also found workload and lack of time to be significant barriers to teachers' integration of Web 2.0 tools in their professional practice. Kopcha (2012) and Wachira and Keengwe (2010) have argued that implementing Web 2.0 tools in classroom would require more of teachers' time because they might have to handle students' misbehaviour when using Internet in classroom. Other researchers (King, Duke-Williams & Mottershead, 2009; Pritchett, Wohleb, & Pritchett 2013) have argued that with the use of Web 2.0 tools in teaching and learning, teachers would have responsibilities (apart from teaching) that take up their time and would therefore be resistant to devoting more time with new pedagogies or spending more time online with students. In a more recent study, Lindberg et al. (2017) also found that although teachers acknowledged the potential of technology in education, insufficient time was available for its use.

2.4.5 Other barriers to Web 2.0 tools in teaching

Armstrong and Franklin (2008) reported that older teachers have problems remembering passwords since using different Web 2.0 tools can involve logging on to several accounts. Moreover, they are resistant to having to learn new Web 2.0 tools, and they fear losing control to the students. In a study by An and Williams (2010) teachers were found to have confronted three barriers when introducing Web 2.0 tools into the classroom environment. Firstly, students were uncomfortable with the open nature of Web 2.0 tools and were reluctant to participate in class activities that made use of Web 2.0. Secondly, technical difficulties arose from a shortage of new computers, problems due to the evolving nature

of Web 2.0 tools, and inadequate technical support. Thirdly, extra time was needed both to learn and then implement Web 2.0 technologies. This applied to both for the teachers and the students. This view concurs with that of Crook et al. (2008) who reported that teachers considered that integrating Web 2.0 tools in teaching and learning would be time consuming for them, and that students' use of Web 2.0 tools in class could be problematic for them to handle. Some other barriers evident from the literature include: concerns about expectations, experiences and competences with respect to using Web 2.0 technologies; the perception that engagement in using these tools has an associated time investment; a mismatch between the current social and cultural context of teaching practices and Web 2.0 approaches (Blin & Munro, 2008); a lack of confidence that correct instructional structures are in place to support these activities; and an inherent uncertainty as to whether or not these technologies will actually make a difference (Conole & Alevizou, 2010). The digital technologies accessible to schools and teachers are always changing (Ertmer & Ottenbreit-Leftwich, 2010; Harris, Mishra, & Koehler, 2009). Consequently, some teachers may be worried about the use of technology in the classroom because their lack of self-confidence in their capability to integrate technology (Moore-Hayes, 2011). Also the implementation of Web 2.0 may result in involving students in the teaching and learning process because teachers may have to resort to asking students for help with online materials development and teachers may perceive some loss of personal esteem (King et al., 2009). However, according to Jimoyiannis et al. (2013), teachers are ready to adopt and use Web 2.0 applications such as blogs and Wikis in the classroom setting, to improve both their instructional practice and students' learning, but consider lack of time, classroom infrastructure, and the restrictions set by the national curriculum as being the main factors determining their intentions and efforts to put Web 2.0 into practice.

Many Web 2.0 applications can now run on all devices without installing anything or paying for them. Consequently, technological barriers to using computers are reduced, making online collaboration easier to implement and Web 2.0 tools becoming a real possibility for pedagogical use inside and outside classroom environments and an opportunity for the professional learning and training of teachers (Weller, 2013). Most of the Web 2.0 tools are available at no or low cost (Schneckenberg et al., 2011) and access to them as well as professional development opportunities have increased (Gray et al., 2010), but findings

from studies (An & William, 2010; Crook et al., 2008; Ertmer et al., 2012; Goktas et al., 2013) are repeatedly showing that teachers fail to integrate technology in their classrooms. This study addresses this issue by exploring the factors that influence teachers' integration of Web 2.0 tools in their professional practice.

2.5 Teacher perceptions of use of Web 2.0 tools in teaching and learning

Research has been carried out on both pre-service and in-service teachers' perceptions of the integration of new digital and social networking tools into classroom environments (Baltaci-Goktalay & Ozdilek, 2010; Coutinho, 2009). Researchers agree that studies of teachers' perceptions are important because teachers' perceptions of technology are significant to the bringing up of technology innovations in teaching and learning (Sawant, 2012).

A study examining pre-service teachers' beliefs, attitudes and technology experiences and exploring the technology preparation needed for them to integrate technology in their future classrooms was conducted by Lei (2009). He found that pre-service teachers reported strong positive beliefs in Web tools technology and that their use of Web 2.0 technologies was limited mainly to social networking sites. These teachers also revealed that they lacked the experience and expertise in using Web 2.0 technologies for classroom application. Baltaci-Goktalay and Ozdilek (2010), in a study examining pre-service teachers' perceptions of Web 2.0 technologies, found that pre-service teachers' perceptions about Web 2.0 technologies were positive and their acceptance of these technologies and willingness to use them were high.

Sadaf, Newby and Ertmer (2012) who investigated pre-service teachers' opinions on Web 2.0 tools and, like Lei (2009), found that many of these teachers understood how Web 2.0 tools could be useful in teaching but felt that it would be difficult for them to integrate the right Web 2.0 tools successfully into their teaching lessons. An explanation could be that the teachers did not have enough classroom experience and the required knowledge and skills to integrate technology into teaching. Sadaf et al. (2012) also found that these teachers believed Web 2.0 would be more effective to use with older children and teenagers. This was because these teachers were aware that outside of the classroom

older children and teenagers would be using Web 2.0 tools regularly and that teachers could keep the students engaged with lessons through Web 2.0 tools. All of this suggests that pre-service teachers understand the potential benefit of Web 2.0 tools but might not always use these tools, due to the lack of confidence on the best way to use these tools.

Cheon, Song, Jones and Nam (2010) argue that teachers who feel that Web 2.0 tools are easy to use and useful are more likely to adopt Web 2.0 tools for teaching, whereas Sadaf et al. (2012) found that teachers' likelihood of using Web-based tools in their classrooms depended largely on whether they thought these tools had the potential of positively influencing and improving students' learning and engagement. The perception of the usefulness, ease of use and strong self-efficacy beliefs could be due to the teachers' exposure to Web 2.0 technologies during their normal daily activities that helped them understand the value of using these technologies in their professional practice.

2.5.1 Positive themes

Generally, teachers believe that Web technologies have positive benefits for educational purposes such as student motivation and engagement, improved teacher-student interaction, accessibility of learning and development of collaboration skills. (Waycott, Gray, Thompson, Sheard, Clerehan, Richardson, & Hamilton, 2010).). These Web technologies can also help to enhance student learning and manage teaching activities (Waycott et al., 2010).

2.5.1.1 Motivation

In a study with secondary school teachers, Ertmer et al. (2012) found that internal factors such as passion for technology and having a problem-solving mentality influence teachers' use of Web 2.0 tools in their practices. It can be argued that teachers are passionate about using Web 2.0 tools in their professional practice because they are regular users of these tools in their daily lives and more importantly, they have understood the affordances of these tools for use in teaching and learning.

According to Clark et al. (2009), students who used social networking sites like Facebook and YouTube were showing more interest in their studies, were more engaged and used these sites to facilitate their learning.

2.5.1.2 Improved teacher-student interaction

Capo and Orellana (2011) and Hunter-Brown (2012) contended that teachers perceive that social media would improve student-teacher communications and that some students prefer using Facebook groups to easily get in touch with their teachers.

2.5.1.3 Accessibility of learning

Researchers (Greenhow, Robelia, & Hughes, 2009; Weller, 2013) have reported that today's learners have more choices, in particular the use of mobile/tablet devices, about how and where to spend their learning time (for example in classrooms and outside formal face-to-face teaching – at home, in private and public places) than they did a decade ago.

With tools like Facebook, students can engage in group projects and continue their schoolwork outside the classroom, as pointed out by the articles written by Carter, Foulger and Ewbank (2008) and Junco (2012). Meabon Bartow (2014) and Mao (2014) have argued that social media are enabling contact among students and teachers outside normal school hours and facilitating the inclusion of multimedia into teaching and learning activities. So, Web 2.0 tools can help in easing lesson content delivery and making learning activities more attractive.

2.5.1.4 Development of collaboration skills

Several studies (Den Exter et al., 2012; Meishar-Tal and Gorsky, 2010; Trentin, 2009) have shown that with Web 2.0 tools students can work collaboratively to build knowledge. In the same vein, Fewkes and McCabe (2012) contend that using Facebook encourages self-regulation and accountability both individually and collaboratively among students. It can be argued that it is the students' immersion in social networking sites such as Facebook that develops their collaborative skills and eventually gives them the possibility to engage more in their learning through the use of learning tasks within these tools.

2.5.2 Negative themes

Technology distraction and inappropriate use of the Internet are the two negative themes that have surfaced in the researcher's literature review.

2.5.2.1 Technology distraction

Dealing with distraction and managing classes that have an Internet connection are major challenges that teachers perceive. Bate, MacNish and Males (2012) conducted a study that examined the implementation of a 1:1 laptop program in a school for boys in Perth, Western Australia. One issue that has emerged from the study is the problem of managing student distraction. The researchers have argued that managing ICT-rich classrooms and minimising distractions in classrooms are issues that teachers have to deal with regularly. Thus, instead of Web 2.0 tools helping students to participate and collaborate formally and informally with others, these tools could turn out to be a distraction in the class.

2.5.2.2 Inappropriate use of technology

Invasion of privacy, exposure to mockery, cyberbullying and production of inappropriate material are among the common fears of teachers about using technology in class (Crook et al., 2008). These fears have also been reported by Howard (2013) and Tindell and Bohlander (2012) who have shown that texting, game playing and social networking were common inappropriate uses of technology in school. There are security risks that are associated with social networking sites, especially when sites such as Facebook are accessed via mobile devices where privacy can be invaded and data can be shared involuntarily (Henderson, Auld & Johnson, 2014). Whether teachers are using social networking sites for personal reasons or in their professional practice, there is a possibility of public search of their profiles, including students seeing aspects of their private lives (Henderson et al., 2014). It seems that teachers tend to be apprehensive of the risk of their professional and personal privacy being compromised if their Facebook profiles are viewed by students. Teachers should be careful when using Web 2.0 tools as there is blurring of lines between what information is private and what is for public view (Huijser, 2008).

In a study by Waycott et al. (2010), teachers expressed that the problems in using Web technologies in education were the increase in workload, dealing with technical issues that may take time out from lessons, losing face-to-face interactions and inappropriate use of the tools by students. Another study by Sharples, Graber, Harrison, and Logan (2009) also found that many teachers would like to have the opportunity to make use of Web 2.0 tools in their classrooms and felt that schools should allow access to several Web 2.0 applications to explore their educational value (Sharples et al., 2009). However, many teachers were concerned with online bullying and the ease of plagiarism. Teachers are not at all opposed to using Web 2.0 technologies, as they are also daily users of social technologies themselves, but often their concerns about bullying and plagiarism are reason enough to prevent them from integrating Web 2.0 tools into an educational context. Teachers are primarily afraid of the disturbance that Web 2.0 tools could possibly have in a teaching and learning environment, such as online bullying, in addition to the amount of answerability that may be required from them (Clark et al., 2009; Sharples et al., 2009). This indicates that apprehension may be the main reason why many teachers are often reluctant to integrate Web 2.0 tools into their teaching.

The literature on the integration of Web 2.0 tools in secondary education is scarce in current research and it is mostly the potentials of Web 2.0 tools in education that have been investigated (Albion, 2008). However, a few research studies and reports (Crook & Harrison 2008; Lee & Tsai 2010; Light & Polin, 2011; Pan & Franklin, 2011) indicate that though teachers have generally positive attitudes towards new technologies, their uptake of Web 2.0 tools in teaching may be limited by low self-efficacy, lack of experience with Internet and Web 2.0 tools, lack of technical and pedagogical knowledge of using Web 2.0, lack of importance placed on Web 2.0 in teaching, lack of professional development, the national curriculum not fostering collaborative learning, and infrastructural issues including insufficient bandwidth, not enough computer access and lack of technical support. This study is also attempting to explore the in-service teachers' perceptions of use Web 2.0 tools in teaching and learning.

2.6 Teacher intentions to use Web 2.0 tools in their professional practice

Knowing which factors best predict teachers' intentions to integrate technology could provide valuable information to professional preparation programs seeking to design learning experiences that help teachers implement technology in their professional practice (Lawless & Pellegrino, 2007). In a mixed-methods study Sadaf, Newby, Lafayette and Ertmer (2012) investigated the factors that influence pre-service teachers' intentions to use Web 2.0 technologies in their future classrooms during teacher education course and their ability to carry out their intentions into actual practice during their teaching experience. One hundred and eighty-nine pre-service teachers completed an online survey and 12 were purposefully selected to participate in a semi-structured interview. Findings revealed that these teachers' attitudes and their perceptions of the usefulness of Web 2.0 technologies were strong predictors of their intention to use Web 2.0 tools during their teacher education course. One year later, those teachers who participated in that study indicated that they were able to transfer their intentions during their teaching practice and that their perceived usefulness of Web 2.0 technologies, technology support, self-efficacy and knowledge of various Web 2.0 tools influenced their use of Web 2.0 during their teaching practice. These results imply that given the presence of appropriate facilitating conditions, teachers can transfer their intentions to use Web 2.0 technologies into actions to help student learning in their classrooms.

In other studies, with pre-service teachers, Anderson, Groulx and Maninger (2012), Niederhauser and Perkmen (2008) and Teo (2009) have also found self-efficacy to significantly predict teachers' intentions to integrate technology into their professional practice. Teo (2009) also hinted that the perceived usefulness of the technology influenced teachers' receptiveness to the idea of using technology in instruction, and computer self-efficacy was indirectly affected by perceptions of the ease and the degree of difficulty of using the technology in teaching environment. These findings are in line with research conducted with practising teachers that has yielded similar findings. Crook et al. (2008) found that openness to the idea of using Web 2.0 tools were influenced by convictions about students' learning processes, as well as by their ideas about the utility of different technologies. In a study of 599 teachers, Pan and Franklin (2011) found that professional

development and school administrative support significantly predict the use of Web 2.0 tools in secondary school classrooms. Similarly, in a mixed-methods approach with secondary in-service teachers, Banas and York (2014) found a positive correlation between self-efficacy and technology adoption. This study also investigated in-service teachers' intentions to use Web 2.0 tools in teaching and learning.

2.7 Conceptual framework

A conceptual framework provides a "map" (Miles & Huberman, 1994) for investigating what is known about topics related to those examined in this study. This study acknowledges that there are several factors that are essential for the understanding of teachers' perceptions of Web 2.0 tools and the factors predicting their intention to use these tools in their professional practice. These require a conceptual framework. These factors take the shape of a system of interrelated elements organised as an interconnected whole. Deepening this concept, this research has used a combination of two frameworks as a conceptual framework. Many researchers adopt a single theoretical lens or framework to structure their investigation. The researcher is conscious that his study which has combined two separate theoretical perspectives which may be perceived, by some, as a shortcoming in the research design. In justification of this decision the researcher would argue that the use of two theoretical perspectives strengthens the research design by taking on board multiple viewpoints for diverse purposes within the study. The conceptual framework for this study draws on findings from relevant prior research and is based on two theoretical models, the UTAUT model (Venkatesh et al., 2003) and the TPACK model (Koehler & Mishra, 2009). This framework has been used to explain teachers' perceptions of Web 2.0 tools and their intention to use Web 2.0 tools use in their professional practice and is discussed in section 2.7.4.

2.7.1 Technology acceptance models

Researchers use a variety of technology acceptance models to study why and how individuals adopt new technologies (Venkatesh et al., 2003). These models seek to predict and explain how and why individuals adopt and use new technologies and examine what hinders use and intention to use the technology. Technology acceptance models focus on

an individual's intention to use a new technology as the predictor of use and technology adoption (Davis, 1989; Davis et al., 1989). Research in IT acceptance has yielded many competing models, each with different sets of acceptance determinants. Some of these models have similar constructs and determinants but use different terminology. Some are limited in scope and others are quite comprehensive. For example, the theory of planned behaviour focuses heavily on behavioural aspects. However, it is limited in that it deals with perceptions of control rather than with actual control issues. Researchers are confronted with a choice of models and generally choose constructs from one or two models and ignore contributions from alternative models (Venkatesh et al., 2003). To eliminate this confusion among researchers who intend to study users' intentions and behaviour towards new technologies, it is useful to use a theory that can integrate the available models into one unified model. In response to this need, Venkatesh et al. (2003) reviewed user acceptance literature and discussed eight prominent models, empirically compared the eight models and their extensions, formulated a unified model that integrated elements across the eight models, and empirically validated the unified model called the UTAUT. The eight models reviewed are the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975), technology acceptance model (Davis et al., 1989), theory of planned behaviour (Ajzen, 1991), the combination of technology acceptance model and theory of planned behaviour (C-TAM theory of planned behaviour) (Taylor & Todd, 1995), model of PC utilisation (Thompson, Higgins, & Howell, 1991), diffusion of innovation theory (DOI) (Moore &Benbasat 1991), social cognitive theory (SCT) (Compeau & Higgins, 1995), and the motivational model (Davis et al., 1992).

2.7.1.1 Theory of reasoned action

Derived from the social psychology setting, the TRA is one of the most fundamental and influential theories of human behaviour (Venkatesh et al., 2003). TRA was first proposed by Fishbein and Ajzen (1975). Three constructs make up the TRA, namely, behavioural intention (BI), attitude (A) and subjective norms (SN). TRA suggests that a person's behavioural intention depends on the person's attitude about the behaviour and subjective norms (BI = A +SN). Attitude towards the behaviour is defined as the individual's positive or negative feelings about performing the behaviour (Fishbein and Ajzen 1975, p. 216).

The next main construct in TRA, subjective norm, is defined as "the person's perception that most people who are important to him or her think he should or should not perform the behaviour in question" (Fishbein and Ajzen 1975, p. 302). In other words, TRA suggests that a person's voluntary behaviour is predicted by his or her attitude towards that behaviour and how he or she thinks other people would view them if he or she performed the behaviour, that is, users consider other people's views before they decide. In the UTAUT model, the construct social influence captures the concept of the subjective norm construct embodied in TRA

2.7.1.2 Technology acceptance model

As the TRA (Fishbein & Ajzen, 1975) did not cater for any technological innovation in its application, Davis' technology acceptance model (1989) provided more insight into technology use. He proposed that perceived usefulness and perceived ease of use were fundamental factors influencing the user's acceptance as they influence the user's attitude towards a technology or system. He defined perceived usefulness as "the degree to which a person believes that using a particular technology or system would enhance his or her job performance" and perceived ease of use as "the degree to which a person believes that using a particular technology or system would be free from effort" (Davis, 1989, p. 4).

Venkatesh and Davis (2000) extended the original technology model to explain perceived usefulness and usage intentions in terms of the social influence process and the cognitive instrumental processes. The extended model was referred to as TAM2 (Venkatesh & Davis, 2000). In TAM2, the social influence process highlights the impact of three interrelated social forces impinging on an individual facing the opportunity to adopt or reject a new technology or system. These include the subjective norm, voluntariness and image factor for user acceptance. The TAM2 highlights the individual's job relevance and output quality and have results demonstrability and perceived ease of use as other fundamental determinants of user acceptance. About 40% variance in intention to use and usage of technology by individuals in organisational settings being explained consistently is the key strength of the technology acceptance model (Mac Callum, Jeffrey & Kinshuk, 2014). The technology acceptance model has been used in various educational contexts, like

technology adoption by student teachers, carrying out a laptop use program and learning online (Straub, 2009). In the UTAUT model, performance expectancy, effort expectancy and social influence take the concepts of the perceived usefulness, perceived ease of use and subjective norm constructs from the technology acceptance model and TAM2.

2.7.1.3 Theory of planned behaviour

The theory of planned behaviour is an extension of the TRA developed by Ajzen (1991). In addition to constructs of attitude towards both behaviour and the subject norm found in the TRA, the construct of perceived behavioural control is included in the theory of planned behaviour. Perceived behavioural control is the expected difficulty of using the technology (Ajzen, 1991) and the perception of both internal and external constraints when using technology (Taylor & Todd, 1995). In the UTAUT model, social influence and facilitating conditions capture the concepts of the subjective norm and perceived behavioural control constructs represented in theory of planned behaviour.

2.7.1.4 Combined technology acceptance model and theory of planned behaviour

Taylor and Todd (1995) developed a hybrid model by combining the predictors of theory of planned behaviour with the constructs from technology acceptance model. This model combines the perceived usefulness predictor of the technology acceptance model and attitude towards behaviour, subjective norms and perceived behavioural control, all from the theory of planned behaviour, to form the four factors that predict intentions to use (Taylor and Todd 1995). In the UTAUT model, performance expectancy and social influence capture the concepts of the perceived usefulness and subjective norm constructs embodied in C-TAM theory of planned behaviour.

2.7.1.5 Social cognitive theory

Bandura (1977) developed SCT. Compeau and Higgins (1999) developed and modified it for technology use. According to this theory, the main constructs that predict computer use and the use of IT in general are performance outcomes, expectations (job-related performance), personal outcomes, like self-esteem and achievement, self-efficacy (a person’s concept of their own ability), affect (positive attitude to using technology), and

anxiety in using technology. In the UTAUT model, performance expectancy takes the concept of the outcome expectations construct represented in SCT.

2.7.1.6 Motivational model

The motivational model consists of extrinsic motivation and intrinsic motivation considered as explaining and predicting technology use (Davis et al., 1992). Venkatesh et al. (2003) found that extrinsic motivation refers to the degree to which a person perceives that using a particular tchnology will enable him or her to achieve better results, whereas intrinsic motivation means that the person enjoys executing a behaviour because he or she does not have other motivation other than executing the activity him- or herself (for example a user will use a system if he or she perceives that using that system will be enjoyable). In the UTAUT model, performance expectancy captures the concept of the extrinsic motivation construct found in the motivational model (MM).

2.7.1.7 Innovation diffusion theory

The innovation diffusion theory (IDT), has been used to investigate many different innovations in a wide range of organisations (Rogers, 2003) and adapted to investigate individual technology acceptance (Moore & Benbasat, 1991). The constructs of this theory are the relative benefit (of the innovation over traditional practice), ease of use, image (perception of value of the innovation), visibility (commonness of use by peers), compatibility (consistency with values and experiences), results of innovation, and willingness to use (Moore & Benbasat, 1991). In the UTAUT model, performance expectancy, effort expectancy, social influence and facilitating conditions capture the concepts of the relative advantage, ease of use, image and compatibility constructs found in IDT.

2.7.1.8 Model of PC utilisation

Thompson, Higgins, and Howell (1991) developed the model of PC utilisation (MPCU) that has been used to predict PC acceptance and use. The MPCU embraces these six constructs: job fit, complexity, long-term consequences, affect towards use, social factors, and facilitating conditions (Thompson et al., 1991). In the UTAUT model, performance

expectancy, effort expectancy, social influence and facilitating conditions capture the concepts of the job fit, complexity, social factors and facilitating conditions constructs embodied in MPCU.

2.7.2 The unified theory of acceptance and use of technology

The UTAUT theory sums up all the constructs from the eight models to four determinants which predict intentions and usage and four moderators of the key relationships (Venkatesh et al., 2003), and seeks to explain intentions to use an information system and subsequent usage behaviour. Table 2.1 shows the constructs from the eight different models that contributed to the UTAUT model.

According to this theory the key constructs are performance expectancy, effort expectancy, social influence and facilitating conditions. These are direct determinants of information system usage intention and usage behaviour (Venkatesh et al., 2003). Venkatesh et al. (2003) suggested that gender, age, experience and voluntariness of use affect the impact of the four key constructs on behaviour and intention to use. Table 2.1 and Figure 2.1 illustrate the relationships that exist in the UTAUT theory.

Table 2.1: UTAUT constructs and combination from other models

UTAUT	Construct	Model
Performance Expectancy	Perceived usefulness	TAM and CTAM-theory of planned behaviour
	Relative advantage	DOI
	Extrinsic motivation	MM
	Job fit	MPCU
	Outcomes expectations	SCT
Effort Expectancy	Perceived ease of use	technology acceptance model and TAM2

UTAUT	Construct	Model
	Complexity	MPCU
	Ease of use	technology acceptance model and DOI
	Subjective norms	TAM2, TRA, TPBtheory of planned behaviour and C TAM-TPB theory of planned behaviour
Social Influence	Social factors	MPCU
	Image	DOI
	Perceived behaviour control	TPBtheory of planned behaviour
	Facilitating conditions Perceived behaviour control	MPCU TPB
Facilitating conditions	Compatibility facilitating conditions	DOI MPCU
	Compatibility	DOI

2.7.2.1 Performance expectancy

Performance expectancy is defined as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance” (Venkatesh et al., 2003, p. 447). Performance expectancy has been used in other models, but with different terminology, such as “perceived usefulness” in technology acceptance model and C-TAM theory of planned behaviour, “extrinsic motivation” in MM, “job fit” in MPCU, “relative advantage” in DOI and “outcome expectations” in SCT.

According to the UTAUT model, it is expected that individuals will become interested in using a particular technology if they think that it will enable them to improve their study or job performance. This means that an individuals’ interest in the new technology depends

on whether it enhances the efficiency or quality of an individual's job. The relationship between performance expectancy and behavioural intention is affected by age and gender

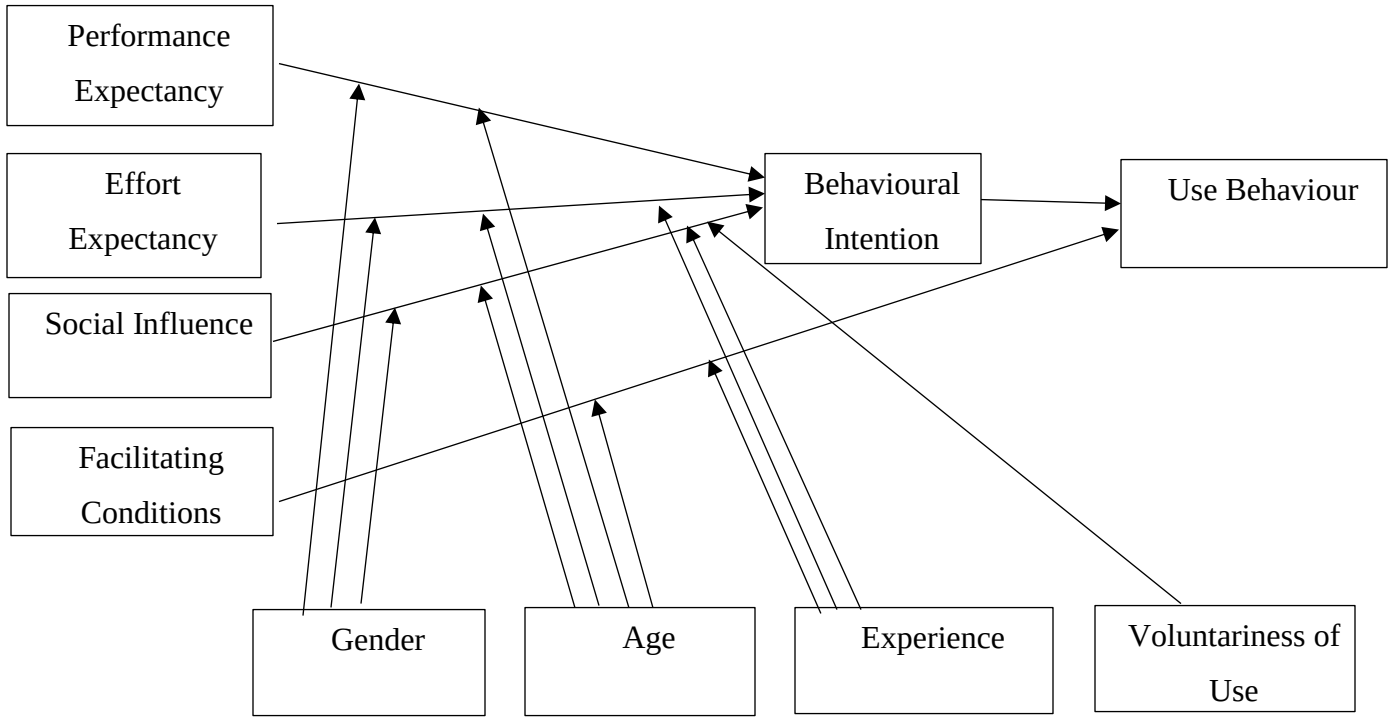

Figure 2.1: Unified theory of acceptance and use of technology.

meaning that performance expectancy directly affects technology usage. It has been found to be stronger for males and younger workers than for other genders and ages (Venkatesh et al., 2003).

Performance expectancy has been found to be the strongest predictor of intention in both voluntary and mandatory settings (Venkatesh et al., 2003). In previous acceptance studies, the performance expectancy construct is also consistently a strong predictor of intention (Davis, Bagozzi & Warshaw, 1992; Venkatesh et al., 2003). In the educational context, performance expectancy is important to technology acceptance decision making and may

influence behavioural intention both directly and indirectly through the determinant of attitude (Birch & Irvin, 2009; Hu, Teo, 2009). Lai and Chen (2011) found that the perceived usefulness of using blogs had an influence on teacher adoption of blogs. Teo (2009) found similar results when examining technology attitudes of 475 pre-service teachers in Singapore, that is, perceived usefulness had a direct effect on behavioural intention to use technology. Oye, Noorminshah and Rahim (2011) found that among the four UTAUT constructs, performance expectancy is the most influential factor in the acceptance and use of ICT among teachers.

In this study, performance expectancy relates to how well teachers believe that Web 2.0 tools will help them in their professional practice. Performance expectancy has therefore been assessed to determine whether it is a predictor for teachers' intention to use Web 2.0 tools in teaching and learning. In a study on pre-service teachers' intention to use Web 2.0 tools in their professional practice, Chiou (2011) found that perceived usefulness was a significant predictor of intention to use Web 2.0 in future teaching approaches, but perceived ease of use did not contribute significantly as a predictor of intention to use in future. However, this view is only partly supported by Sadaf et al. (2012), who argue that both perceived usefulness and ease of use are among the most significant predictors of intentions by pre-service teachers to use Web 2.0 technologies in the future. Findings from this present study on how far perceived usefulness and perceived ease of use are significant predictors of in-service teachers' intention to use Web 2.0 in their future teaching approaches are found in Chapter Six.

2.7.2.2 Effort expectancy

Effort expectancy is defined as the degree of ease associated with the use of an innovation (Venkatesh et al., 2003). Few models have used this construct, with different terms such as "perceived ease of use" in technology acceptance model, "complexity" in MPCU and "ease of use" in DOI. According to the UTAUT model people are likely to show interest in technology usage if that technology is easy to use. This means that less complex technologies can more easily evoke usage intention in many users than complex technologies. In several studies (Dijk, Peters & Ebbers, Im, Hong, & Kang, 2011; Kang,

2014; Moya, Nakalema, & Nansamba, 2018), effort expectancy has been found to affect behavioural intention positively, indicating that lesser the efforts to understand a technology, the greater is the intention to adopt the technology. The effort expectancy construct is important in both voluntary and compulsory use situations during the early stages of technology adoption and becomes less significant, or insignificant over periods of extended and continued usage (Venkatesh et al., 2003; Birth & Irvine, 2009).

In this study, effort expectancy refers to the extent to which teachers consider the use of Web 2.0 tools to be easy and intuitive (Venkatesh, Thong, & Xu, 2012). In a study conducted by An and Williams (2010), the participants reported that Web 2.0 tools were easy to use and provided a more flexible learning environment by removing time barriers constrained to classroom walls. Self-efficacy beliefs as depicted by the item such as "I possess the necessary skills to use Web 2.0 tools" also forms part of the effort expectancy construct. Previous studies have also shown self-efficacy to positively influence teachers' views of and intentions to use and integrate technology in education (Anderson &Maninger, 2007; Giallamas & Nikolopoulou, 2010). For Ertmer and Ottenbreit-Leftwich (2010), self-efficacy may be more important than skills and knowledge among teachers who implement technology in their classrooms. Although pre-service teachers expressed high self-efficacy in using Web 2.0 applications, their self-efficacy related to integrating Web 2.0 applications in lessons within classrooms is low (Sadaf et al., 2012). This may be due to their lack of actual classroom experience. However, Pan and Franklin (2011), in a study involving 599 in-service teachers, found that self-efficacy was a significant predictor of teachers' use of Web 2.0 technology in their classrooms.

2.7.2.3 Social influence

Social influence is defined as the degree to which an individual perceives that important persons believe he or she should use the new technology (Venkatesh et al., 2003). According to UTAUT individuals will be able to show interest in technology use if their contemporaries or superiors value and encourage the use of such technologies. Thus, an individual's intention to use a new technology is expected to be high if such an individual expects approval from their peers or superiors if they use that technology. This determinant

is also represented in other models with different terms, such as “subjective norm” in TRA, theory of planned behaviour and C-TAM theory of planned behaviour, “social factors” in MPCU and “image” in DOI. In the UTAUT this determinant has been found to have a direct effect on individuals’ intentions in mandatory contexts. In contrast, it has been found to have no effect on users’ intentions in voluntary contexts (Venkatesh et al., 2003). However, social Influence in mandatory settings appears to be significant only in the early stages of the individual’s experience with the technology. In this study, social influence means how teachers are affected by their peers or head of department or head of school in deciding on the use of Web 2.0 tools in teaching and learning.

2.7.2.4 Facilitating conditions

Facilitating conditions refer to the degree to which an individual considers that an organisational and technical infrastructure exists to facilitate the use of the technology (Venkatesh et al., 2003). This determinant is represented in other models, sometimes with different terms, such “perceived behavioural control” in the theory of planned behaviour and C-TAM theory of planned behaviour, “facilitating conditions” in MPCU and “compatibility” in DOI. In the UTAUT the facilitating conditions determinant was found to be non-significant in predicting intention but had a direct influence on users’ usage behaviour, especially with increasing experience as they find several opportunities for help and support throughout the organisation. (Venkatesh et al. 2003). The influence of facilitating conditions on use of technology are mediated by age and experience such that its effect is greater for older people and those with more experience. In other words, it is likely that older people would show less interest in adopting the technology than would be the case with younger people. The effect of facilitating conditions on technology usage is also expected to grow with experience “as users of technology find multiple avenues for help and support throughout the organisation, thereby removing impediments to sustained usage” (Venkatesh et al., 2003, p. 453).

Facilitating conditions (Teo, 2009) have been found to influence acceptance indirectly through perceived ease of use and/or perceived usefulness of the use of the system (Venkatesh et al., 2003). Furthermore, it was found that facilitating conditions significantly

related to the actual use of Internet-based teaching (Limayem& Hirt, 2000). In a study involving 559 in-service teachers, Pan and Franklin (2011) found that school administrative support was a predictor for integration of Web 2.0 tools in instructional settings. “Facilitating conditions” is defined and used in this research as teachers’ beliefs that the school has organisational support and technical infrastructure to assist the implementation of Web 2.0 tools in teaching and learning.

Within the context of this study, facilitating conditions also include factors in implementation settings such as support from management, adequate infrastructure, training and technological support, all aimed at eliminating barriers to Web 2.0 tools usage (Venkatesh et al., 2003). Venkatesh et al. (2003) found that intention to use and facilitating conditions were direct determining factors of actual usage.

The eight theories individually explained 17% to 53% of the variation in use of various technologies (Venkatesh et al., 2003). This research is most interested in the UTAUT theory since it has been proven to be more accurate than the other models, with the ability to predict technology acceptance 70% of the time (adjusted R^2 = 70%). This predictability is much better than any of the eight models alone (Venkatesh et al., 2003).

While the UTAUT provides a sound theoretical basis for explaining how people adopt and use technology, few studies have applied it to an education environment. To provide a more education-specific model, it is imperative to understand how the four main constructs of the model relate to prior literature on teacher barriers to technology integration. Ertmer (2005) described two types of barriers at the teacher level that prevent the successful integration of technology into the classroom. On the one hand, first-order extrinsic barriers prevent teachers from integrating technology into their classrooms because they lack time, training, professional development, access to enough hardware and software, and support (Ertmer, 2005). These extrinsic limitations relate to the UTAUT construct of facilitating conditions (Venkatesh et al., 2003). On the other hand, second-order personal limitations, including teaching beliefs, perceived value of technology for education, and comfort with technology also affect whether teachers embrace technology in their classrooms (Ertmer, 2005). These personal limitations correspond to the remaining three UTAUT constructs,

namely performance expectancy, effort expectancy and social norms (Venkatesh et al., 2003). UTAUT has enhanced technology acceptance research by unifying the theoretical perspectives common in literature and including four moderators to account for dynamic influences, namely gender, age, voluntariness, and experience (Venkatesh et al., 2003). It seems reasonable to assume that UTAUT could be used to investigate predictors of teachers' intention to use Web 2.0 tools in teaching and learning.

2.7.3 Technological pedagogical and content knowledge

Numerous past studies in respect of the use of innovative practices such as ICT in pedagogy have focused on frameworks or models (described in the previous section). While all those frameworks put forward factors that may be significant for the adoption of innovative practices, none of them presents knowledge as an important factor. To address this shortcoming, Mishra and Koehler (2009) offered a model to describe the nature of knowledge crucial for teachers to effectively adopt ICT in their professional practice.

The TPACK framework is derived from Lee Shulman's (1986) descriptions of Pedagogical content knowledge (PCK). Shulman claimed that content knowledge (what to teach) and pedagogical knowledge or (how to teach) are interconnected, and together form the PCK Mishra and Koehler (2006) added technological knowledge to Shulman's framework and argued that technology knowledge had to be considered as a separate knowledge domain, given that teaching with digital technologies requires more complex knowledge than teaching with the traditional technologies available in Shulman's time. Thus, their framework has as its base three knowledge domains, content knowledge, pedagogical knowledge and technology knowledge, which, they contend, interact and interconnect, thus forming three additional knowledge domains, PCK, technological content knowledge, and technological pedagogical knowledge, and one triad, TPACK (TPACK).

TPACK was introduced in 2005 by Koehler and Mishra as a theoretical framework to depict teachers' body of knowledge to successfully implement technology in their teaching (Koehler & Mishra, 2009). The TPACK framework proposes that teachers need to be empowered with technological pedagogical and content knowledge rather than simply technology knowledge (Mishra & Koehler, 2006) and that for teachers to effectively

implement ICT in their teaching, they must understand how technology, pedagogy and content can interrelate with one another to effectively integrate technology in the teaching of their subject area content. (Shin et al., 2009).

Koehler and Mishra (2009) define TPACK as the connections and interactions between content knowledge (what to teach), pedagogical knowledge (how to teach), technological knowledge (how to use technology), and the transformation that takes place when combining these domains. According to Koehler and Mishra (2009):

> Good teaching is not simply adding technology to the existing teaching and content domain. Rather, the introduction of technology causes the representation of new concepts and requires developing a sensitivity to the dynamic, transactional relationship between all three components suggested by the TPACK framework. (p. 134)

There are seven constructs in the TPACK framework Mishra & Koehler (2006). These are summarised in Figure 2.2.

Table 2.2: TPACK constructs

The Constructs	Abbreviation	Definitions
Content Knowledge	CK	Knowledge of subject matter
Technology knowledge	TK	Knowledge of various technologies
Pedagogical knowledge	PK	Knowledge of the processes or methods of teaching
Technological content knowledge	TCK	Knowledge of subject matter representation with technology
Technological pedagogical knowledge	TPK	Knowledge of using technology to implement different teaching methods
Pedagogical content knowledge	PCK	Knowledge of teaching methods for different types of subject matter

The Constructs	Abbreviation	Definitions
Technological pedagogical and content knowledge	TPACK	Knowledge of using technology to implement teaching methods for different types of subject matter

This framework suggests that intractions exist among the three main constructs of knowledge (technology, pedagogy and content) (Koehler & Mishra, 2008; Mishra & Koehler, 2006). The following sub-sections describe these three domains of knowledge in more detail.

2.7.3.1 Content knowledge

Content knowledge (CK) is knowledge about the subject matter to be learnt or taught (Koehler & Mishra, 2009). This type of knowledge mostly refers to the facts, concepts, theories, and principles that are taught and learned within a specific subject area. Teachers must possess a broad base of content knowledge within their subject area; otherwise, students "could receive incorrect information and develop misconceptions about the content area" (Koehler & Mishra, 2009, p. 63).

2.7.3.2 Pedagogical knowledge

Pedagogical knowledge (PK) is teachers' deep knowledge about the processes or methods of teaching and learning, the comprehension of how students learn, overall classroom management skills, lesson planning, and student assessment (Koehler & Mishra, 2009). "A teacher with deep pedagogical knowledge understands how students construct knowledge and acquire skills and how they develop habits of mind and positive dispositions toward learning" (Koehler & Mishra, 2009, p. 63).

2.7.3.3 Technological knowledge

Technological knowledge (TK) is as a developed technology literacy where an individual can "understand information technology broadly enough to apply it productively at work and in their everyday lives, to recognize when information technology can assist or impede

the achievement of a goal, and to continually adapt to changes in information technology" (Koehler & Mishra, 2009, p. 64). For the present study technological knowledge is defined as knowledge of how to use Web 2.0 tools.

2.7.3.4 Pedadogogical content knowledge

Pedagogical content knowledge (PCK) comes at the intersection of content knowledge and pedagogical knowledge. "PCK covers the core business of teaching, learning, curriculum, assessment and reporting, such as the conditions that promote learning and the links among curriculum, assessment, and pedagogy" (Koehler & Mishra, 2009, p. 64). In other words, PCK is the knowledge of how to ease the learning of specific content (Koehler & Mishra, 2009; Mishra & Koehler, 2006). The concept of PCK is similar to Shulman's idea of knowledge about how to merge pedagogy and content effectively (Shulman, 1987). Shulman defined PCK as "that amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (p. 8). He also highlighted teachers' representation of content knowledge in teaching as follows: "It represents the blending of content and pedagogy into an understanding of how particular topics, problems or issues are organised, represented, and adapted to the diverse interests and abilities of learners and presented for instruction" (p. 8). According to Shin et al. (2009), "PCK is knowledge about what teaching approaches fit the content and how elements of the content can be arranged for better teaching" (p. 2).)

2.7.3.5 Technological content knowledge

Technological content knowledge (TCK) is the area of knowledge that develops at the intersection of technology knowledge and content knowledge. TCK is knowledge of technologies that can be used to deliver and learn specific subject area content. It is essential for teachers to grasp the "manner in which the subject matter can be changed by the application of technology" (Koehler & Mishra, 2009, p. 65). For the present study, TCK describes teachers' knowledge of how specific units of subject area content under study are transformed by the use of certain Web 2.0 tools (for example, how Web 2.0 brings new ways about content representation, content creation and sharing among students and

teachers through the various tools, like educational blogs, educational Wikis, collaborative concept mapping and others).

2.7.3.6 Technological pedagogical knowledge

Technological pedagogical knowledge (TPK) is at the intersection of technology knowledge and pedagogical knowledge. According to Koehler and Mishra (2009), TPK is "an understanding of how teaching and learning can change when particular technologies are used in particular ways" (p. 65). Based on her study, Cox (2008) defines TPK as "a knowledge of the technologies that may be used in a generic pedagogical context, including the affordances and constraints of those technologies, and how those technologies influence or are influenced by the teacher's pedagogical strategies and student learning" (p. 76). It appears that TPK is the consideration of how the usage of technology can assist overall teaching strategies. Since most of the popular emerging technologies are not initially developed for educational purposes, teachers need to have TPK that allows them to customise these technologies for specific pedagogical applications (Manca, S, & Ranieri, M, 2016). Teachers need to "look beyond the immediate technology and 'reconfigure' it for their own pedagogical purposes" (Koehler & Mishra, 2009, p. 17). In this study, TPK comprises the knowledge of the pedagogical affordances of Web 2.0 tools and the knowledge of how Web 2.0 tools can assist some particular pedagogical strategies in the classroom (such as encouraging inquiry learning and sustaining collaborative learning).

2.7.3.7 Technological pedagogical content knowledge

As all the above components of knowledge interrelate, this leads to the perception of teaching subject area content with suitable pedagogical methods and technologies. The intersection of all the components is the basis of the model which is the technological pedagogical and content knowledge (TPACK) component. Koehler and Mishra (2009) affirmed that the TPACK component is different from the three components (content knowledge, pedagogical knowledge and technology knowledge) separately, rather the interaction and intersection of all of these components. Consequently, TPACK is referred to as:

> the basis of effective teaching with technology, requiring 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 to develop new epistemologies or strengthen old ones (Koehler & Mishra, 2009, p. 66).

TPACK is the knowledge of the dynamic, transactional negotiation among technology, pedagogy and content and how that negotiation impacts student learning in a classroom context (Cox & Graham, 2009). TPACK's essential features are the use of appropriate technology (a) in a content area; (b) as part of a pedagogical strategy; (c) within a given educational context; and (d) to develop students' knowledge of a particular topic or meet an educational objective or student need (Cox & Graham, 2009). The TPACK framework provides an approach to examining the technological, pedagogical, content knowledge needed to understand and develop practices that address the learning of content using technology (Baran, Chuan, & Thompson, 2011). According to Koehler and Mishra (2009), context, being "the conditions around the knowledge and activities of teachers" (Rosenberg, & Koehler, 2015 p. 1) is an important component that must be considered in order to successfully implement technology into teaching practices. Consequently, Koehler and Mishra (2009) included context in the model as a crucial part of the TPACK theoretical framework (see Figure 2.2).

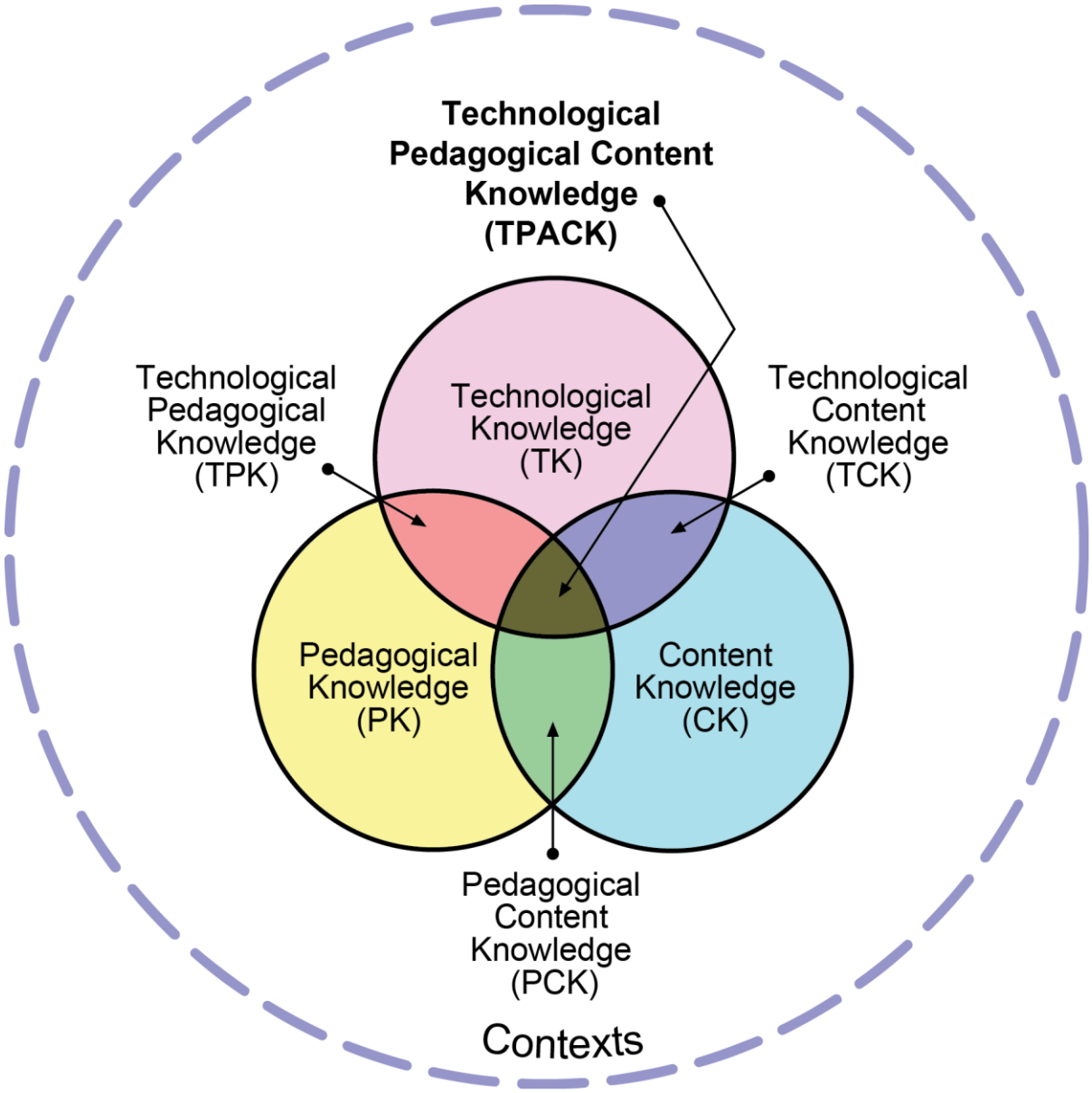

Figure 2.2: TPACK framework

The TPACK framework has provided a valuable tool, both for designing teacher education experiences and for assessing teacher knowledge in technology integration in both in-service and pre-service teachers (Baran et al., 2011). Research in educational technology suggests the need for TPACK to incorporate technology in pedagogy (Koehler & Mishra, 2009) and the interconnectedness among content, pedagogy and technology has important effects on learning as well as on professional development. In a systematic literature review about TPACK of 55 peer-reviewed journal articles published between

2005 and 2011 Voogt, Fisser, Pareja Roblin, Tondeur & van Braak (2013). revealed that teachers' knowledge and beliefs about pedagogy and technology are intertwined and that active involvement in design and implementation of technology-enhanced lessons was found as a promising strategy for the development of TPACK in teachers.

Several studies have used the PCK, technology pedagogy knowledge, technological content knowledge and TPACK constructs from the TPACK model to measure teachers' perceptions of preparedness to teach with technology (Archambault, 2011; Chai, Koh, & Tsai, 2011; Koh, Chai, & Tsai, 2010; Lee & Tsai 2010; Schmidt et al., 2009) and teacher attitudes towards use of technology in teaching (Avidov-Ungar & Eshet-Alkalai , 2011). The TPACK framework which has been used to frame other constructs believed to influence technology integration, such as self-efficacy and confidence beliefs (Graham, 2011). It has also been used as a lens for understanding how teacher candidates make decisions about the use of information and communication technology in their teaching (Graham, Borup & Smith, 2012).

Most of the accessible research studies on TPACK were conducted with pre-service teachers (Abbitt, 2011; Chai et al., 2010; Graham et al., 2012; Schmidt, et al., 2009). In the prediction of educational use of the Internet by pre-service teachers, Sahin, Celik, Oguz Akturk and Aydin (2013) found that these teachers' technology knowledge, content knowledge and technological content knowledge were statistically significant factors. They also indicated that teachers who understand TPACK will have better integration habits in using the Internet (Sahin et al., 2013). However, Koh and Divaharan (2013), in a study on TPACK conceptions, found that in-service teachers' technological content knowledge to be slightly more influential than technological pedagogical knowledge, arguing that this may be since teachers are more experienced with school-based curriculum demands (Koh, Chai & Tsai, 2012). Also, as expected, in-service and pre-service teachers are different with regard to the process and the content of their instructional decisions (Chai, Koh, & Tsai, 2013). Given experienced teachers' greater familiarity with teaching and curriculum, the nature and development of their technological pedagogical, technological content and technological pedagogical content knowledge are distinct from those of pre-service teachers in many ways (Harris & Hoffer, 2011).

Although many studies have been conducted with TPACK as the framework (Voogt et al., 2013), Graham (2011) carried out a critical analysis of the theoretical foundations of the framework. He stated that TPACK looks clear and simple on the outside but also holds a deep level of intricacy. This has led some researchers to point at the the distinctiveness of the various constructs of the framework (Archambault & Barnett, 2010; Graham, 2011). Archambault and Barnett (2010) conducted a survey comprising 24 items based on the seven TPACK constructs with 596 practising teachers. They did an EFA which yielded only three factors. The non-technology constructs (content knowledge, pedagogical knowledge and PCK) loaded as one factor, while the technology-related constructs (technology pedagogy knowledge, technological content knowledge, and TPACK formed another factor and items from technology knowledge constituted the last factor. Similarly, an EFA performed by Koh et al. (2010) on a survey among 1,185 Singaporean pre-service teachers produced five factors categorised as technology knowledge, content knowledge, knowledge of teaching with technology (KTT), knowledge of pedagogy and knowledge from critical reflection. KTT comprised items from technological content knowledge, technology pedagogy knowledge and TPACK. Knowledge of pedagogy consisted of items from pedagogical knowledge and PCK. In a factor analysis of pre-service teachers' TPACK conceptions by Chai, Koh, Tsai and Tan (2011), technological content knowledge did not emerge as a factor. These studies indicated that items belonging to technology-related factors tended to group together while non-technology-related pedagogical items formed another group, showing that teachers were not quite able to distinguish among the seven constructs of TPACK.

Although the definition of some of the components of the TPACK framework seem to be unclear (Graham, 2011), TPACK has nevertheless been able to provide an explanation of the types of knowledge teachers and teacher educators need in order to successfully implement technology in their teaching and has progressed as the knowledge crucial for successful teaching with technology (Chai et al., 2013; Cox & Graham, 2009; Niess, 2012).

2.7.3.8 Studies involving TPACK and technology acceptance models

In a study involving 470 pre-service teachers, Liu (2010) combined the technology acceptance model with TPACK, and added two research variables, actual technology use and intention to use to develop a new model for investigating the knowledge of pre-service teachers and the predictive effects of TPACK on technology integration. The technology acceptance model's constructs perceived usefulness and perceived ease of use confirmed the predictive effect on actual technology use for pre-service teachers. The study also revealed that knowledge about technology (from TPACK) influenced actual technology use and that perceived TPACK also predicted pre-service teacher actual technology use and intention to use while teaching. In a mixed-method inquiry with university teachers at Hong Kong Polytechnic University, Cheung, Wan and Chan (2018) used a close-ended survey consisting of 30 items based on the TPACK framework and 20 items based on the UTAUT to investigate the efficient use of clickers. The participants in the survey agreed that the use of clickers was helpful in engaging students in learning and gauging formative students' progress. The present study also involved the use of TPACK and UTAUT and differed from the above studies since it focused more on predictors of teachers' intention to use Web 2.0 tools.

2.7.4 Combined model

In this study, the UTAUT and TPACK models were used because they evaluated different areas of interest: UTAUT constructs were specific to adoption and use of Web technology whereas the TPACK constructs were knowledge areas related to Web technology, pedagogy and content. All the constructs from the UTAUT model and TPACK model were deemed a good theoretical fit for investigating teachers' perceptions of Web 2.0 tools and their intention and formed the basis of the conceptual framework for this study. This framework is graphically depicted in Figure 2.3.

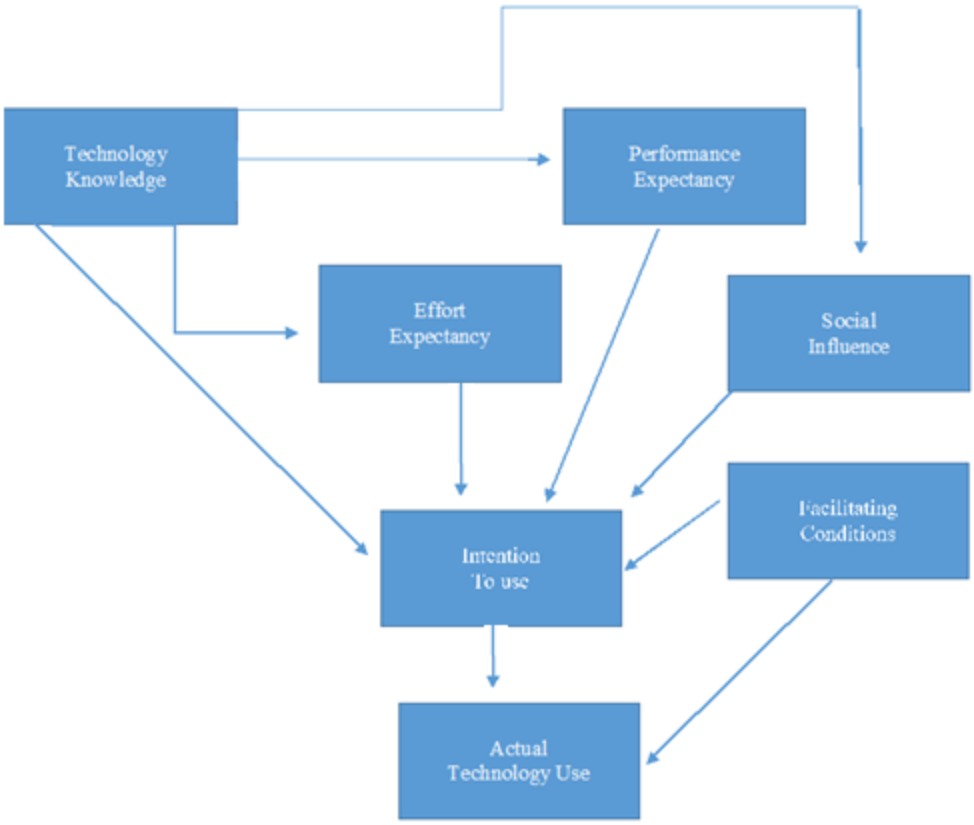

Figure 2.3: A framework for understanding teachers' intention to use Web 2.0 tools

The framework suggests the following:

- Knowledge of technology is relevant to performance expectancy, effort expectancy and social influence;
- Facilitating conditions influence intention to use, which subsequently influences actual technology use; and
- Knowledge of technology influences intention to use, which subsequently influences actual technology use.

2.8 Gaps in the current literature

Although the findings about teachers' perceptions (Baltaci-Goktalay & Ozdilek, 2010; Cheon et al., 2014, Coutinho, 2009; Crook & Harrison 2008; Lee & Tsai 2010; Light, 2011; Pan, 2011, Sadaf et al., 2012, Scott & Ryan, 2009) are valuable, the applicability of these

findings cannot be generalised because of the choice of their research participants. For instance, the participants in the research studies conducted by Crook and Harrison, and by Light were teachers who had already started implementing Web 2.0 technologies in their lessons, thus not necessarily identifying concerns that might impact those who have not yet begun integrating such tools in teaching. Thus, teachers' perceptions towards Web 2.0 tools in relation to teaching still need further investigation to better inform professional development efforts focusing on teachers' integration of Web 2.0 tools in their professional practice. A gap appears to exist in the research relating to in-service teachers' perceptions of adopting Web 2.0 tools in their teaching. This study attempts to look at this gap in the current literature by exploring the in-service teachers' perceptions of use of Web 2.0 tools in teaching and learning.

Studies on teachers' intention to use Web 2.0 tools in their professional practice have used constructs from either the UTAUT or TPACK model but not from both. The present study attempts to address the research gap to investigate if the various domains of the TPACK model will contribute to the determinants of the UTAUT model in determining teachers' intention to use Web 2.0 tools in their professional practice.

In most studies involving pre-service teachers (Anderson & Maninger, 2007, Chen, 2010, Groulx, & Maninger, 2011, Niederhauser & Perkmen, 2008, Sadaf et al., 2012, Teo, 2009) or in-service teachers (Crook et al., 2008, Pan & Franklin, 2011), the participants had either some training in the use of Web 2.0 tools or were implementing these tools in their professional practice. Investigation on teachers' intentions to use Web 2.0 tools in the classroom environment with teachers who have not yet started using these tools in their professional practice seems to be absent from current literature. This study attempts to fill this gap in literature by investigating the in-service teachers' intentions to use Web 2.0 tools in teaching and learning with participants who have not had any training on Web technologies.

2.9 Summary

This chapter has reviewed the literature related to this study. Studies on the use of technology by digital natives in their personal and student lives, and the potential of Web

2.0 technologies as pedagogical tools were discussed. Literature has shown that the aspects of active learning theory, social learning theory, constructivism and connectivism can be found in Web 2.0 tools due to their diverse participatory and collaborative nature. Several studies have revealed that the common barriers preventing the use of Web 2.0 technology applications were a lack of time to devote to new pedagogies or spend more time online with students, lack of clear ideas on how these applications could be effectively used to support their students' learning. Studies still yield mixed findings, citing teachers' positive attitudes towards the use of Web 2.0 technologies for educational purposes but also their concerns for the lack of experience with Internet and Web 2.0 tools, and lack of technical and pedagogical knowledge of using Web 2.0. Cyberbullying and plagiarism were also seen as reason enough to prevent them from integrating Web 2.0 tools into their educational contexts. Findings revealed that teachers' attitude and their perceived usefulness of Web 2.0 technologies were strong predictors of their intention to use Web 2.0 tools. Self-efficacy, professional development and school administration were also found to significantly predict the use of Web 2.0 tools. A gap appears to exist in the research relating to in-service teachers' perceptions of adopting Web 2.0 tools in their teaching and their intentions to use Web 2.0 tools in classroom environment with teachers who have not yet started using these tools in their professional practice. The next chapter discusses the research design and methodologies used in this study.

3 Research methodology

3.1 Introduction

This chapter outlines the research methodology adopted for the conduct of this study. Research is a process of steps used to gather and examine information to increase our understanding of a topic or issue (Creswell, 2013). For this research, the researcher chose a sequential mixed-method explanatory strategy to collect data, characterised by the collection and analysis of quantitative data followed by the collection and analysis of qualitative data (Creswell, 2013). The purpose of this strategy is to use the qualitative results to assist in the explanation and interpretation of the findings of the quantitative data (Creswell, 2013).

This chapter begins with brief description off the research paradigm, ontology and epistemology that are consistent with the research objectives, a discussion of research methods, and a justification for the chosen methodology. Next, details of the quantitative phase of the study are presented, describing how data was gathered and analysed. Then the qualitative phase of the study is presented, describing how data was gathered and analysed. The ethical concerns involved in this study are also addressed. Validity in mixed-methods research is also discussed.

Before the main study, a pilot study was conducted to examine the reliability of the research instrument. The results of the pilot study are presented in this chapter.

The different phases of the research have been summarised in Figure 3.1 below.

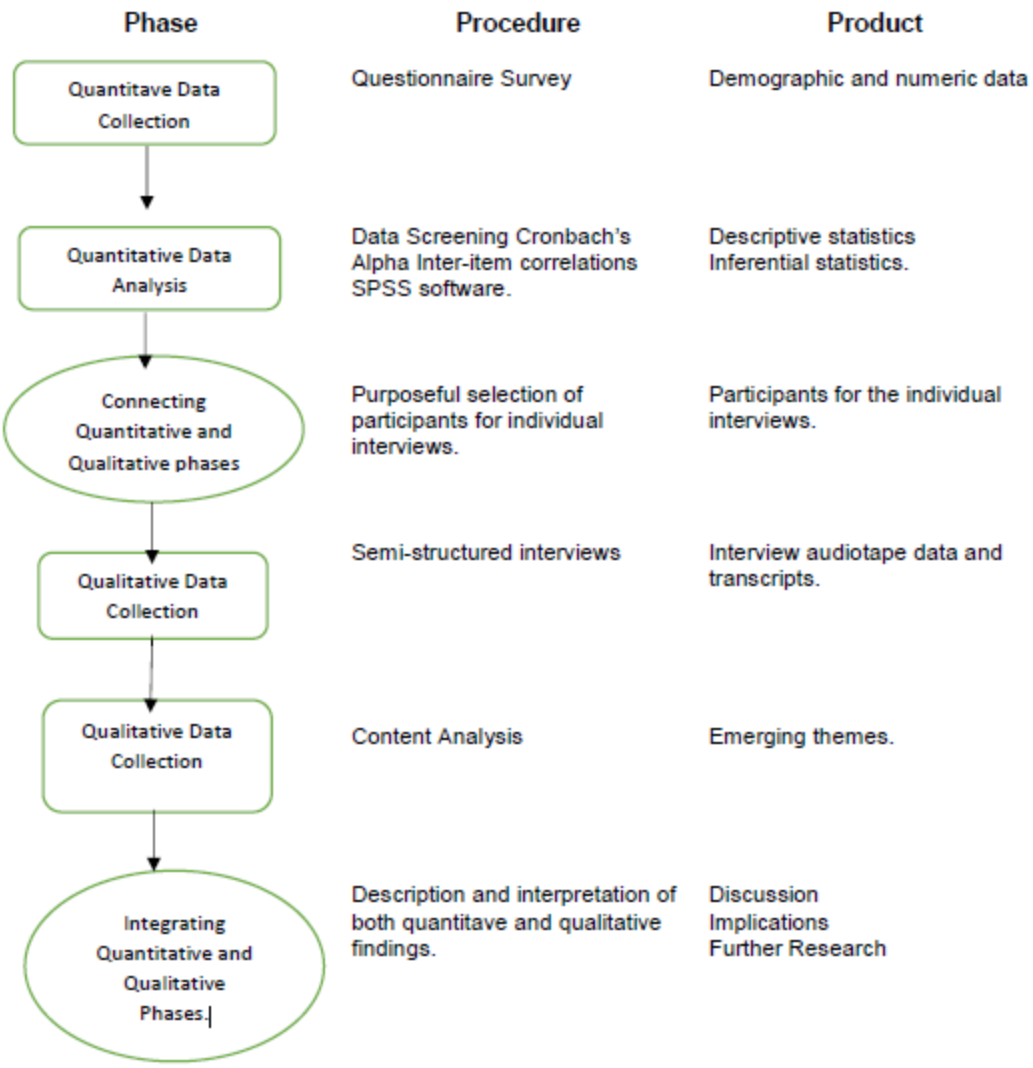

Figure 3.1: Phases of the research process

3.2 Research paradigm

This section looks at the research paradigm, the ontological and epistemological assumptions and perspectives that are consistent with the research strategy chosen to investigate and answer the research questions and the methodology used. A paradigm,

defined as the “basic belief system or worldview that guides the investigator” (Guba & Lincoln, 1994, p. 105) is often referred to as the beliefs of what knowledge is, what is knowable and how one can go about gaining knowledge. For Denzin and Lincoln (2005), paradigms are the researcher’s “net” that holds the ontological, epistemological and methodological beliefs. According to Mackenzie and Knipe (2006), the term paradigm is used to represent the philosophical intent or underlying theoretical framework and motivation of the researcher about the research and that positivism, interpretivism and pragmatism are well-known philosophical paradigms that regularly inform research. These paradigms outline the researcher’s epistemological and/or ontological beliefs and inform the method of data collection necessary for accomplishing the aims of the intended research (Mackenzie & Knipe, 2006).

Positivism is sometimes referred to as “scientific method” or 'science research', "reflects a deterministic philosophy in which causes probably determine effects or outcomes" (Creswell, 2003, p.7). Positivists believe that researchers can look for explanation of what has happened and expect what will happen in the social world by examining patterns and associations among the relevant variables (Ma, 2015). According to interpretivists social phenomena are multi-layered and deserve multiple interpretations (Ma, 2015). The interpretivist researcher tends to rely upon the “participants' views of the situation being studied” (Creswell, 2003, p.8) and recognises the impact on the research of their own background and experiences. Interpretivists do not generally begin with a theory (as with positivists) but they rather “generate or inductively develop a theory or pattern of meanings” (Creswell, 2003, p.9) throughout the research process. With regard to reality the positivist believes that a single reality exists that can be measured, whereas in the interpretivist paradigm, there are multiple realities that are continually changing, which makes it very difficult if not impossible to measure. Quantitative research aligns with the positivist paradigm, whereas the qualitative research aligns itself with the interpretivist paradigm. Quantitative research is a formal, objective, deductive approach to problem solving.

Pragmatism, which is most commonly associated with mixed-methods research, is more and more popular and is presently recognised as a third main research paradigm, beside quantitative and qualitative research paradigms (Creswell & Plano Clark, 2011). According

to Feilzer (2010, p. 8) “Pragmatism, when regarded as an alternative paradigm, accepts, philosophically, that there are singular and multiple realities that are open to empirical inquiry and orients itself towards solving practical problems in the ‘real world’”.

Pragmatism takes along differing opinions associated to epistemology and ontology (Creswell & Plano Clark, 2011) and presents a very rational method to research because it is problem centred and real-world oriented (Creswell & Plano Clark, 2011). Pragmatist researchers focus on the “what” and “how” of the research problem (Creswell, 2003, p.11). Pragmatism lays emphasis on the results of the research, and, instead of an emphasis on methods, pragmatists identify the most essential aspect of the research as the problem being studied and the queries probed about the problem (Creswell, 2003). Pragmatism, seen as the paradigm that provides the underlying philosophical framework for mixed-methods research, places “the research problem” as central, and applies all approaches to understanding the problem (Creswell, 2003, p.11). With the research question “central”, data collection and analysis methods are chosen as those most likely to provide insights into the question with no philosophical loyalty to any alternative paradigm, pragmatism not being committed to any one system of philosophy or reality (Mackenzie & Knipe, 2006). Instead of assuming a position of either inductive or deductive reasoning, pragmatic research makes use of abductive reasoning which involves moving back and forth between induction and deduction, between data and theory (Teddlie & Tashakkori, 2009). Thus, a central view of pragmatism is that research should be socially relevant, addressing specific concerns in the “real world” and seeking to propose possible solutions (Creswell, 2013; Feilzer, 2010). Such is the focus and overall purpose of this study.

The researcher has defined his research paradigm through an ontology which relates to his assumptions of the nature of the reality, an epistemology which relates to his assumptions of how reality is known and understood, and a methodology, which deals with how he goes about finding out about facets of the reality. Therefore, the suitability of the method for the collection and analysis of data is determined by the researcher’s paradigm and the phenomena being studied, and the choice of methods is influenced by the research methodology chosen.

The selection of an appropriate research strategy is always a challenging task and the researcher chose to look at this research inquiry starting with a discussion of the ontology and epistemology of the research paradigm.

3.2.1 Ontology and epistemology

Ontology refers to the nature of reality (Guba & Lincoln, 1994) and the researcher's ontological position is one which sees the social world as being socially and subjectively constructed and based upon the reality of the world people experience and live in (Johnson & Onwuegbuzie, 2004). The aim of this research reflects this ontological position, in that it investigates teachers' perceptions of the use of Web 2.0 for teaching and learning and their intentions of using Web 2.0 tools for teaching and learning.

The epistemological perspective focuses on representations of knowledge. Epistemology is about how one makes meaningful sense of the world (Levers, 2013) and refers to "the relationship between the knower and known; the researcher and the participant" (Teddlie & Tashakkori, 2009, p.89). This current research looks at the teachers' perceptions of the use of Web 2.0 tools for teaching and learning and their intention of using Web 2.0 tools for teaching and learning. To gain this knowledge and evidence, it is therefore necessary to gather information about teachers' use of Web 2.0 tools in their personal lives and their professional practice and their opinions about the use of Web 2.0 tools for teaching and learning purposes. It is also essential to collect data from these teachers in order to describe their answers. From these descriptions, each of which is a unique interpretation for that individual teacher, common categories are identified that help make sense of this knowledge and make it useful as a research tool in the educational field. Through a purposive sampling of participants from among the teachers, qualitative data would be collected to further understand their opinions and experiences with the use of Web 2.0 for teaching and learning.

This research is consistent with the epistemological perspective that was used to determine the representations of knowledge that answer the research questions, and the epistemological assumptions where the individual teachers' opinions and experiences

were collected as representations of the knowledge of using Web 2.0 tools for teaching and learning, and then re-interpreted to provide answers to the research questions posed. The first stage of this research was to understand how teachers viewed their use of Web 2.0 tools, their perceptions of use of these tools for teaching and learning and their intention to use these for teaching and learning purposes through a survey questionnaire.

The next stage of the research was to attempt to seek individual teachers' understanding of the world (with Web 2.0 tools) in which they live and work. This was achieved through an analysis of the transcripts of the interviews. In other words, the researcher assessed teachers' opinions and experiences with using Web 2.0 in their personal lives as well as their professional practice through a survey, and subsequently obtained other outstanding and unexpected findings, in interviews with individuals to gain a deeper understanding of the results from the survey.

3.2.2 The positioning of the researcher

Data collection, analysis of data and the positioning of the researcher are crucial processes in research whereby a theory is developed and verified through the systematic collection and analysis of data (Strauss & Corbin, 1998). The researcher's positioning was to ensure that the design of the research for the data collection was suitable and that the sensitivity of each participant during the survey and the interview sessions was taken into consideration. The researcher has been teaching the basics of how to use technology to teachers as well as how to integrate technology into their teaching for more than 20 years. Despite his efforts, the researcher has not seen technology widely used for teaching and learning purposes. The conviction that technology has reached the point of having the capacity for changing education has led the researcher to this current field of study. For this study, it was necessary for the researcher to identify his own biases in terms of the use of Web 2.0 tools and not to make assumptions and jump to conclusions about the teachers and their experiences with Web 2.0 tools based on his own experiences. The researcher needed to be aware of the current realities of use of technologies for teaching and learning and not make assumptions about the use of Web 2.0 for teaching and learning.

The researcher would need to ensure that his methodological approach to data collection, data management, coding, analysis and interpretation were given proper attention. Additionally, the researcher also needed to ensure the privacy and confidentiality of the information and answers from each individual and therefore allow the teachers to be at ease and feelcomfortable, with no coercion and no presence as an authoritative figure in eliciting and collecting answers from them, as he tried to collect and triangulate his data from the teachers. The researcher needed to ensure that he constantly kept an open mind during the interviews, to ask questions when needed and not to assume things: to check on assumptions while maintaining focus on his research topic. Rapport building and a sense of mutual trust in the relationship between the teachers and the researcher were important to elicit the teachers' experiences, opinions and their wealth of knowledge regarding the research questions. In the data collection, the power imbalance between, the researcher as the lecturer, and the teacher was avoided by conducting the interviews whenever the teachers were free, and prior to the interviews by chatting with the teachers informally. The researcher also informed teachers about preserving each teacher's privacy and confidentiality.

3.3 Mixed-methods research

This study used a mixed-methods approach that focused on collecting, analysing, and mixing both quantitative and qualitative data in a coherent manner (Creswell, 2013). In the first issue of the *Journal of Mixed Methods Research*, the editors defined mixed methods as, "research in which the investigator collects and analyses data, integrates findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or programme of inquiry. A key concept in this definition is integration" (Tashakkori & Creswell, 2007, p. 4)

The main argument for a mixed-methods approach is that neither quantitative nor qualitative methods are adequate, and the use of both methodologies offers a better comprehension of the research problem rather than using each approach separately (Creswell & Plano Clark, 2011). The mixed-methods approach has been debated since the 1960s regarding the usefulness of combining quantitative and qualitative research

methodologies in the same study (Creswell, 2013). While some scholars remain deeply rooted in distinguishing the value of quantitative versus qualitative research methods, other scholars advocate views of these methods that are complementary. Qualitative results can be used to support or explain quantitative results and vice versa (Creswell, 2013). The mixed-methods approach has emerged, engaging and elaborating the method in journals, at conferences, and in books where specific procedures for “mixing” have been developed, including designs and mixed-methods questions (Creswell, 2013).

3.3.1 Mixed-method research: Strengths and weaknesses

Mixed-method research has strengths and weaknesses (Johnson & Onwuegbuzie, 2004). Mixed-methods research provides strengths that counterbalance the weaknesses of both quantitative and qualitative research. One might argue that quantitative research is weak in understanding the research context because the verbal responses of participants are not directly heard. Also, quantitative researchers are in the background, and their own personal biases and interpretations are not often discussed. Qualitative research makes up for these weaknesses as Johnson and Onwuegbuzie (2004) point out that in mixed-methods research qualitative data findings in form of words, pictures and narratives can be used to add meaning to quantitative results in form of numbers. On the other hand, qualitative research is seen as incomplete because of the personal interpretations made by the researcher, the resulting bias generated by this, and the difficulty in generalising findings to a large group because of the small number of participants studied. Quantitative research, it is contended, does not have these weaknesses since in mixed-methods research quantitative results in the form of numbers could be used to add precision to qualitative data findings in form of words, pictures and narratives (Johnson & Onwuegbuzie, 2004). Thus, the combination of strengths of one approach makes up for the weaknesses of the other approach. Mixed-methods research helps to answer questions that cannot be answered by quantitative or qualitative approaches only because the researcher is not solely limited to a single research approach or method (Cronholm & Hjalmarsson, 2011). Also, researchers can make use of all the tools of data collection available rather than being restricted to the types of data collection typically associated with quantitative research or qualitative research. Thus, the mixed-method approach can

manage a broader and more complete range of research questions. Mixed-methods research can provide more robust evidence for a conclusion to a research problem than either quantitative or qualitative research alone by adding insights and understanding that might be overlooked when only a single method is used (Johnson & Onwuegbuzie, 2004). The use of a mixed method can, through merging and validation of findings, increase the ability to generalise the results compared to a qualitative study (Cronholm & Hjalmarsson, 2011). Thus, qualitative and quantitative approaches when used together, yield more complete knowledge necessary to enlighten theory and practice (Johnson & Onwuegbuzie 2004).

Mixed methods also have several weaknesses (Johnson & Onwuegbuzie 2004). One weakness is that it could be problematic for one researcher alone to carry out both qualitative and quantitative research (Cronholm & Hjalmarsson, 2011). This can be the case if the qualitative and quantitative research should be used concurrently. A design implementing concurrency might require a research team. Concurrency encompasses more participants and more activities, and hence, is time consuming (Johnson & Onwuegbuzie 2004). Other difficulties that might be associated with the mixing of methods is that the researcher must learn about multiple methods and their rationality in order to mix them accordingly and be able to use them in a professional manner. It is often simpler to focus on a single method or approach. Another weakness is that methodological purists contend that a researcher should always work within either a qualitative or a quantitative paradigm and not mix the two (Johnson & Onwuegbuzie, 2004)

3.3.1.1 Types of mixed methods

Mixed-methods research combines quantitative and qualitative methods to benefit from the strengths of both and to gain a holistic perspective, giving a way to being able to look at the question from different angles. According to Creswell and Clark (2007) there are six types of mixed-method research designs. They are the convergent parallel design, the explanatory sequential design, the exploratory sequential design, the embedded design, the transformative design, and the multiphase design

In convergent parallel design quantitative and qualitative data collection and analysis are carried out independently from each other or at the same time. The results of each phase are compared and interpreted at the end. Explanatory sequential design is one where quantitative phase is administered first and according to the results of that phase qualitative phase follows up. Finally, all results are interpreted. Exploratory sequential design is the opposite of the explanatory one, the time qualitative phase being administered first. With the embedded design, researchers conduct one of the phases within the other. Transformative design is like the explanatory design, but it lays emphasis on the theoretical framework. Multiphase design is used through a period or within a program using the quantitative and qualitative phases repeatedly.

3.3.2 Explanatory sequential design

For this study, the researcher used the explanatory sequential design. In this kind of mixed-methods research, results of the qualitative phase are used to explain the quantitative results of the first phase. The explanatory sequential design is used when a researcher wants to investigate the relationships among quantitative data and to explain the mechanisms behind those relationships. A sequential explanatory design two-phased mixed-methods research approach was used where the qualitative data were required to provide an explanation on the statistical results from the quantitative phase. However, the researcher had to deal with the technical concerns of priority, implementation, and integration of the quantitative and qualitative research approaches (Creswell, 2013).

3.3.2.1 Priority

Priority refers to the choice of giving more consideration to either quantitative data or qualitative data (Creswell, 2013). For instance, in the sequential explanatory design, priority is accorded to the to the quantitative approach because quantitative data collection comes first, representing a main part of the study, while a smaller qualitative data collection section follows in the second stage of the study (Ivankova et al., 2006). In the present study, priority was given to the quantitative approach.

3.3.2.2 Implementation

Implementation refers to whether the quantitative or qualitative data is used first, second, or simultaneously in the data collection (Creswell, 2013). In the sequential explanatory design, a researcher first gathers and analyses the quantitative data, and then collects and analyses the qualitative data in the second phase of the study with the intention of clariflying the results obtained from the quantitative phase. The researcher collected the quantitative data using self-administered survey instruments. Analysis of the survey instruments indicated that the data was trustworthy and with no inconveniences such as missing values and outliers and consequently multiple regression analysis could be safely carried out to identify potential explanatory variables that could best predict and explain teachers' perceptions of Web 2.0 tools and their intention to use these tools in their professional practice, and to elaborate an interview process for the qualitative phase. The researcher then collected and analysed qualitative data to help shed light on the quantitative findings.

3.3.2.3 Integration

Integration refers to the phase when the data is connected, that is, during the design phase of the study, data collection and data analysis, or during interpretation of the findings (Teddlie & Tashakkori, 2009). In this study, the researcher connected both the quantitative and qualitative data at two stages. The first connection of data happened during the design phase of the study when developing interview questions for the qualitative phase, based on the results of the quantitative phase, while the second connection of data happened during the interpretation of the findings.

3.4 Research process

For this study, during the first phase, the quantitative data was collected, using a questionnaire survey, and the data was analysed. The aim of the quantitative phase was to identify the possible predictive power of the variables on the teachers' intention to use Web 2.0 tools in their practice. In the second phase, a qualitative multiple case study approach was used to gather text data through individual semi-structured interviews. The

qualitative phase in the study focused on explaining the statistical findings obtained in the first, quantitative, phase. The rationale for this approach is that the quantitative phase provides an overall picture of the research problem, while the qualitative phase enhances and explains those statistical results by more deeply exploring participants' views.

3.4.1 Quantitative phase

A quantitative correlational research design was used in this study. Gall and Borg (2005) define this research design as a type of quantitative investigation that seeks to find out the direction and extent of the association among variables using correlational statistics. A correlational design was chosen because this study sought to determine relationships among the UTAUT and TPACK constructs and in-service teachers' perceptions of Web 2.0 tools and their intention to use Web 2.0 tools in their professional practice. Correlational research involves the following steps: identifying participants, deciding on measures for the variables under study, collecting data, analysing the data to determine relationships between variables (strengths and directions) and interpreting the results to form conclusions (Creswell, 2013).

3.4.2 Target population and sample

The population of interest in this study was secondary level in-service teachers coming from both state and private schools in all teaching subject areas. The target population for this study consisted of in-service teachers following courses at a teacher-training institution. All in-service teachers (200) enrolled for the two-year teacher's certificate program (the PGCE cohort 2013–2014) formed the sample for this study. These teachers formed a convenient sample because the researcher could have access to them easily since they attended courses at the institution at least twice a week.

3.4.2.1 Quantitative data collection

Quantitative measures are succinct, parsimonious and easily aggregated for analysis; quantitative data are systematic, standardised, and easily presented in a short space (Patton, 2002). According to Nardi (2003), survey research is an efficient and effective tool

to use when the desire is to obtain a large amount of data in a relatively short period of time.

In this study, the researcher has used a single survey instrument with close-ended questions to capture a detailed, self-reported observation of in-service teachers' demographics, their use of Web 2.0 tools in their personal and professional lives and their perceptions of use of Web 2.0 tools in teaching and learning.

The questionnaire consisted of four parts.

Part I was concerned with demographic information in relation to age, gender, qualification, number of years of teaching experience and subject area taught.

Part II and Part III sought responses that best reflected the frequency of teachers' use of Web 2.0 tools in their personal lives and their professional practice respectively. The teachers were asked to respond with their agreement to six statements, each using a five-point Likert scale, with responses ranging from Every Day to Never.

Part IV of the questionnaire was based on questionnaires adapted from the UTAUT and TPACK models. These two models were used in this study because they assessed different areas of interest: the UTAUT questions were particular to adoption and use of Web technology whereas the TPACK questions examined knowledge areas related to Web technology, pedagogy and content. The teachers were asked to respond with their agreement to 42 statements (24 from UTAUT and 18 from TPACK), each using a five-point Likert scale, with responses ranging from Strongly Disagree to Strongly Agree.

The UTAUT questionnaire, created by Venkatesh et al. (2003), was adapted to measure intention to use Web 2.0 tools in teaching and learning. Teachers were asked to respond to their agreement with three statements that Venkatesh (2003) proposed to measure teachers' intention to use technology. Furthermore, Venkatesh et al. (2003) proposed that performance expectancy, effort expectancy and social influence predicted intention to use a technology; therefore, these constructs were independent variables in the current study. To adapt to the context of this study, these constructs were measured to reflect intention to use Web 2.0 tools in teaching and learning rather than intention to use a technology.

Finally, Venkatesh (2003) proposed that facilitating conditions was an important component in understanding intent to use and subsequent usage; therefore, this construct was measured. The TPACK questions were based on a survey published by Archambault, (2009), Schmidt, et al. (2009) and Chai, Koh, Ho & Tsai, (2012).

The following variables were used for the quantitative phase:

Dependent variable: intention to use Web 2.0 tools in the future among in-service teachers is the dependent variable.

Independent Variables: performance expectancy, effort expectancy, social influence, facilitating conditions, technology knowledge, pedagogy knowledge, content knowledge, technology and content knowledge, PCK, technology and pedagogy knowledge and TPACK.

3.4.2.2 Quantitative data analysis

The statistical package SPSS® for Windows was used for most of the statistical analysis for this study. Descriptive statistics were conducted to address the first two research questions. EFA and multiple regressions were conducted in response to the third and fourth research questions. The relationship among the UTAUT and TPACK constructs was examined using Pearson's correlation coefficient.

3.4.2.2.1 Descriptive statistics

Using SPSS®, demographic and background characteristics were analysed by computing descriptive statistics and frequency tables. Numerical summaries, frequencies and percentages were computed for gender, age, years of experience in teaching, use of Web 2.0 tools in personal life and use of Web 2.0 tools in professional life

3.4.2.2.2 Exploratory factor analysis

According to Field (2009), EFA is a statistical technique "(1) to understand the structure of a set of variables; (2) to construct a questionnaire to measure an underlying variable; and (3) to reduce a data set to a more manageable size while retaining as much of the original

information as possible" (p. 627). He argues that EFA is used to generate theories by constructing latent variables (factors). To investigate the associations among those variables by other statistical techniques, such as regression, latent variables need to be constructed.

There are many methods for EFA. In this study, principal component analysis with Varimax rotation was used to get the factors. Principal component analysis (PCA) with Varimax rotation is the most popular technique among researchers (Costello & Osborne, 2005)

To determine that assumptions regarding a sufficient sample size and the suitability of the data to factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were computed. The KMO value should be high, namely close to 1.0. If it is less than 0.5, then factor analysis likely will not be useful. Bartlett's Test of sphericity is used to test whether group variances are the same and the result should be significant (i.e. $p < 0.05$).

The number of factors is selected based on three criteria: eigenvalues, scree test and extracted variance as suggested by Field (2009):

1. All selected factors should have an eigenvalue that is higher than 1.
2. The number of factors in the first two steps should be in some congruence with the Catell's (1952) scree plot results.
3. Selected number of factors should explain more than 50% of the variance.

The results of the EFA were saved as a regression score for subsequent multiple regression analysis.

3.4.2.2.3 Multiple regression analysis

Multiple regression analysis was conducted to address the third and fourth research questions. Multiple regression is a statistical technique that is used to predict scores on one variable based on scores on several other variables. The relationship between various independent variables (the factor scores obtained from the EFA) and the dependent variable intention to use, was examined through multiple regression analysis. Both the

Enter and Stepwise methods were used for multiple regression analysis. Field (2009) suggested that if the initial forced entry method (the Enter method) of multiple regression reveals two or more significant predictors, then a forward Stepwise multiple regression must be run to realise the individual contributions of each variable. With the Enter method, all variables are entered into the analysis simultaneously by the SPSS® program without the researcher deciding on the order of entry. The Stepwise method was also chosen because the procedure begins without any predictor but rather inserts the predictors as and when they meet the criteria (Field, 2009). It also eliminates the slightest contributing independent variable whenever a predictor is inserted to the equation, thus eliminating any non-contributing predictors (Field, 2009).

Before multiple regression analysis was conducted, assumptions of the multiple regression were checked. Before multiple regression analysis was conducted, the researcher checked the assumptions mentioned below required to safeguard the accuracy of predictions.

Multicollinearity is a problem that occurs when independent variables in a regression model are correlated. A high degree of correlation can cause problems when fitting the model and interpreting the results. To test for multicollinearity, the variance inflation factor (VIF) and tolerance statistics were examined. Tolerance refers to the percentage of the variance in a given variable that cannot be explained by the other variables. When the tolerance values are close to 0, there is high multicollinearity and the standard error of the regression coefficients will be inflated. One way to quantify collinearity is with VIF. A VIF greater than 3 is considered to indicate a serious problem of multicollinearity.

Outliers were checked by Cook's distance and standardised dfbetas. According Field (2009), values greater than 1 may be outliers.

Independent errors assumption was checked by the Durbin-Watson test. A Durbin-Watson value less than 1 or greater than 3 is cause for concern (Field, 2009).

A linear relationship existed between the independent and dependent variables, as evidenced by partial regression plots.

3.4.2.3 Pilot test

According to Dillman (2007), a questionnaire should be pilot tested before researchers intend to use it to collect data, to increase its efficiency and validity. Pilot testing enables researchers to find the time required to complete the questionnaire, whether any question is biased or wrongly encoded, whether the questionnaire directions are easy to follow, and any other problems related to the survey's design (Dillman, 2007).

A pilot study was conducted on a class of 35 in-service teachers from the targeted sample. In-service teachers were asked to voluntarily complete the anonymous questionnaires after their lectures.

The time needed to complete the questionnaires, as well as any confusing questions or misunderstanding, was noted. The teachers completed the questionnaires comfortably within 20 minutes. Thirty-five questionnaires were included in the pilot study. An analysis of the questionnaires was conducted using SPSS (version 17.0). The third item ("use of podcasts") in Parts II and III of the questionnaire was removed, since 33 teachers indicated that they have never used podcasts. For reliability testing the "Cronbach's Alpha" (coefficient of reliability) value was computed. By using Cronbach's alpha, internal consistency can be estimated. The table below summarises the relation between Cronbach's alpha and internal consistency.

Table 3.1: Relation between Cronbach's alpha and internal consistency

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Internal consistency (Cronbach's Coefficient Alpha) was computed on items in the questionnaire as a reliability estimate to ensure that all items grouped together on an instrument were measuring the same construct consistently. If an instrument had high internal consistency, then if in-service teachers strongly agreed on one item, it was expected that they would also strongly agree on other items measuring the same construct. Internal consistencies (like Cronbach's Alpha) of 0.7 or higher are considered adequate (Barclay et al., 1995). For this pilot test the Cronbach's Coefficient Alpha obtained was 0.87, indicating good internal consistency.

3.4.2.4 Validity and reliability

3.4.2.4.1 Validity

To assess the content validity of the questionnaires, a panel of local experts familiar with ICT in teacher education programs has been asked to review the questionnaires and provide feedback on content relevance and clarity.

3.4.2.4.2 Reliability

The UTAUT and TPACK sections of the finalised questionnaire were independently tested with Cronbach's Coefficient Alpha. The UTAUT section, comprising 24 items, achieved a reliability score of 0.902, which was consistent with prior studies (Avci & Askar, 2012; Baltaci-Goktalay & Ozdilek, 2010). The TPACK section, comprising 18 items achieved a reliability score of 0.875 and was consistent with other TPACK studies (Chai, Koh, & Tsai, 2011; Schmidt et al., 2009). The UTAUT and TPACK constructs have been tested separately for reliability before conducting EFA and the results are shown in Chapter Five.

3.4.3 Qualitative phase

In the qualitative phase of the research process, semi-structured individual interviews were conducted after the finalised questionnaires were analysed, in order to assist with further interpretation of the quantitative data.

3.4.3.1 Participant selection

In a sequential explanatory mixed-methods design, individuals participating in the qualitative phase should also have participated in the initial, quantitative phase (Creswell & Plano Clark, 2007). Because the qualitative phase uses the quantitative results, only individuals that contributed to the quantitative phase are suitable to take part in the qualitative follow-up. In this study, participants were asked to indicate on the survey questionnaire if they would be interested in participating in a semi-structured interview on use of Web 2.0 in teaching and learning. The participants were informed that the interviews would last between 20 and 30 minutes, and that if selected, they would be contacted via email.

3.4.3.2 Target population

Purposeful sampling was used to select participants for the semi-structured interviews. The logic and power of purposeful sampling lies in selecting information-rich cases for in-depth study (Patton, 1990). Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the research (Patton, 1990). Due to the nature of the sequential design of this study, the selection of the participants for the second, qualitative phase depended on the results from the first, quantitative phase. More details on the final sample is provided in Chapter 5 Section 5.2.

3.4.3.3 Semi-structured interviews

In a semi-structured interview, the researcher–interviewer uses pre-prepared questions that are used to guide the interview process. However, the researcher–interviewer is free to explore responses on a deeper level and in addition has the opportunity to add questions when he or she deems it to be necessary – for example if he or she finds a question or series of questions not thought about before but seeming to be relevant to ask at a specific point in time during the interview.

The semi-structured interview promotes flexibility, as it allows one to move beyond the initial pre-determined questions and as a result helps one to capture personal experiences outside the realm of the pre-determined ones (Creswell, 2013), and as a result contributes

to being a very productive data gathering tool The purpose of using in-depth semi-structured interviews with in-service teachers was to understand their attitudes and beliefs regarding use of Web 2.0 tools in their teaching strategies. The interview protocol included 10 to 15 open-ended questions and was pilot tested. The content of the protocol questions was based on the results of the statistical tests obtained from the quantitative phase. The interviews were tape-recorded, and word processed. Respondents were given the opportunity to review and, if necessary, modify the contents of their word-processed interview.

3.4.3.4 Qualitative data analysis

The researcher transcribed the data from the interviews. The qualitative data was examined using content analysis, to “identify, code and categorise the primary patterns in the data” (Patton, 1990, p. 381). For this phase of the analysis, inductive analysis was used, meaning that “the patterns, themes and categories of analysis come from the data” (Patton, 1990, p. 390). The steps in qualitative analysis included: (1) preliminary assessment of the data by reading through the transcripts and writing memos; (2) coding the data by segmenting and clssifying the text; (3) using codes to build up themes by bringing together similar codes; (4) linking and interrelating themes; and (5) building a narrative (Creswell, 2013). A visual data display was created to show the developing conceptual framework of the factors and relationships in the data (Miles & Huberman, 1994).

3.4.3.5 Establishing credibility

The criteria for passing judgement on a qualitative research are different from quantitative study. Within qualitative research, the researchers must scrutinise themselves and the participants to deal with issues relating to reliability and validity (Creswell, 2013). In the 1980s, Guba and Lincoln replaced the terms reliability and validity with the notion of trustworthiness. Fundamentally, trustworthiness relates to what exrtent a study accomplishes what it is intended to do (Merriam, 1998). In qualitative research, the researcher looks for believability, based on consistency, insight, and trustworthiness (Lincoln & Guba, 1985) through a process of verification instead of traditional validity and

reliability measures. To validate the findings, determine the credibility of the information and whether it matches reality (Merriam, 1988), four procedures were used in the qualitative phase of the study: (1) triangulation by converging diverse sources of information; (2) participant checking by receiving the feedback from the participants on the accuracy of the identified categories and themes; (3) provision of rich, thick description to express the findings; and (4) external audit requesting a person not involved in the study to review the qualitative study and report back (Creswell, 2003).

3.4.4 Research permission and ethical considerations

The researcher developed an informed consent form. In the form it is stated that the participants who would agree to be involved in the study were guaranteed certain rights and that their rights were protected. A statement concerning the informed consent was attached to the survey questionnaire and reflected compliance by participation (Appendix D). The anonymity of participants was safeguarded by numerically coding each returned questionnaire and keeping the responses confidential. While conducting the interviews, the selected participants were allocated fictitious names for use in their description and reporting of the results. Participants were informed that summary data would be circulated to the professional public and it would not be possible to trace responses to individuals.

3.4.5 Integration of quantitative and qualitative data: The mixing approach

In this study, the mixing of the quantitative and qualitative data occurred during two phases. The first integration occurred during the design phase of the study when developing questions for the qualitative phase based on the results of the quantitative phase. The second mixing of data occurred after qualitative data collection and analysis to determine teachers' perceptions of and intention to use Web 2.0 tools aligned with the outcomes of the quantitative findings. The second connecting point served as a foundation for the larger interpretation discussed in the findings section of the study.

3.4.6 Validity within mixed-methods research

According to Creswell and Plano Clark (2007), since mixed methods research includes both quantitative and qualitative elements data, the researcher must ensure that specific

threats to validity are discussed for both types of data methods. Validity in mixed-methods research refers to the approaches that tackle possible issues in data collection, analysis, and interpretation that might compromise the connection of the data strands and the conclusions drawn from the study (Creswell & Plano Clark, 2007). In this particular study, the following were threats to validity: (1) using inappropriate sample sizes for the qualitative and quantitative data collection; (2) choosing insufficient participants for the continuation phase who cannot explain significant results; (3) choosing weak quantitative results for the qualitative phase; and (4) comparing the two data sets when they are meant to build rather than merge (Creswell & Plano Clark, 2007). The following strategies were used to minimise the threats to validity: (1) use of a large sample for the quantitative strand (200 participants) and a small sample for the qualitative strand (15 participants); (2) use only of individuals who would have participated in the quantitative phase for the qualitative phase, (3) use of strong quantitative findings to conduct the qualitative phase and (4) interpretation of the quantitative and qualitative data to address the mixed-methods research questions (Creswell & Plano Clark, 2007).

3.5 Summary

This chapter described the research methods and procedures used in the study. The research design, population, sample, instruments, data collection procedures and data analysis procedures were discussed. The following chapter presents the analysis of the data, findings and their interpretation.

4 Quantitative data analysis

4.1 Introduction

This chapter presents the quantitative findings of this study and reveals the statistical data that highlight in-service teachers' perceptions of the use of Web 2.0 tools for teaching purposes and the relationships among the independent variables (the TPACK and UTAUT constructs) and the dependent variable (intention to use). This study was designed to find out whether teachers had the necessary skills and attitudes to adopt Web technologies and determine the predictors to Web technology adoption in teaching and learning. Chapter Four will also provide statistical results that are applicable to the research questions in this study. The first part of this chapter discusses the biographical and descriptive data, while the second part provides illustrations of the various statistical results. The data for this study were collected through hand-delivered survey questionnaires that targeted 200 in-service secondary school teachers. However, only 186 participants responded to the survey.

4.2 Descriptive statistics

The following section reports on the descriptive, explanatory and predictive analysis of the data.

4.2.1 Description of gender

The descriptive statistics relating to the gender of the secondary school in-service teachers who participated in the survey are presented in Table 4.1.

Table 4.1: Descriptive statistics for the gender of in-service teachers

	Frequency	Percent	Valid Percen	Cumulative Percent
Male	60	32.3	32.3	32.3
Female	126	67.7	67.7	100.0
Total	186	100.0	100.0	

In terms of gender, Table 4.1 shows that there were 186 responses to the survey. Most of the participants were females who represented 67.7% (n=126) of the sample, while the males represented only 32.3% (n=60).

4.2.2 Description of age

Table 4.2 provides an illustration of the age of secondary school in-service teachers.

Table 4.2: Descriptive statistics for the age of secondary school in-service teachers.

Age	Frequency	Percent	Valid Percent	Cumulative Percent
21-25	41	22.0	22.0	22.0
26-30	68	36.6	36.6	58.6
31-35	59	31.7	31.7	90.3
36-40	12	6.5	6.5	96.8
40-45	4	2.2	2.2	98.9
51-55	1	.5	.5	99.5
56-60	1	.5	.5	100.0
Total	186	100.0	100.0	

As illustrated in Table 4.2, the majority of the participants (36.6%) fell into the 26–30 year age group. The 31–35 year age group constituted 31.7% of the sample with 22.0% in the 21–25 age group. There were no participants in the age group 46–50. The participants were mostly digital natives, since more than 90% were less than 36 years of age.

4.2.3 Description of educational qualifications

The descriptive statistics for the in-service teachers' highest qualifications are shown in Table 4.3.

Table 4.3: Descriptive statistics for in-service teacher's highest qualification

Qualification	Frequency	Percent	Valid Percent	Cumulative Percent
BSc	147	79.0	79.0	79.0
MSc	38	20.4	20.4	99.5
Other	1	.5	.5	100.0
Total	186	100.0	100.0	

As depicted in Table 4.3, the description of the participants' highest qualification reveals that 79.0% of the participants have a bachelor's degree (n=147) while 20.4% of the participants have a master's degree (n=38).

These statistics are indicative of the fact that most of the participants in this sample have bachelor's degrees.

4.2.4 Description of teaching experience

The descriptive statistics for the participants' teaching experience are illustrated in Table 4.7: .

Table 4.4: Descriptive statistics for teachers' teaching experience

Teaching experience	Frequency	Percent	Valid Percen	Cumulative Percent
1-5	103	55.4	55.4	55.4
6-10	62	33.3	33.3	88.7
11-15	14	7.5	7.5	96.2
16-20	3	1.6	1.6	97.8
More than 20	4	2.2	2.2	100.0
Total	186	100.0	100.0	

As depicted in Table 4.4, the description of the participants' teaching experience revealed that 55.4% of the participants have been teaching between one and five years (n=103), while 33.3% of the participants have been teaching between six and 10 years (n=62). These statistics illustrate that most of the participants have been in the teaching profession for less than six years.

4.2.5 Description of subject area taught

The descriptive statistics for the subject area taught by the participants are shown in Table 4.5.

Table 4.5: Descriptive statistics for teachers' subject area

Subject taught	Frequency	Percent	Valid Percen	Cumulative Percent
English	17	9.1	9.1	9.1
French	26	14.0	14.0	23.1
Maths	20	10.8	10.8	33.9
Social Studies	5	2.7	2.7	36.6
Physical Educatior	6	3.2	3.2	39.8
Home Economics	4	2.2	2.2	41.9
Chemistry	5	2.7	2.7	44.6
Physics	5	2.7	2.7	47.3
Biology	5	2.7	2.7	50.0
Computer studies	22	11.8	11.8	61.8
Oriental language	37	19.9	19.9	81.7
Arts and Design	11	5.9	5.9	87.6
Business Studies	9	4.8	4.8	92.5
Travel and tourism	4	2.2	2.2	94.6
Economics	5	2.7	2.7	97.3
Other subject	5	2.7	2.7	100.0
Total	186	100.0	100.0	

Nineteen point nine percent oriental language (Hindi, Tamil, Telegu and Marathi) participants (n=37) responded to the survey.

4.2.6 Teachers' use of Web 2.0 tools in their personal lives

Table 4.6: Frequency of participants' use of Web 2.0 tools in their personal lives

		Scores in percentage				
	N	Never	At least once a year	At least once a month	At least once a week	Every day
Web log in personal life	186	12.4	5.4	16.7	31.2	34.4
Wiki in personal life	186	2.7	2.7	15.1	55.4	24.2
Networking in personal life	186	8.6	2.2	7.5	26.9	54.8
Google Apps in personal life	186	2.2	1.1	9.1	39.8	47.8
Multimedia in personal life	186	2.2	1.1	9.1	39.8	47.8
File hosting service in personal life	186	10.8	2.2	17.7	46.8	22.6

Table 4.6 shows participants' reported use of Web 2.0 tools in their personal lives. Of the applications considered, social networking sites were the Web 2.0 technology most commonly used by the participants (81.7% of the participants reported daily or weekly use). More than 60% of participants reported daily or weekly use of the other Web tools.

4.2.7 Teachers' use of Web 2.0 tools in their professional practice

Table 4.7 summarises the participants' proficiencies using different Web 2.0 tools in teaching and learning.

Table 4.7: Frequency of teachers' use of Web 2.0 tools in their professional practice

		Scores in percentage				
	N	Never	At least once a year	At least once a month	At least once a week	Every day
Web log in professional practice	186	30.6	5.9	21.0	28.5	14.0
Wiki in professional practice	186	15.6	3.8	19.9	41.9	18.8
Networking in professional practice	186	36.6	3.2	14.5	24.7	21.0
Google Apps in professional practice	186	15.1	8.1	18.3	27.4	31.2
Multimedia in professional practice	186	20.4	6.5	14.5	37.1	21.5
File hosting service in professional practice	186	30.6	4.3	14.0	36.0	15.1

Table 4.7 shows the participants' reported use of Web 2.0 tools in their professional practice. Of the applications considered, use of Wikis was the Web 2.0 technology most commonly used by the participants (60.7% of the participants reported daily or weekly use). More than 58.6% of the participants reported daily or weekly use of Google Apps and Multimedia). Almost one-third of the number of the participants did not use other Web 2.0 services for their professional practice (30.6% of the participants reported not using file hosting services and 36.6% not using social networking).

4.2.8 Teachers' perceptions towards use of Web 2.0 tools in teaching

Part D of the survey instrument requested the participants to show their level of agreement or disagreement with five-point Likert Scale statements regarding the use of Web 2.0 tools for teaching and learning.

The descriptive statistics regarding teachers' perceptions towards use of Web 2.0 tools in teaching are depicted in Table 4.8. For the first four items 78.5% to 85.5% of the participants strongly agreed or agreed with the stated usefulness of Web 2.0 technologies in teaching. For items 5, 6, 7 and 8, responses were somewhat lower, with only 54.3% to 67.2% of the participants indicating strong agreement or agreement. For items 9,10,11,12 and 13 responses were quite high, with 64.5% to 73.1% indicating strong agreement or agreement about their self-efficacy beliefs about use of Web 2.0 tools.

Table 4.8: Teachers' perceptions towards use of Web 2.0 tools in teaching (percentages)

Teachers' perceptions	N	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
Web 2.0 tools help me teach my subject area	186	1.1	3.8	16.7	53.8	24.7
Using Web 2.0 tools in teaching will enable me to accomplish tasks	186	1.1	4.3	12.9	61.8	19.9
Web 2.0 useful in my teaching	186	0	2.2	12.4	60.2	25.3
Using Web 2.0 tools will enhance my efficiency as a teacher	186	0	1.6	19.9	52.7	25.8
Web 2.0 tools will reduce my workload	186	2.2	13.4	30.1	38.7	15.6
Using Web 2.0 tools I can interact with my students	186	2.2	4.8	25.8	50.5	16.7
Web 2.0 tools will enable me teach at my pace	186	2.7	10.2	30.1	46.8	10.2
Web 2.0 tools will provide me the flexibility to teach anytime, from any place	186	.5	8.1	24.7	47.8	18.8
I find it easy to get Web 2.0 tools to do what I want	186	3.2	8.1	24.2	51.6	12.9

It is easy for me to become competent at using Web 2.0 tools	186	2.7	5.9	23.7	53.8	14.0
I find Web 2.0 tools easy to use	186	1.1	7.0	18.8	54.8	18.3
My interaction with Web 2.0 tools is clear and understandable	186	.5	7.0	22.0	55.4	15.1
I possess the skills necessary to use Web 2.0 tools	186	1.1	10.8	21.5	52.2	14.5
Web 2.0 tools help me teach my subject area	186	1.1	3.8	16.7	53.8	24.7
Using Web 2.0 tools in teaching will enable me to accomplish tasks	186	1.1	4.3	12.9	61.8	19.9

4.3 Influence of teachers' expertise on intention to use Web 2.0 tools

4.3.1 TPACK constructs

When asked to rate their own comprehension of the different constructs of TPACK on a five-point (strongly disagree to strongly agree) Likert scale, the participants showed a very high level of comprehension of the different constructs of the TPACK framework as can be seen in Table 4.9

Table 4.9: In-service teachers' mean scores on the TPACK constructs

Constructs	Mean score	Standard Deviations
Technology Knowledge	3.60	0.77
Pedagogy Knowledge	3.90	0.52
Content Knowledge	4.15	0.56
Technology Pedagogy Knowledge	3.78	0.73
Pedagogy Content Knowledge	3.98	0.59

Technology Content Knowledge	3.86	0.66
Technology Pedagogy Content Knowledge	3.87	0.68

N = 186

The participants scored high means for all the different constructs with their lowest mean score being 3.6 for the technological knowledge construct. The participants' high mean scores implied that they agreed with most of the items on the different constructs and therefore had high awareness of their knowledge of the constructs of TPACK. The content knowledge, pedagogical content knowledge and pedagogy knowledge had the highest mean scores. This is an indication that the participants had more knowledge of the content and pedagogy constructs. A low standard deviation indicates that the data points tend to be very close to the same value (in this case the mean) while high standard deviation indicates that the data are spread out over a large range of values. The technology knowledge, technology content knowledge and technology pedagogy knowledge constructs yielded lower mean scores and larger standard deviations than for the remaining constructs, indicating a lower and less consistent if teacher agreement with these items.

4.3.2 Exploratory factor analysis

Exploratory factor analysis (EFA) is a statistical technique that is used to reduce data to a smaller set of summary variables and to explore the underlying theoretical structure of the phenomena. Principal Component Analysis (PCA)is a dimension-reduction tool that can be used to reduce a large set of variables to a small set that still contains most of the information in the large set. EFA with PCA as the extraction and rotated with Varimax rotation was carried out with all items constituting the different TPACK constructs. Factor analysis is a technique used to verify whether the items of a construct are really measuring that construct and thus helps to produce a rigorous instrument. PCA deals with determining which linear components exist within a data set and how variables might impact on that component or construct (Field, 2009).

A review of TPACK literature revealed two main approaches to EFA. One approach is to take all the items of the different constructs together and then perform factor analysis to find out the number of factors that will be derived and which items will load under the extracted factors (Koh et al., 2010; Lux, Bangert, & Whittier, 2011). Another approach is to run separate factor analysis for each of the constructs of the TPACK framework (Sahin, 2011; Schmidt et al., 2009). Koh et al. (2010) and Lux et al. (2011) sought to find out whether TPACK really comprised all the seven constructs while Sahin (2011) and Schmidt et al. (2009) concluded that TPACK had all the seven constructs from literature and thus were interested in determining items that will assist to assess the different constructs. Since this aim of this research was not to examine each of the different subscales of the TPACK framework as shown in Sahin (2011) and Schmidt et al. (2009) but rather to find out which type of knowledge will reveal teachers' intention to use Web 2.0 tools, the EFA was run for all items constituting the different TPACK constructs.

A PCA was conducted on the 18 variables with orthogonal rotation (Varimax).

4.3.2.1 Test for sampling adequacy and presence of correlations

Table 4.10: KMO and Bartlett's Test of Sphericity

KMO Measure of Sampling Adequacy.		.814
Bartlett's Test of Sphericity	Approx. Chi-Square	1719.252
	df	153
	Sig.	.000

The Kaiser-Meyer-Olkin (KMO) test is used for measuring sampling adequacy. Bartlett's test of sphericity tests the hypothesis that one's correlation matrix is an identity matrix, which would indicate that one's variables are unrelated and therefore unsuitable for structure detection. As indicated in Table 4.10, the KMO value (0.814) is greater than 0.7 which means the data is likely to factor well. The data was considered to be fit for factor

analysis (Field, 2009; Sahin, 2011). The Bartlett's Test of Sphericity is a statistical test for the presence of correlations among the variables that provides the statistical probability that the correlation matrix has significant correlations among several of the variables (Field, 2009). Bartlett's Test has a null hypothesis that the correlation matrix is the identity matrix, which means that the variables are unrelated, and hence unsuitable for factor analysis. For this study the Bartlett's Test of Sphericity demonstrated that this statistical probability of significant correlations existed with these data ($X2 = 1719.252$, $df = 153$; $p < .001$). Because the p value for Bartlett's Test on the variables was 0.000, the null hypothesis was rejected, and the data is suitable for factor analysis.

4.3.2.2 Communalities

Communalities indicate the amount of variance in each variable that is accounted for.

Table 4.11: Communalities

		Initial	Extraction
Item 1	I am able to use Web 2.0 for personal purpose	1.000	.402
Item 2	I am able to teach my students to use Web 2.0 tools	1.000	.769
Item 3	I am able to integrate the use of Web 2.0 tools	1.000	.741
Item 4	I am able to use conferencing software for collaboration	1.000	.674
Item 5	I teach my students to adopt appropriate learning strategies	1.000	.698
Item 6	I know how to guide my students to discuss effectively during group work	1.000	.705
Item 7	I know how to guide my student to learn independently	1.000	.624
Item 8	I have sufficient knowledge about my subject area	1.000	.822

		Initial	Extraction
Item 9	I have various ways and strategies of developing my understanding of my subject area	1.000	.727
Item 10	I will encourage my students to use Web 2.0 tools to work with other students	1.000	.816
Item 11	I will encourage my students to use Web 2.0 tools to analyse information with their classmates	1.000	.875
Item 12	I will encourage my students to use Web 2.0 tools to communicate with other people about their ideas	1.000	.778
Item 13	I can help my students to understand the content knowledge of my subject area in various ways	1.000	.605
Item 14	I know how to select effective teaching approaches to guide student thinking and learning in my subject area	1.000	.497
Item 15	I know about technologies that I can use for understanding and doing my subject area	1.000	.685
Item 16	I can use appropriate technologies to represent the content of my subject area	1.000	.729
Item 17	I can teach lessons that appropriately combine my subject area, technologies and teaching approaches	1.000	.763
Item 18	I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn	1.000	.709
	Extraction Method: Principal Component Analysis		

4.3.2.3 As shown in Table 4.11, items 1, 7, 13 and 14 had communalities less than 0.7 and were deleted from the data set. According to Field (2009), when there

are less than 30 variables, communalities after extraction exceeding 0.7 are desirable. Rotated Component matrix

Table 4.12: Rotated Component matrix

	Rotated Component Matrix[a]					
		Component				
		1	2	3	4	5
Item 1	I am able to use Web 2.0 for personal purposes			.462		
Item 2	I am able to teach my students to use Web 2.0 tools			.839		
Item 3	I am able to integrate the use of Web 2.0 tools			.806		
Item 4	I am able to use conferencing software for collaboration			.814		
Item 5	I teach my students to adopt appropriate learning strategies				.761	
Item 6	I know how to guide my students to discuss effectively during group work				.800	
Item 7	I know how to guide my student to learn independently				.739	
Item 8	I have sufficient knowledge about my subject area					.886
Item 9	I have various ways and strategies of developing my understanding of my subject area					.772
Item 10	I will encourage my students to use Web 2.0 tools to work with other students	.868				

	Rotated Component Matrix[a]					
Item 11	I will encourage my students to use Web 2.0 tools to analyse information with their classmates	.901				
Item 12	I will encourage my students to use Web 2.0 tools to communicate with other people about their ideas	.850				
Item 13	I can help my students to understand the content knowledge of my subject area in various ways	.467	.449		.424	
Item 14	I know how to select effective teaching approaches to guide student thinking and learning in my subject area	.497				
Item 15	I know about technologies that I can use for understanding and doing my subject area		.735			
Item 16	I can use appropriate technologies to represent the content of my subject area		.813			
Item 17	I can teach lessons that appropriately combine my subject area, technologies and teaching approaches		.844			
Item 18	I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn		.764			

As shown in Table 4.12, only factor loadings greater than 0.4 are displayed. Generally, factor loadings less than 0.4 are ignored (Field, 2009), the above table is displaying only the factor loadings greater than .04. A factor with fewer than three loading items is generally weak and unstable; 5 or more strongly loading items (.50 or better) are desirable and indicate a solid factor (Costello & Osborne, 2005). The fourth and fifth factors had less than three loadings. These two factors were not considered for further analysis. Therefore item

8 and item 9 were removed from the data set. A “crossloading” item is an item that loads at 0.32 or higher on two or more factors. According to Costello and Osborne (2005) a crossloading item should be dropped from the analysis if there are several crossloaders adequate to strong loaders (.50 or better) on each factor. If there are several crossloaders, the item may be poorly written or the a priori factor structure could be flawed (Costello & Osborne, 2005). Item 13 was removed from the data set since it was crossloaded on three factors.

The EFA was rerun with the following results:

Table 4.13: Communalities recalculated

		Initial	Extraction
	I am able to teach my students to use Web 2.0 tools	1.000	.784
	I am able to integrate the use of Web 2.0 tools	1.000	.754
	I am able to use conferencing software for collaboration	1.000	.707
	I teach my students to adopt appropriate learning strategies	1.000	.793
	I know how to guide my students to discuss effectively during group work	1.000	.783
	I have sufficient knowledge about my subject area	1.000	.834
	I have various ways and strategies of developing my understanding of my subject area	1.000	.751
	I will encourage my students to use Web 2.0 tools to work with other students	1.000	.853

		Initial	Extraction
	I will encourage my students to use Web 2.0 tools to analyse information with their classmates	1.000	.905
	I will encourage my students to use Web 2.0 tools to communicate with other people about their ideas	1.000	.810
	I know about technologies that I can use for understanding and doing my subject area	1.000	.655
	I can use appropriate technologies to represent the content of my subject area	1.000	.752
	I can teach lessons that appropriately combine my subject area, technologies and teahcing approaches	1.000	.774
	I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn	1.000	.737
	Average communality		.778

As indicated in Table 4.13 the average communality is greater than 0.7. This implies that factor analysis can be performed using these data.

4.3.2.4 Factor analysis

Table 4.14: Percentage variance: total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.935	35.251	35.251	4.935	35.251	35.251	2.797	19.981	19.981
2	1.878	13.411	48.662	1.878	13.411	48.662	2.634	18.811	38.792
3	1.553	11.095	59.757	1.553	11.095	59.757	2.280	16.285	55.076

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
4	1.487	10.619	70.376	1.487	10.619	70.376	1.617	11.551	66.627
5	1.041	7.438	77.814	1.041	7.438	77.814	1.566	11.188	77.814
6	.603	4.304	82.119						
7	.539	3.851	85.970						
8	.481	3.433	89.402						

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
9	.335	2.391	91.793						
10	.303	2.167	93.960						
11	.271	1.933	95.893						
12	.233	1.664	97.558						
13	.223	1.595	99.153						

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
14	.119	.847	100.000						

According to the eigenvalues in the above table, five factors have eigenvalues greater than 1.0, which is a common criterion for a factor to be useful (Field, 2009).

The scree plot below supports a five-factor solution.

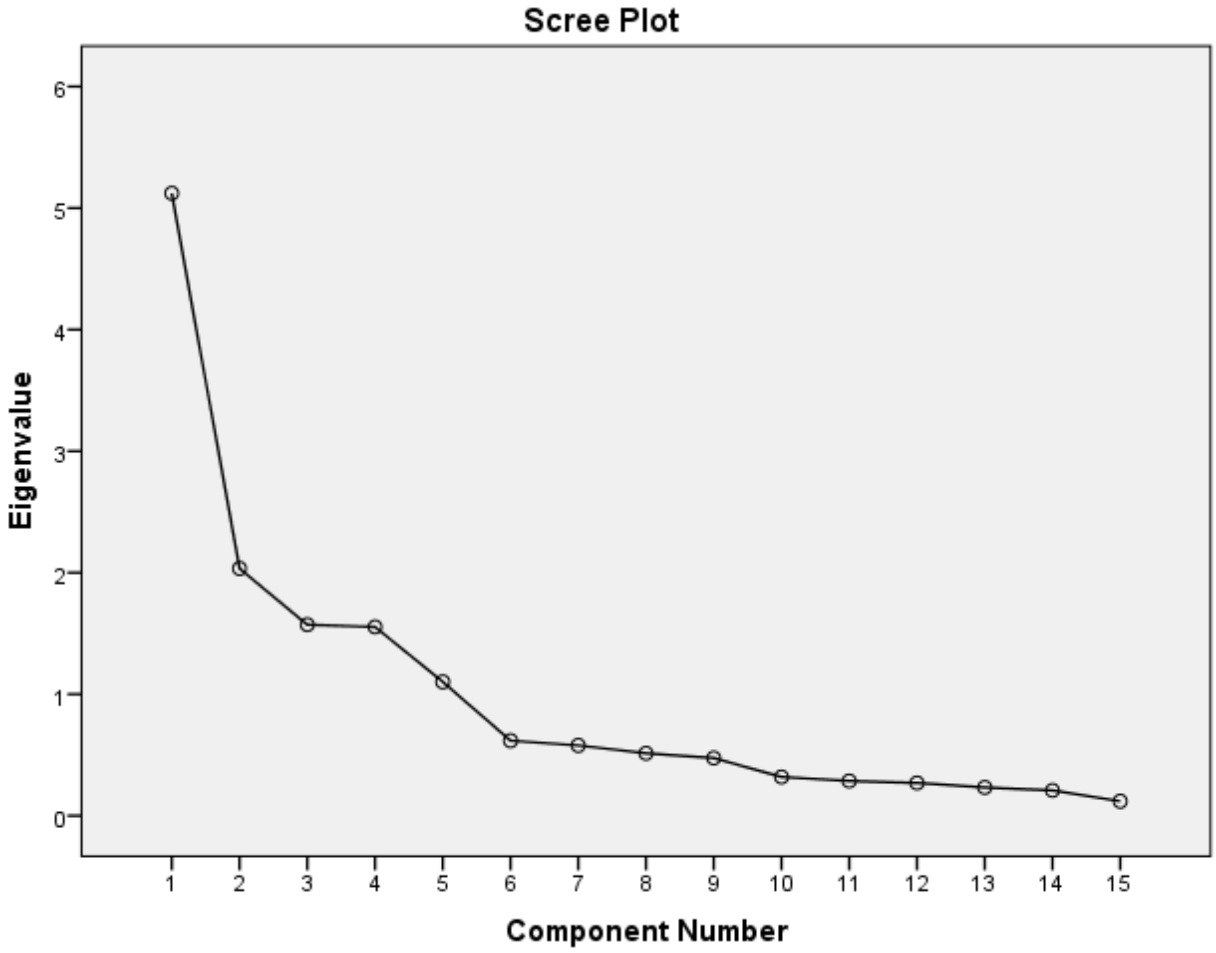

Figure 4.1: Scree plot

4.3.2.5 Recalculation of rotated components

Table 4.15: Rotated components recalculated

	Component				
	1	2	3	4	5
I am able to teach my students to use Web 2.0 tools			.854		
I am able to integrate the use of Web 2.0 tools			.820		
I am able to use conferencing software for collaboration			.832		
I teach my students to adopt appropriate learning strategies					.832
I know how to guide my students to discuss effectively during group work					.829
I have sufficient knowledge about my subjec area				.900	
I have various ways and strategies of developing my understanding of my subject area				.803	
I will encourage my students to use Web 2.0 tools to work with other students		.884			
I will encourage my students to use Web 2.0 tools to analyse information with their classmates		.910			
I will encourage my students to use Web 2.0 tools to communicate with other people about their ideas		.859			
I know about technologies that I can use for understanding and doing my subject area	.733				

	Component				
	1	2	3	4	5
I can use appropriate technologies to represent the content of my subject area	.828				
I can teach lessons that appropriately combine my subject area, technologies and teahcing approaches	.862				
I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn	.777				

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalisation[a]

a. Rotation converged in 5 iterations.

As shown in the Table 4.15, all factor loadings are greater than 0.7 and there are no crossloadings. The usual case is that a minimum of three items must load significantly on each factor (Raubenheimer, 2004). So, factors with only two loadings were not be considered for further analysis.

The three factors that were used for further analysis are:

Factor1: Technological content knowledge and TPACK

Factor2: Technology knowledge

Factor3: Technology pedagogy knowledge

After identifying the three factors through EFA, the Cronbach's Alpha measure was computed to determine how well a set of variables measured a single factor. An Alpha value of .6 to .7 is a lenient but acceptable measure of reliability, .7 to .8 is good, and higher than .8 is very good (Field, 2009). All the alpha values were higher than .8. These values also are listed in Table 4.16.

Table 4.16: Summary of factors loaded

Factor	Question (Variable)	Factor loading
Factor 1 TCK and TPACK (Technology Content Knowledge together with pedagogy knowledge) Eigenvalue 4.85 Variance explained = .35.251 Cronbach's Alpha =.855	I know about technologies that I can use for understanding and doing my subject area	.733
	I can use appropriate technologies to represent the content of my subject area	.828
	I can teach lessons that appropriately combine my subject area, technologies and teaching approaches	.862
	I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn	.777
Factor 2 Technology Pedagogy knowledge Eigenvalue 1.81 Variance explained = 13.411% Cronbach's Alpha =.916	I will encourage my students to use Web 2.0 tools to work with other students	.884
	I will encourage my students to use Web 2.0 tools to analyse information with their classmates	.910
	I will encourage my students to use Web 2.0 tools to communicate with other people about their ideas	.859
Factor 3 Technology Knowledge Eigenvalue 1.55 Variance explained = 11.09%, Cronbach's Alpha =.824	I am able to teach my students to use Web 2.0 tools	.854
	I am able to integrate the use of Web 2.0 tools	.820
	I am able to use conferencing software for collaboration	.832

As shown in Table 4.16, Cronbach's Alpha for the four factors range between .75 and .92 indicating a "good" reliability (Field, 2009).

4.3.3 Multiple regression analysis

Multiple regression is a statistical technique that is used to predict scores on one variable based on scores on several other variables. The relationship between various dependent variables (the factor scores obtained from the EFA) and the independent variable intention to use, was examined through multiple regression analysis. Both the Enter and Stepwise methods were used for multiple regression analysis. To address the research question "To what extent does teachers' expertise influence their intention to use Web 2.0 technology in their practice?" the regression techniques used to perform analysis on the data collected were the Enter and Stepwise methods.

Before multiple regression analysis was conducted, assumptions of the multiple regression were checked.

4.3.3.1 Multicollinearity

Multicollinearity is a problem that occurs when there is very high intercorrelations among the independent variables. If multicollinearity is present in the data, the statistical conclusions made about the data may not be reliable. To test for multicollinearity, the VIF and tolerance statistics were examined.

Tolerance refers to the percentage of the variance in a given variable that cannot be explained by the other variables. When the tolerance values are close to 0, there is high multicollinearity and the standard error of the regression coefficients will be inflated. One way to quantify collinearity is with VIF. A VIF greater than 3 is considered to indicate a serious problem of multicollinearity As shown in Table 4.18, the collinearity test for both the tolerance and VIF is equal to 1, which indicates that there is no multicollinearity problem in this study (Jena & Sahoo, 2014).

Outliers were checked by Cook's distance and standardised dfbetas. According to Field (2009), values greater than 1 may be outliers. In the present study, Cook's distance ranged

from .000 to .378 (with a mean of .009) and none of the dfbetas were greater than 1. Hence, no extreme scores affecting the regression analysis were found.

Independent errors assumption was checked by the Durbin-Watson test. The Durbin-Watson value for the present study was 1.794, which was between 1.5 and 2.5 (see Table 4.17). Thus, none of the residuals were correlated.

4.3.3.2 Results with the Enter method

R-Squared and overall significance of the regression

The R-squared of the regression is the fraction of the variation in the dependent variable that is accounted for or predicted by independent variables (DSS - Interpreting Regression Output, (n.d.). The P value tells how confident one can be that independent variables have a linear relationship with the dependent variable and whether the derived regression model either significantly or otherwise predicts the dependent variable (DSS - Interpreting Regression Output, (n.d.).

Table 4.17: Model summary (Enter method)

Model	R	R Squared	Adjusted R Squared	Std Error of the Estimate	Change Statistics					Dubin-Watson
					R Squared Change	F Change	df1	dF2	Sig F change	
1	.902[a]	.814	.811	.337784	.814	264.817	3	182	.000	1.794

Results of regression analysis presented in Table 4.17

Table 4.17 show that the full regression model, with combined predictors (technological content knowledge, TPACK, technology knowledge and technology pedagogy knowledge) was significant in predicting teachers' intention to use Web 2.0 tools in their professional practice with $R = 0.902$, $R^2 = 0.814$, *Adjusted* $R^2 = 0.811$, F (3, 182) =264.817, p<.001. $R = 0.902$ shows the multiple correlation coefficient between the combined predictors and

the dependent variable. The combined predictors accounted for 0.814 in predicting participants' intention to use Web 2.0 tools in their professional practice depicted by R^2. This is interpreted as 81.4% of variance in teachers' intention to use Web 2.0 tools in their professional practice was accounted by technological content knowledge and TPACK, technology pedagogy knowledge and technology knowledge. The value of *Adjusted* R^2 = 0.811 indicates the amount of variance explained by the predictors when the model is applied to another sample in the same population. There was a small drop of 0.003 or 0.3% in validating the model depicted by the difference between *R2* and *Adjusted R2*. The small difference showed that the validation of the model was good.

Table 4.18: Summary of multiple regression analysis (Enter method)

Coefficients[a]								
		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	3.602	.025		145.414	.000		
	TCK and TPACK (Technology content knowledge together with pedagogy knowledge)	.131	.025	.169	5.284	.000	1.000	1.000
	TPK (Technology Pedagogy knowledge)	.146	.025	.188	5.867	.000	1.000	1.000
	TK (Technology Knowledge)	.672	.025	.866	27.058	.000	1.000	1.000

All the three factors made a statistically significant contribution to teachers' intention to use Web 2.0 in professional practice. Technology knowledge made the largest contribution to participants' intention to use Web 2.0 in professional practice. The beta value for this construct was 0.866. Although the overall multiple regression was significant, it was seen that only technology knowledge ($p < .001$) made the greatest contribution to participants' intention to use Web 2.0 in professional practice. To further determine how far the other factors contributed significantly to the model and to confirm the outcome of the multiple regression analysis, the Stepwise method of regression was performed on the three factors.

4.3.3.3 Results with Stepwise method

Stepwise regression is a technique for selecting variables to fit in a multiple regression model in which the choice of predictive variables is carried out by an automatic procedure. In stepwise regression, the variables ending up in the final equation signify the best combination of independent variables to predict the dependent variable (Yu, Yu, Li, & Wang, 2014**)**

Table 4.19: Model summary (Stepwise method)

Model Summary										
				Std. Error of the	Change Statistics					
Model	R	R Square	Adjusted R Square	Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.866[a]	.750	.748	.38931	.750	551.331	1	184	.000	
2	.886[b]	.785	.783	.36183	.035	30.004	1	183	.000	
3	.902[c]	.814	.811	.33784	.029	27.918	1	182	.000	1.794

In Model 1 technology knowledge predicted 74.8% of variance of teachers' intention to use Web 2.0 tools in their professional practice. In Model 2 the combined effect of the two predictors (technology knowledge and technology pedagogy knowledge) raised the variance of participants' intention to use Web 2.0 tools in their professional practice from 74.8% to 78.3%, technology pedagogy knowledge accounting for an increase of 3.5% prediction. In Model 3 the three predictors (technological content knowledge and TPACK, technology pedagogy knowledge and technology knowledge) accounted for 81.4% variance of prediction, the third predictor accounting for an increase of 2.9% prediction.

Table 4.20: Summary of multiple regression analysis (Stepwise method)

Coefficients								
		Unstandardized Coefficients		zed Coefficie			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	3.602	.029		126.190	.000		
	TCK and TPACK (Technology content knowledge together with	.672	.029	.866	23.480	.000	1.000	1.000
2	(Constant)	3.602	.027		135.771	.000		
	TPK (Technology Pedagogy knowle	.672	.027	.866	25.263	.000	1.000	1.000
	TK (Technology Knowledge)	.146	.027	.188	5.478	.000	1.000	1.000
3	(Constant)	3.602	.025		145.414	.000		
	TCK and TPACK (Technology content knowledge together with	.672	.025	.866	27.058	.000	1.000	1.000
	TPK (Technology Pedagogy knowle	.146	.025	.188	5.867	.000	1.000	1.000
	TK (Technology Knowledge)	.131	.025	.169	5.284	.000	1.000	1.000

Although the standard multiple regression has shown that the technology knowledge construct was the largest predictor of teachers' intention to use Web 2.0 tools, the Stepwise regression has shown that technological content knowledge and TPACK and technology pedagogy knowledge accounted for 2.9% and 3.5% respectively variance to teachers' intention to use Web 2.0 tools.

4.4 Predictors for Web 2.0 technology acceptance and intention to use

4.4.1 Exploratory factor analysis

4.4.1.1 To determine the best predictors of teachers' intention to use Web 2.0 tools, the EFA was run for all items constituting the different UTAUT andTPACK

constructs. A PCA was conducted on the 42 variables with orthogonal rotation (Varimax). Test for sampling adequacy and presence of correlations

To determine that assumptions regarding a sufficient sample size and the suitability of the data to factor analysis, the KMO measure of sampling adequacy and Bartlett's Test of sphericity were computed.

Table 4.21: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.823
Bartlett's Test of Sphericity	Approx. Chi-Square	2126.956
	df	153
	Sig.	0.000

As shown in Table 4.23, the Kaiser-Meyer-Olkin (KMO) test for measuring sampling adequacy and Barlett's test of Sphericity gave satisfactory results. . The KMO value (0.823) is greater than 0.7 which means the data is likely to factor well. The data was considered to be fit for factor analysis (Field, 2009; Sahin, 2011). Bartlett's Test has a null hypothesis that the correlation matrix is the identity matrix, which means that the variables are unrelated and, hence, unsuitable for factor analysis. Because the *p* value for Bartlett's Test on the variables was 0.000, the null hypothesis was rejected, and the data is suitable for factor analysis. Both diagnostic tests confirm that the data are suitable for factor analysis.

EFA was run several times, each time removing communalities less than 0.65. Communalities after extraction exceeding 0.7 – being desirable – (Field, 2009), and all communalities less than .65 were removed from the data set. Below is the final list of communalities obtained after extraction.

4.4.1.2 Communalities

Average communality is .806, (which is greater than 0.7) implying that factor analysis can be performed using these data.

Table 4.22: Communalities

	Initial	Extraction
Web 2.0 tools help me teach my subject area	1.000	.806
Using Web 2.0 tools in teaching will enable me to accomplish tasks	1.000	.847
Web 2.0 useful in my teaching	1.000	.767
Web 2.0 tools will reduce my workload	1.000	.836
Web 2.0 tools will enable me to teach at my pace	1.000	.710
I find Web 2.0 tools easy to use	1.000	.808
My interaction with Web 2.0 tools is clear and understandable	1.000	.867
I possess the skills necessary to use Web 2.0 tools	1.000	.827
My institution has provided me all the facilities I need for Web 2.0 tools	1.000	.718
My institution provides incentives to teachers who use Web 2.0	1.000	.852
My institution provides incentives to students who use Web 2.0	1.000	.861
There is technical help available if required while using Web 2.0 tools	1.000	.776
I am able to teach my students to use Web 2.0 tools	1.000	.801
I am able to integrate the use of Web 2.0 tools	1.000	.770
I am able to use conferencing software for collaboration	1.000	.698
I will encourage my students to use Web 2.0 tools to work with other students	1.000	.856

	Initial	Extraction
I will encourage my students to use Web 2.0 tools to analyse information with their classmates	1.000	.905
I will encourage my students to use Web 2.0 tools to communicate with other people about their ideas	1.000	.807

4.4.1.3 Factor analysis

In Table 4.23, six factors have eigenvalues greater than 1.0, which is a common criterion for a factor to be useful (Field, 2009).

Table 4.23: Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.01	33.39	33.39	6.01	33.39	33.39	3.208	17.821	17.821
2	2.734	15.187	48.576	2.734	15.187	48.576	2.664	14.799	32.621
3	1.987	11.041	59.617	1.987	11.041	59.617	2.542	14.123	46.744
4	1.503	8.352	67.969	1.503	8.352	67.969	2.305	12.807	59.55
5	1.231	6.836	74.805	1.231	6.836	74.805	2.237	12.425	71.976
6	1.047	5.815	80.621	1.047	5.815	80.621	1.556	8.645	80.621
7	0.57	3.167	83.787						
8	0.49	2.723	86.51						

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
9	0.401	2.227	88.737						
10	0.338	1.878	90.615						
11	0.297	1.652	92.267						
12	0.263	1.462	93.729						
13	0.26	1.442	95.17						
14	0.231	1.281	96.452						
15	0.205	1.137	97.588						
16	0.187	1.041	98.629						
17	0.126	0.699	99.328						
18	0.121	0.672	100						

Table 4.24: Total Variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.010	33.390	33.390	6.010	33.390	33.390	3.208	17.821	17.821
2	2.734	15.187	48.576	2.734	15.187	48.576	2.664	14.799	32.621
3	1.987	11.041	59.617	1.987	11.041	59.617	2.542	14.123	46.744
4	1.503	8.352	67.969	1.503	8.352	67.969	2.305	12.807	59.550
5	1.231	6.836	74.805	1.231	6.836	74.805	2.237	12.425	71.976

6	1.047	5.815	80.621	1.047	5.815	80.621	1.556	8.645	80.621
7	.570	3.167	83.787						
8	.490	2.723	86.510						
9	.401	2.227	88.737						
10	.338	1.878	90.615						
11	.297	1.652	92.267						
12	.263	1.462	93.729						
13	.260	1.442	95.170						
14	.231	1.281	96.452						
15	.205	1.137	97.588						
16	.187	1.041	98.629						
17	.126	.699	99.328						
18	.121	.672	100.000						

The scree plot in Figure 4.2 supports a six-factor solution to the EFA as shown in Table 4.23 and Table 4.24.

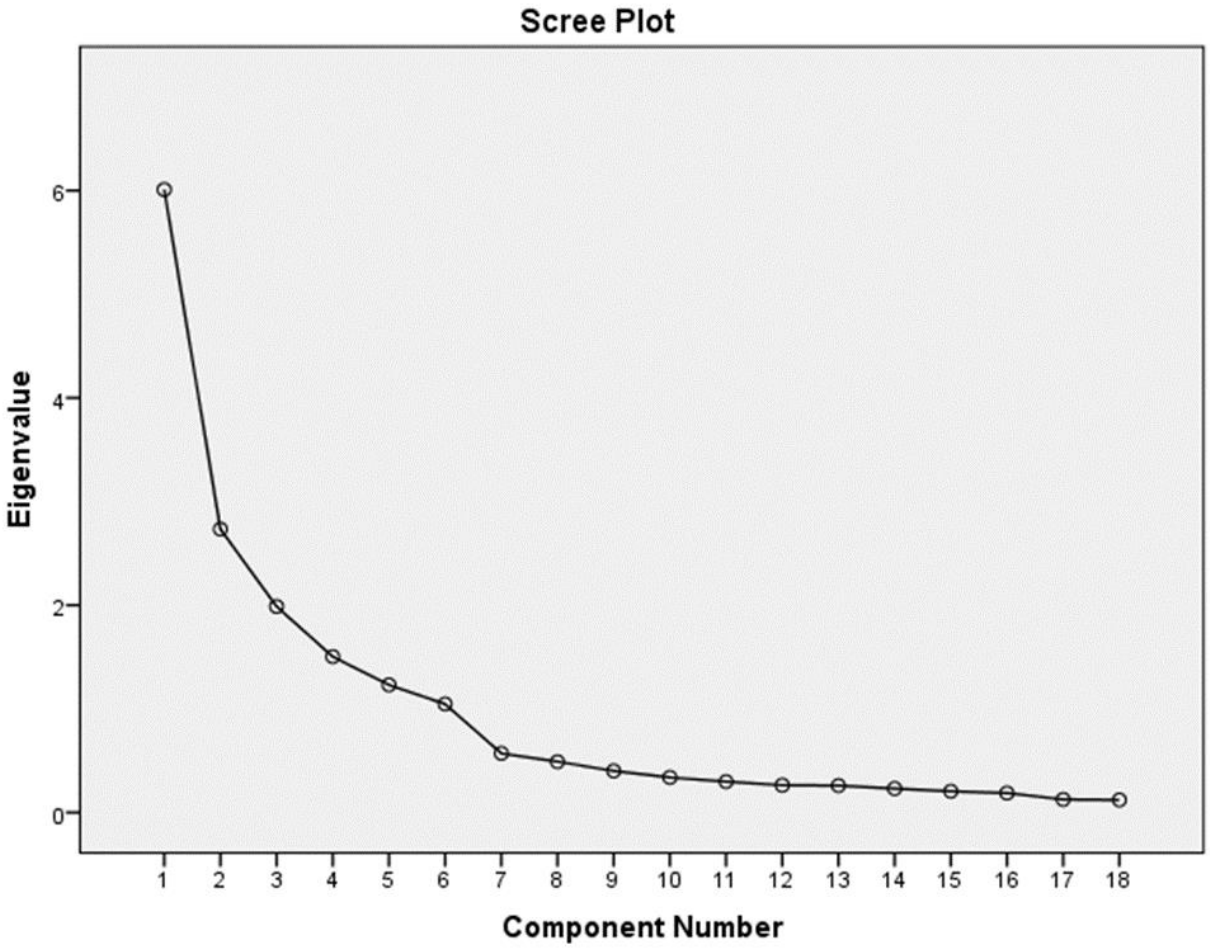

Figure 4.2: Scree Plot

4.4.1.4 Rotated component matrix

Since for each component factor loadings less than 0.4 are ignored (Field, 2009), the table below is displaying only the factor loadings > 0.4. A factor with fewer than three items is generally weak and unstable; 5 or more strongly loading items (.50 or better) are desirable and indicate a solid factor (Costello & Osborne, 2005).

Table 4.25: Rotated component matrix

	Component					
	1	2	3	4	5	6
Web 2.0 tools help me teach my subject area				.842		
Using Web 2.0 tools in teaching will enable me to accomplish tasks				.873		
Web 2.0 useful in my teaching				.766		
Web 2.0 tools will reduce my workload						.881
Web 2.0 tools will enable me to teach at my pace						.715
I find Web 2.0 tools easy to use			.857			
My interaction with Web 2.0 tools is clear and understandable			.899			
I possess the skills necessary to use Web 2.0 tools			.866			
My institution has provided me all the facilities I need for Web 2.0 tools	.817					
My institution provides incentives to teachers who use Web 2.0	.889					
My institution provides incentives to students who use Web 2.0	.912					
There is technical help available if required while using Web 2.0 tools	.849					
I am able to teach my students to use Web 2.0 tools					.840	
I am able to integrate the use of web 2.0 tools					.794	
I am able to use conferencing software for collaboration					.789	
I will encourage my students to use web 2.0 tools to work with other students		.875				
I will encourage my students to use web 2.0 tools to analyse information with their classmates		.907				
I will encourage my students to use web 2.0 tools to communicate with other people about their ideas		.878				
Web 2.0 tools help me teach my subject area				.842		

Using Web 2.0 tools in teaching will enable me to accomplish tasks				.873		

As shown in the Table 4.25, all factor loadings are greater than 0.7 and there are no crossloadings. The usual case is that a minimum of three items must load significantly on each factor (Raubenheimer, 2004). So, factors with only two loadings were not be considered for further analysis. Only the first five factors have been considered for further analysis.

Factor1: Facilitating conditions

Factor2: Technology pedagogy knowledge

Factor3: Ease of use

Factor4: Perceived usefulness

Factor5: Technology knowledge

After identifying the five factors through EFA, the Cronbach's Alpha measure was computed to determine how well a set of variables measured a single factor.

Table 4.26: Factors loaded

Factor	Question (Variable)	Factor loading
Factor1 Facilitating Conditions) Eigenvalue: 6.010 Variance explained = 33.390% Cronbach's Alpha =.910	My institution has provided me all the facilities I need for Web 2.0 tools	.817
	My institution provides incentives to participants who use Web 2.0	.889
	My institution provides incentives to students who use Web 2.0	.912
	There is technical help available if required while using Web 2.0 tools	.849

Factor	Question (Variable)	Factor loading
Factor 2 Technology Pedagogy knowledge Eigenvalue: 2.734 Variance explained = 15.187% Cronbach's Alpha =.916	I will encourage my students to use Web 2.0 tools to work with other students	.875
	I will encourage my students to use Web 2.0 tools to analyse information with their classmates	.907
	I will encourage my students to use Web 2.0 tools to communicate with other people about their ideas	.878
Factor3 Ease of Use) Eigenvalue 1.55 Variance explained = 11.09%, Cronbach's Alpha =.824	I find Web 2.0 tools easy to use	.857
	My interaction with Web 2.0 tools is clear and understandable	.899
	I possess the skills necessary to use Web 2.0 tools	.866
Factor4 Perceived usefulness	Web 2.0 tools help me teach my subject area	.842
	Using Web 2.0 tools in teaching will enable me to accomplish tasks	.873
	Web 2.0 useful in my teaching	.766
Factor5 Technology Knowledge	I am able to teach my students to use Web 2.0 tools	.840
	I am able to integrate the use of Web 2.0 tools	.794

Factor	Question (Variable)	Factor loading
	I am able to use conferencing software for collaboration	.789

4.4.2 Multiple regression analysis

To answer the research question "What are the best predictors of Web 2.0 technology acceptance and participants' intention to use Web 2.0 tools in their professional practice?" the regression techniques used to perform analysis on the data collected were the Enter and Stepwise methods.

Before multiple regression analysis was conducted, assumptions of the multiple regression were checked.

Multicollinearity: A VIF greater than 3 is considered to indicate a serious problem of multicollinearity. As shown in Table 4.23 the collinearity test for both the tolerance and VIF is equal to 1, which indicates that there is no multicollinearity problem in this study (Jena & Sahoo, 2014).

Outliers were checked by Cook's distance and standardised Dfbetas. According Field (2009), values greater than 1 may be outliers. In the present study, Cook's distance ranged from .000 to .196 (with a mean of .007) and none of the Dfbetas were greater than 1. Hence, no extreme scores affecting the regression analysis were found.

Independent errors assumption was checked by the Durbin-Watson test. The Durbin-Watson value for the present study was 1.832, which was between 1.5 and 2.5. Thus, none of the residuals were correlated.

4.4.3 The Enter method

Table 4.27: Model summary (Enter method)

Model	R	R Squared	Adjusted R Squared	Std Error of the Estimate	Change Statistics					Dubin-Watson
					R Squared Change	F Change	df1	dF2	Sig F change	
1	.922[a]	.850	.846	.30426	.850	204,769	5	180	.000	1.83

Results of regression analysis presented in Table 4.28 indicate that the full regression model, with combined predictors facilitating conditions, technology pedagogy knowledge, ease of use, perceived usefulness and technology knowledge was significant in predicting participants' intention to use Web 2.0 tools in their professional practice with $R = 0.922$, $R^2 = 0.850$, *Adjusted R2* = 0.846, F (5, 180) =204.769, p<.001. $R = 0.922$ shows the multiple correlation coefficient between the combined predictors and the dependent variable. The combined predictors accounted for 0.850 in predicting in-service participants' intention to use Web 2.0 tools in their professional practice depicted by R Square (*R2*). This is interpreted as 85.0% of variance in participants' intention to use Web 2.0 tools in their professional practice was accounted by Facilitating Conditions, Technology Pedagogy Knowledge, ase of Use, Perceived Usefulness and Technology Knowledge. The value of *Adjusted R2* = 0.846 indicates the amount of variance explained by the predictors when the model is applied to another sample in the same population. There was a small drop of 0.004 or 0.4% in validating the model depicted by the difference between R^2 and *Adjusted* R^2. The small difference showed that the validation of the model was good.

Table 4.28: Summary of multiple regression analysis (Enter method)

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.602	.022		161.461	.000		
	Factor1: FC (Facilitating conditions)	.138	.022	.177	6.153	.000	1.000	1.000
	Factor2: TPK (Technology Pedagogy knowledge)	.161	.022	.207	7.195	.000	1.000	1.000
	Factor3: EU (Ease of Use)	.148	.022	.190	6.600	.000	1.000	1.000
	Factor4: PU (Perceived Usefulness)	.110	.022	.141	4.909	.000	1.000	1.000
	Factor5: TK (Technology Knowledge)	.659	.022	.848	29.438	.000	1.000	1.000

It can be seen from Table 4.28, a summary of the multiple regression analysis, all the five factors made a statistically significant contribution to teachers' intention to use Web 2.0 in professional practice and that technological knowledge made the largest contribution to participants' intention to use Web 2.0 in professional practice. The beta value for this construct was 0.848. Although the overall multiple regression was significant, it was seen that only technology knowledge ($p < .001$) made the greatest contribution to teachers' intention to use Web 2.0 in professional practice. To further determine how far the other factors contributed significantly to the model and to confirm the outcome of the multiple regression analysis, the Stepwise method of regression was performed on the five factors

4.4.4 Stepwise method

Table 4.29: Model summary (Stepwise method)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.848[a]	.720	.718	.41194	.720	472.762	1	184	.000	
2	.873[b]	.763	.760	.38004	.043	33.179	1	183	.000	
3	.894[c]	.799	.796	.35081	.036	32.765	1	182	.000	
4	.911[d]	.830	.827	.32309	.031	33.572	1	181	.000	
5	.922[e]	.850	.846	.30426	.020	24.094	1	180	.000	1.832

In Model 1 technology knowledge predicted 71.8% of variance of teachers' intention to use Web 2.0 tools in their professional practice. In Model 2 the combined effect of the two predictors technology knowledge and technology pedagogy knowledge raised the variance of teachers' intention to use Web 2.0 tools in their professional practice from 72.0% to 76.0%, technology pedagogy knowledge accounting for an increase of 4.2% prediction. In Model 3 the three predictors technology knowledge, technology pedagogy knowledge and ease of use accounted for 79.6% variance of prediction, the third predictor accounting for an increase of 3.6% prediction. In Model 4 the four predictors technology knowledge, technology pedagogy knowledge, ease of use and facilitating conditions accounted for 82.7% variance of prediction, the fourth predictor accounting for an increase of 3.1% prediction. In Model 5 the five predictors technology knowledge, technology pedagogy knowledge, ease of use, facilitating conditions and perceived usefulness accounted for 84.6% variance of prediction, the fifth predictor accounting for an increase of 2.9% prediction.

The Stepwise regression has shown that the five predictors technology knowledge, technology pedagogy knowledge, Ease of Use, facilitating conditions and perceived usefulness accounted for 72.0% ,4.2%, 3.6%, 3.1% and 2.9% respectively variance to teachers' intention to use Web 2.0 tools.

Table 4.30: Summary of multiple regression analysis (Stepwise method)

Model		Unstandardized coefficients		Standardized coefficients	t	sig	Collinearity statistics	
		B	Std. Error	Beta			tolerance	VIF
1	(Constant)	3.602	.030		119.258	.000		
	Factor 5: TK (technology knowledge)	.659	.030	.848	21.743	.000	1.000	1.000
2	(Constant)	3.602	.028		129.266	.000	1.000	1.000
	Factor 5: TK (technology knowledge)	.659	.028	.848	23.568	.000		
	Factor 2: TPK(technology pedagogy knowledge)	.161	0.28	.207	5.760	.000	1.000	1.000
3	(Constant)	3.602	.026		140.036	.000		
	Factor5: TK (technology knowledge)	.659	.026	.848	25.531	.000	1.000	1.000
	Factor2: TPK (technology pedagogy knowledge)	.161	.026	.207	6.240	.000	1.000	1.000
	Factor3: EU(ease of use)	.148	.026	.190	5.724	.000	1.000	1.000
4	(Constant)	3.602	.024		152.052	.000		
	Factor 5: TK (technology knowledge)	.659	.024	.848	27.722	.000	1.000	1.000
	Factor2: TPK (technology pedagogy knowledge)	.161	.024	.207	6.775	.000	1.000	1.000
	Factor 3:EU (ease of use)	.148	.024	.190	6.215	.000	1.000	1.000
	Factor 1: FC (facilitating conditions)	.138	.024	.177	5.724	.000	1.000	1.000
5	(Constant)	3.602	.022		161.461	.000		
	Factor 5: TK(technology knowledge)	.659	.022	.848	29.438	.000	1.000	1.000
	Factor 2: TPK(technology pedagogy knowledge)	.161	.022	.207	7.195	.000	1.000	1.000
	Factor 3: EU (ease of use)	.148	.022	.190	6.600	.000	1.000	1.000
	Factor1:FC (facilitating conditions)	.138	.022	.177	6.153	.000	1.000	1.000
	Factor4 : PU(perceived usefulness)	.110	.022	.141	4.909	.000		

4.5 Relationship between the UTAUT constructs and the TPACK constructs

The UTAUT is about technology acceptance and use of technology while the TPACK is about technology, pedagogy and content knowledge. The researcher has used Pearson's coefficient of correlation to find a statistically significant relationship between the UTAUT constructs and the TPACK constructs.

There was no significant relationship between the UTAUT constructs (perfomance expectation, effort expectation, social influence and facilitating conditions) and the TPACK constructs content knowledge and PK.

Table 4.31: Correlation of performance expectancy and the TPACK constructs

		TK1	TK2	TK3	TK4	TPK1	TPK2	TPK3	PCK1	PCK2	TCK1	TCK2	TPACK1	TPACK2
PE1	Pearson Correlation	.232**	.133	.169*	.136	.323**	.308**	.265**	.272**	.185*	.222**	.142	.142	.119
	Sig. (2-tailed)	.001	.071	.021	.065	.000	.000	.000	.000	.011	.002	.054	.053	.106
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
PE2	Pearson Correlation	.248**	.192**	.178*	.205**	.426**	.413**	.359**	.336**	.270**	.319**	.183*	.229**	.136
	Sig. (2-tailed)	.001	.008	.015	.005	.000	.000	.000	.000	.000	.000	.012	.002	.063
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
PE3	Pearson Correlation	.194**	.105	.100	.008	.351**	.380**	.416**	.307**	.221**	.337**	.212**	.233**	.158*
	Sig. (2-tailed)	.008	.154	.175	.915	.000	.000	.000	.000	.002	.000	.004	.001	.032
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
PE4	Pearson Correlation	.048	.138	.180*	.246**	.254**	.250**	.190**	.248**	.126	.228**	.298**	.251**	.219**
	Sig. (2-tailed)	.518	.060	.014	.001	.000	.001	.009	.001	.086	.002	.000	.001	.003
	N	186	186	186	186	186	186	186	186	186	186	186	186	186

		TK1	TK2	TK3	TK4	TPK1	TPK2	TPK3	PCK1	PCK2	TCK1	TCK2	TPACK1	TPACK2
PE5	Pearson Correlation	.096	.185*	.238**	.229**	.426**	.412**	.296**	.351**	.273**	.325**	.296**	.253**	.301**
	Sig. (2-tailed)	.193	.011	.001	.002	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
PE6	Pearson Correlation	.132	.279**	.393**	.264**	.384**	.400**	.302**	.341**	.326**	.419**	.407**	.374**	.378**
	Sig. (2-tailed)	.072	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
PE7	Pearson Correlation	.257**	.155*	.182*	.182*	.337**	.336**	.325**	.331**	.239**	.284**	.250**	.346**	.312**
	Sig. (2-tailed)	.000	.035	.013	.013	.000	.000	.000	.000	.001	.000	.001	.000	.000
	N	186	186	186	186	186	186	186	186	186	186	186	186	186

As can be seen in Table 4.31 not all the performance expectancy (PE1 to PE7) constructs had a significant relationship with Technology knowledge. However, all these constructs (PE1 to PE7) appears to correlate with technology pedagogy knowledge, PCK, technological content knowledge and TPACK.

Table 4.32: Correlation of effort expectancy and the TPACK constructs

		TK1	TK2	TK3	TK4	TPK1	TPK2	TPK3	PCK1	PCK2	TCK1	TCK2	TPACK1	TPACK2
EE1	Pearson Correlation	.240**	.198**	.238**	.248**	.240**	.234**	.235**	.248**	.191**	.221**	.281**	.388**	.242**
	Sig. (2-tailed)	0.001	0.007	0.001	0.001	0.001	0.001	0.001	0.001	0.009	0.002	0	0	0.001
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
EE2	Pearson Correlation	.276**	.298**	.262**	.183*	.318**	.328**	.287**	.284**	.219**	.305**	.241**	.438**	.272**
	Sig. (2-tailed)	0	0	0	0.013	0	0	0	0	0.003	0	0.001	0	0
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
EE3	Pearson Correlation	.327**	.235**	.230**	.221**	.212**	.167*	.175*	.227**	.170*	.267**	.395**	.531**	.302**
	Sig. (2-tailed)	0	0.001	0.002	0.002	0.004	0.023	0.017	0.002	0.021	0	0	0	0
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
EE4	Pearson Correlation	.235**	.262**	.222**	.195**	.233**	.227**	0.133	.263**	.239**	.327**	.429**	.500**	.313**
	Sig. (2-tailed)	0.001	0	0.002	0.008	0.001	0.002	0.07	0	0.001	0	0	0	0
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
EE5	Pearson Correlation	.280**	.303**	.210**	.310**	.188*	.182*	0.13	.244**	.152*	.314**	.384**	.412**	.218**
	Sig. (2-tailed)	0	0	0.004	0	0.01	0.013	0.076	0.001	0.038	0	0	0	0.003
	N	186	186	186	186	186	186	186	186	186	186	186	186	186

As shown in Table 4.32, all the constructs of effort expectancy seem to correlate with all the TPACK constructs except for content knowledge and pedagogical knowledge.

Social influence has little correlation with technology knowledge and technology pedagogy knowledge.

Table 4.33: Correlation of social influence and the TPACK constructs

		TK1	TK2	TK3	TK4	TPK1	TPK2	TPK3	PCK1	PCK2	TCK1	TCK2	TPACK1	TPACK2
SI1	Pearson Correlation	0.13	.206**	.275**	.189**	.169*	.219**	.206**	0.088	0.033	0.09	0.134	0.134	0.109
	Sig. (2-tailed)	0.077	0.005	0	0.01	0.021	0.003	0.005	0.23	0.654	0.222	0.069	0.068	0.137
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
SI2	Pearson Correlation	0.13	.182*	.215**	.177*	.193**	.196**	.179*	.145*	0.088	0.109	.158*	.192**	.200**
	Sig. (2-tailed)	0.077	0.013	0.003	0.016	0.008	0.007	0.014	0.048	0.231	0.139	0.031	0.009	0.006
	N	186	186	186	186	186	186	186	186	186	186	186	186	186

Table 4.34: Correlation of facilitating conditions and the TPACK constructs

		TK1	TK2	TK3	TK4	TPK1	TPK2	TPK3	PCK1	PCK2	TCK1	TCK2	TPACK1	TPACK2
FC1	Pearson Correlation	0.023	.258**	.393**	.279**	.179*	.163*	0.114	0.03	0.089	0.074	.172*	0.087	0.113
	Sig. (2-tailed)	0.75	0	0	0	0.014	0.026	0.123	0.684	0.227	0.318	0.019	0.237	0.124
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
FC2	Pearson Correlation	0.052	.312**	.337**	.274**	.195**	.189**	.176*	0.116	0.136	.165*	.187*	0.098	.175*
	Sig. (2-tailed)	0.48	0	0	0	0.008	0.01	0.016	0.115	0.065	0.024	0.011	0.182	0.017
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
FC3	Pearson Correlation	0.011	.333**	.353**	.335**	.155*	.163*	0.138	0.043	0.097	.157*	.205**	0.126	.179*
	Sig. (2-tailed)	0.878	0	0	0	0.035	0.026	0.06	0.563	0.189	0.032	0.005	0.085	0.014
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
FC4	Pearson Correlation	0.017	.296**	.364**	.283**	.155*	.154*	0.112	-0.01	0.063	0.129	.176*	0.098	0.139
	Sig. (2-tailed)	0.822	0	0	0	0.034	0.036	0.127	0.856	0.393	0.079	0.017	0.184	0.058
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
FC5	Pearson Correlation	0.117	.282**	.367**	.221**	0.123	.145*	0.109	0.065	0.07	0.092	0.126	0.087	.144*
	Sig. (2-tailed)	0.113	0	0	0.002	0.094	0.049	0.139	0.379	0.341	0.209	0.087	0.237	0.05
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
FC6	Pearson Correlation	0.096	.220**	.310**	.207**	.321**	.304**	.290**	.210**	0.139	.240**	.180*	0.131	.210**
	Sig. (2-tailed)	0.194	0.003	0	0.005	0	0	0	0.004	0.058	0.001	0.014	0.074	0.004
	N	186	186	186	186	186	186	186	186	186	186	186	186	186

Only the construct Technology Knowledge appears to have some significant correlation with facilitating conditions of the UTAUT construct.

Table 4.35: Correlation of intention to use and the TPACK constructs

		TK1	TK2	TK3	TK4	TPK1	TPK2	TPK3	PCK1	PCK2	TCK1	TCK2	TPACK1	TPACK2
BI1	Pearson Correlation	.146*	.339**	.389**	.285**	.399**	.358**	.311**	.164*	.186*	.193**	0.015	0.104	.183*
	Sig. (2-tailed)	0.047	0	0	0	0	0	0	0.026	0.011	0.008	0.837	0.157	0.012
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
BI2	Pearson Correlation	.157*	.327**	.368**	.266**	.426**	.367**	.336**	.237**	.208**	.195**	0.096	0.116	.251**
	Sig. (2-tailed)	0.032	0	0	0	0	0	0	0.001	0.004	0.008	0.195	0.116	0.001
	N	186	186	186	186	186	186	186	186	186	186	186	186	186
BI3	Pearson Correlation	0.109	.397**	.417**	.192**	.448**	.444**	.361**	.165*	.204**	.163*	0.067	0.09	.228**
	Sig. (2-tailed)	0.139	0	0	0.009	0	0	0	0.024	0.005	0.026	0.361	0.222	0.002
	N	186	186	186	186	186	186	186	186	186	186	186	186	186

The construct intention to use seem to correlate mostly with technology knowledge and technology pedagogy knowledge.

The data analysis has shown that there was no significant relationship between the UTAUT constructs (perfomance expectation, effort expectation, social influence and facilitating conditions) and the TPACK constructs content knowledge and pedagogy knowledge. This might be due to the fact that these two constructs do not have a technology component.

All the Performance Expectancy (PE1 to PE7) constructs and effort expectancy (EE1 to EE5) had a significant relationship with all the TPACK constructs (technology knowledge, technology pedagogy knowledge, PCK, technological content knowledge and TPACK) except for content knowledge and PK. A surprising finding was the association between performance expectancy and PCK and effort expectancy and PCK. PCK is only about pedagogy and content knowledge and has no technology component. One explanation could be that the participants have already acquired this type of knowledge since the participants are in-service teachers. The participants who reported having higher levels of PCK might be more

likely to find Web 2.0 tools easy to use or perceive the usefulness Web 2.0 tools for teaching and learning.

Social influence has little correlation with technology knowledge and technology pedagogy knowledge.

Only the construct technology knowledge appears to have some significant correlation with facilitating conditions. This finding implies that the more facilitating conditions exist, the more likely for technology knowledge to increase.

The construct intention to use seem to correlate mostly with technology knowledge and PK. This finding implies that as technology knowledge and technology pedagogy knowledge increases, the intention to use technology increases as well.

4.6 Summary

This chapter examined and reported the findings from the research survey questionnaire on in-service participants, use of Web 2.0 tools, their perceptions on use of Web 2.0 tools for teaching purposes and the best predictors of teachers' intention to use Web 2.0 tools in teaching. The majority of the participants were female, representing 67.7% (n=126) of the sample, while males represented only 32.3% (n=60). Most of the participant (36.6%) fell into the 26–30 age group. The 31–35 age group constituted 31.7% of the sample, with 22.0% in the 21–25 age group. There was no respondent in the age group 46–50. The respondents were mostly digital natives, and more than 90% were less than 36 years of age. Seventy-nine percent of the participants had a bachelor's degree (n=147) while 20.4% of the participants had a master's degree (n=38); 55.4% of the participants had been teaching for one to five years (n=103), while 33.3% of the participants had been teaching between six and 10 years (n=62). These statistics illustrate that the majority of participants have been in the teaching profession for less than six years. The participants taught a wide range of subjects including Arts and Design, Biology, Business Studies, Chemistry, Computer studies, Economics, English, French, Home Economics, Mathematics, Oriental language, Physical Education, Physics, Social Studies and Travel.

Social networking sites were the Web 2.0 technology most commonly used by the participants (81.7% of the participants reported daily or weekly use) in their personal lives. More than 60% of the participants reported daily or weekly use of the other Web tools). Wikis were the Web 2.0 technology most commonly used by the participants (60.7% of the participants reported daily or weekly use) in their professional practice. More than 58.6% of the participants reported daily or weekly use of Google Apps and Multimedia. Almost one-third of the number of participants did not use other Web 2.0 services for their professional practice (30.6% of the participants reported not using file hosting services and 36.6% not using social networking).

The participants had positive perceptions towards use of Web 2.0 tools in teaching. For the first four items 78.5% to 85.5% of the participants strongly agreed or agreed with the expressed usefulness of Web 2.0 technologies in teaching. For items 5, 6, 7 and 8, responses were slightly lower, with only 54.3% to 67.2% of the participants showing strong agreement or agreement. For items 9,10,11,12 and 13 responses were quite high, with 64.5% to 73.1% indicating strong agreement or agreement about their self-efficacy beliefs about use of Web 2.0 tools.

The participants scored high means for all the various constructs of TPACK with their lowest mean score being 3.6 for the technology knowledge construct. The participants' high mean scores showed that they agreed to most of the items on the different constructs and therefore had high consciousness of their knowledge of the constructs of TPACK. Content knowledge, PCK and pedagogical knowledge had the highest mean scores, implying that the participants had more knowledge in the content and pedagogy constructs.

An EFA was run for all items constituting the different TPACK constructs and yielded three factors, namely technological content knowledge and TPACK, technology pedagogy knowledge and technology knowledge. Multiple regression analysis on the regression scores obtained from the EFA revealed that the technology knowledge construct accounted for 74.8% variance of prediction of the teachers' intention to use Web 2.0 tools. The Stepwise regression had also shown

that technology pedagogy knowledge and technological content knowledge and TPACK and accounted for variances of 3.5% and 2.9% respectively in participants' intention to use Web 2.0 tools.

An EFA was run for all items constituting the different UTAUT and TPACK constructs and yielded five factors, namely facilitating conditions, technology pedagogy knowledge, ease of use, perceived usefulness and technology knowledge. Multiple regression analysis on the regression scores obtained from the EFA revealed that the five predictors technology knowledge, technology pedagogy knowledge, ease of use, facilitating conditions and perceived usefulness accounted for variances of 72.0% ,4.2%, 3.6%, 3.1% and 2.9% respectively in the teachers' intention to use Web 2.0 tools.

The data analysis has shown that there was no significant relationship between the UTAUT constructs and the TPACK constructs content knowledge and pedagogical knowledge. This might be due to the fact that these two constructs do not have a technology component. All the performance expectancy (PE1 to PE7) constructs and effort expectancy (EE1 to EE5) had a significant relationship with all the TPACK constructs, except for content knowledge and pedagogical knowledge. Social Influence had little correlation with technology knowledge and technology pedagogy knowledge. Only the construct technology knowledge appeared to have some significant correlation with facilitating conditions. This finding implies that the more facilitating conditions exist, the more likely for technology knowledge to increase. The construct intention to use seemed to correlate mostly with technology knowledge and technology pedagogy knowledge. This finding implies that as technology knowledge and technology pedagogy knowledge increase, the intention to use technology increases as well.

5 Qualitative analysis

5.1 Introduction

The purpose of the qualitative data in the present study is to validate, and clarify the meaning of, quantitative results. The aim of this chapter is to analyse the qualitative data obtained through interviews of 15 teachers who have already responded to the survey questionnaire on teachers' use of Web 2.0 tools, their perceptions of Web 2.0 tools in teaching and their intention to use Web 2.0 tools in their current practice. Prior to the analysis of interview data, a description of the sampling and the qualitative data analysis is given. Transcripts of 15 interviews were collected and analysed. The interview transcripts were coded using inductive analysis. Patterns, themes and categories of analysis stemmed from the interview data (Patton, 1990). Qualitative data analysis results comprise explanation of the semi-structured interviews, theme and category elaboration, analysis of each theme and the participants' dissimilar opinions on some themes.

5.2 Sampling

Respondents to the survey questionnaire were invited to provide their contact details in case they volunteered to participate in a follow-up interview. Those who responded positively were asked to provide their contact details. Thirty-one respondents indicated agreement to an interview on the survey form. From the pool of 31 respondents agreeing to attend an interview, only 15 presented themselves for the interview. The purpose of the interviews was to enrich the understanding of the quantitative findings (Creswell, 2013). Interviews were conducted in order to best assist understanding (Creswell, 2013) of teachers' current usage of Web 2.0 tools, their perceptions of the implementation of Web 2.0 tools in teaching and learning, and the factors which influence teachers' use of these tools.

5.3 Data collection

Data were collected using semi-structured interviews on teachers' perceptions and use of Web 2.0 tools for teaching and learning. In addition, interviews, guided by open-ended questions, were conducted to identify factors influencing the intention

to use Web 2.0 tools for teaching and learning. Appendix F contains a schedule of interview questions where an instrument to guide the interviews was elaborated based on the results of the quantitative data analysis and related literature. For example, the construct perceived usefulness has the highest mean (4.00) and participants were asked: *Not all respondents to the survey felt that Web 2.0 tools were very useful for teaching. Could you tell me more about the usefulness of Web technology in teaching?* Such guiding questions served to keep focus on information of interest and hinted for prompts and probing questions aimed at explaining the quantitative responses to the survey. The interview survey instrument was pilot tested on two teachers. Response from the pilot test assisted in the amendment of the interview schedule in order to make questions easily understood by teacher interviewees and to ensure that interviews could be finished within 20 to 30 minutes. The interview instrument focused on three parts:

- Gaining insight and information on teachers' personal and professional use of Web 2.0;
- Getting a deeper knowledge of the use and perceptions of using Web 2.0 tools for teaching and learning; and
- Web 2.0 tools attributes and barriers to using Web 2.0 tools for learning.

The 15 interviews lasted between 15 and 25 minutes. The researcher conducted and recorded the interviews. All interviews were then word processed. The interview data was analysed using the six steps described in Creswell (2003). Data was analysed manually.

5.4 Data analysis

5.4.1 Themes

The word-processed interview data was searched for recurring opinions and a code allocated to each theme that might come out from them. The likelihood that an opinion is significant increases with the number of times the opinion recurs. The researcher searched for phrases representing opinions that related to his research

and coded them in themes. The researcher tried to create themes that were both descriptive and explanatory.

The coding for all the interview transcripts was reviewed so to address possible changes in the researcher's view on theme properties. The themes that emerged from the interviews are outlined in Table 5.1.

Table 5.1: Themes identified in interview analysis

Lack of technology knowledge
Students' misuse of Web tools
Lack of resources
Lack of time
Professional development
Technological support
Pedagogical use of technology
Social interaction
Efficient use of class time
Teaching of abstract concepts
Motivation
Autonomous learner
Accessibility
Development of collaboration skills

In the next section, the themes identified as being related to the use of Web 2.0 tools for learning are classified by category.

5.4.2 Categories

Using a naturalistic approach (Denzin & Lincoln, 2011; Merriam, 2008), the interview data were translated using inductive content analysis because of its ability to help a researcher to maintain the original meaning of interview responses. The researcher used the constant comparative method for the development of themes and categories. This involved comparing each theme and category with existing ones as it emerged from the data analysis. Each theme was then further scrutinised to elaborate central themes or categories in which the themes would relate. Four thematic categories (Table 5.2) emerged: barriers, enabling factors, perceived pedagogical benefits and usefulness. These categorised themes were then translated and brought together to produce descriptive statements helpful in understanding teachers' perceptions of use of Web 2.0 tools in teaching and learning.

Table 5.2: Categories and themes

Category	Themes
Barriers	Lack of technology knowledge
	Students' misuse of Web tools
	Lack of resources
	Lack of time
Enabling factors	Professional development
	Technological support
	Pedagogical use of technology

Category	Themes
Perceived pedagogical benefits	Efficient use of class time
	Teaching of abstract concepts
	Motivation
	Autonomous learner
	Development of collaboration skills
Usefulness	Accessibility
	Social interaction

5.4.2.1 Barriers

This category comprises four themes: lack of technology knowledge, misuse of Web 2.0 tools, lack of resources and lack of time. To identify barriers to using Web 2.0 tools for learning, the participants were asked questions such as:

What are the reasons, do you think, for teachers not to use Web 2.0 tools in their professional practice?

Is there anything that makes you reluctant to use your Web 2.0 tools for teaching and learning?

5.4.2.1.1 Lack of technology knowledge

According to the participants, many teachers had little knowledge of the range of Web 2.0 tools that were available and, because of this, had not been able to form an opinion on the potential of these tools to enhance their teaching and the learning of their students. This is apparent in the following responses.

If teachers don't use Web 2.0 tools, there is only one reason: They don't know how to use them. It is not that they don't want to use it. Rather they don't have the proper knowledge about technology [Participant 8]

Teachers are not using technology because they are not aware of the benefits of using online tools. This is pointed out by the comments below.

Many teachers are not aware of the facilities of these Web 2.0 tools, for example I often use Google Drive which is a very capable tool where you can upload all your notes and access it everywhere. If these teachers are made aware of these tools, I am sure they would like these tools very often and especially if Internet is accessible everywhere. [Participant 3]

If teachers don't use Web 2.0 tools there is only one reason: They don't know how to use them. They are not aware of the potentials of these tools in education. If teachers are empowered properly, I think they will make use of these tools. [Participant 9].

Some participants in this study reported that despite having advanced technology skills they often had trouble in keeping pace with the rapid development of technology.

It is very important for a teacher to keep pace with any new development in technology. As such, I must always keep myself updated with the latest technology to be able to take advantage of these media to make learning relevant to this generation of young learners. [Participant 10]

These Web tools keep changing, with newer version each time. One is not yet well accustomed to the current tools and you see new things being added. You must constantly update yourself to be able to follow the trend [Participant 11]

Teachers do not know how to use these tools properly and how to use these tools efficiently in terms of pedagogy, how to make them implement these tools, how to teach, impart knowledge, how to deliver or share information on a platform that is available to everyone today. [Participant 6].

5.4.2.1.2 Students' misuse of Web 2.0 tools

5.4.2.1.2.1 Technology distraction

The participants reported concerns about the use of wireless networks, computers, smartphones and other digital devices which may lead to some students indulging in some activities that are not necessarily relevant to the class. These fears are due to the fact that the participants might not be clear about what would be happening in their classroom since while they would be writing on the board. Also, students could be listening to music, texting others, playing games or even connect with people outside the classroom. This is expressed in the quotes below.

> *Using technology and social media with thirty-five students in a class with Internet access can be extremely challenging for managing the class. When the Internet is available to students in class, they can engage in activities that are not linked with their studies. For example, chatting with friends on social networking sites or playing online games. Dealing with such kind of misbehaviours in classes would take much of your teaching time. [Participant 4].*

> *My biggest concern is whether students will really adopt social media as a learning tool during the class or they might use it for other purposes. For example, while doing some collaborative work with their peers or instead of downloading the files that the teacher has shared for discussion, students may be seizing the opportunity of being online to communicate with their online friends or play games. Managing such classes can be problematic. [Participant 3]*

> *I think bringing social media in class is a potential for distractions. How can you prevent some students from indulging in their favourite past-times like playing online games or chatting with online friends or responding to posts? [Participant 9]*

> *Social media like Facebook is primarily designed as a social networking tool. So, use of Facebook in class might result in students spending more time in off-topic discussion with online friends. The, students may have some difficulty balancing their online learning activities and their other non-learning or leisure activities. [Participant 11]*

5.4.2.1.2.2 Inappropriate use of Web 2.0 tools

Several participants expressed fear and anxiety about using online tools for teaching and learning. This is because students may have access to teachers' personal information through social networking sites. This is illustrated in in the comment below.

> *The nature of social media itself is that it allows individuals to post whatever they want, without any restrictions. If you have some kids who are not very happy with you right now, they can voice their frustrations on Facebook and everybody sees the nasty comments they may publish on you. [Participant 6]*

Some participants reported that students rely too much on technology. Participant 13 reported on students' over-reliance on technology.

> *I'm afraid that children are so technology obsessive that they just do not read books or papers and that they need some type of animation or digital to understand things. Also, students love to copy paste, not thinking this is plagiarism. [Participant 13]*

Some participants were apprehensive about the potential for students accessing inappropriate content access to inappropriate content. For example, for Participant 4:

> *Just a Google search for an image can bring up something that they should not see. [Participant 4]*

Privacy was also another concern for the participants. This can be seen in the comments below.

> *Students can misuse our pictures or publish anything on us which can ruin our reputation as a teacher. We can't trust anyone. [Participant 1]*

> *With Skype there is not much problem. If Facebook yes because students can misuse identity, personality, publish photos where it should not be and information to others. [Participant 2]*

5.4.2.1.3 Lack of resources

The most cited worries of the participants were the lack of access to up-to-date technological resources. This is attested to in the comments below:

> *All students need equitable access to appropriate technology for each class. We need a laptop (or other device) for every student to actually teach the way I would like to teach! [Participant 8]*

> *By not having access to technology 100% of the time, it is impossible to integrate technology in the class. [Participant 12]*

> *Lessons can be more interesting with more hands-on opportunities for the students, if the technology was up-to-date and readily available. [Participant 10].*

Some participants were not satisfied with the quality of Internet connection available in their schools:

> *The Internet connection in the computer labs is slow and disappointing. The computer labs are always being used for computer classes and there are not enough time slots for teachers of different subject areas to use the resources. There is no WIFI at my school. Pupils are not allowed to bring smartphones or laptops [to] school. [Participant 4]*

> *There are no Internet facilities in my school. [Participant 1]*

Participant 3 believed that

> *In most schools in Mauritius, the Internet connection is not very good, or you simply do not have Internet connection. [Participant 3]*

But in his school the situation is different.

> *In fact, because of the recent tablet project by the government, the Internet connection in my school has improved. So now I can easily upload and share notes with my students at any time and the connection is very good. The government is improving the Internet connection in every school so that we can use the Web 2.0 tool across the country. [Participant 3]*

5.4.2.1.4 Lack of time

The participants mentioned that they could not find time to study new technologies and then effectively implement them into daily professional practice.

> *I wish I could use technology in my class, but it's difficult to find the time to study it first myself before I start using it in my teaching. [Participant 7]*

> *Planning with technology takes longer time, but we do not have more time to plan our lessons, being busy with other tasks. [Participant 14]*

Participants reported that their workload was already heavy and that activities with social networking software would become an extra workload for them. Participants were also concerned about the limited time available to explore Web 2.0 tools given that teaching the core content of their subject area should take higher priority. This is seen in the comments below.

> *Bringing social networking sites in teaching would mean additional stress added to an already heavy workload. [Participant 1]*

> *Perhaps when we have more free time, which is very rare, we will be able to make use of these social networking sites in the class. [Participant 2].*

5.4.2.2 Enabling factors

This category includes three themes: professional development, technological support and pedagogical use of technology.

5.4.2.2.1 Professional development

The participants claimed that professional development would be vital to appropriately integrate technology into the classroom. Many of the comments below highlighted the need for continuing professional development to empower teachers with the necessary skills to use new technologies to enhance their teaching and student learning.

Technology can only have an impact if all teachers are provided with appropriate professional development in the school environment and also equitable access to technology for all students so that teachers are able to put into practice whatever they have learnt immediately. [Participant 12]

Technology is changing so fast and we will not be able to incorporate it in class. Teachers will need proper professional development to help them make use of technology in their classroom. With online facilities teachers can have their professional development at school and hence no need to travel. Consequently, there is no disruption of work. [Participant 10]

When questioned about how to make teachers interested in implementing Web 2.0 tools in teaching and learning, the participants' responses were mainly about access to computers, Internet facilities and training.

In most schools in Mauritius, the Internet connection is not very good, or you simply do not have Internet connection. If the government ensures that there is a good Internet connection everywhere, I am sure it would be easy for teachers to use these tools. [Participant 3]

I think it would be a good idea to provide teachers with appropriate training, through Internet access such as an awareness course on these tools, to give them the technology knowledge. At least they will be interested. Surely if they are interested, they would at one point of time try to use these tools. [Participant 4]

Teachers need guidance, technological knowledge. They need training in applying these tools for teaching, though they already have pedagogical knowledge. [Participant 6]

Several participants expressed the need for a training that should lay emphasis on pedagogy with technology. This is supported by the following comments.

Teachers need to know to use the technology. Teachers need training that will help them to know how to incorporate technologies in their teaching training from people who know how to teach with technology. [Participant 1]

They need to know about the benefit of using the technology in class and how technology can help them to better manage their class. [Participant 4]

5.4.2.2.2 Technological support

The participants stated that the technology available at school may be defective or not working properly and therefore they would require continuing technological support.

Use of technology is sometimes more of a problem, especially when it doesn't work. You can lose a lot of the time meant for actual teaching when you have technical difficulties. [Participant 8]

The computers in the school always have technical problems so it is frustrating when you have planned to use computers in your class and they do not function properly. So technical support should be available in the school. [Participant 9]

5.4.2.2.3 Pedagogical use of technology

The use of technology in teaching was mentioned in many of the comments, particularly the need to appropriately implement technology into the curriculum. Some participants felt that pedagogy should be the main driver for student learning, with technology assisting in the delivery of the curriculum and also being used as a support to teaching and learning.

Technology should make the curriculum more accessible, interactive and engaging. Professional development of teachers should ensure that emphasis is laid on use of technology in pedagogy. [Participant 12]

There is a need to look at the present/future professional developments that caters for the use of technology to support pedagogy. [Participant 10]

5.4.2.3 Perceived pedagogical benefits

This category includes five themes: efficient use of class time, teaching of abstract concepts, motivation, autonomous learner and development of students' collaboration skills.

5.4.2.3.1 Efficient use of class time

The participants reported that social media can help teachers to use teaching time at school judiciously. This is expressed in the comments below.

> *With Web tools in the classroom, teachers will save time copying notes. Students can access them online with their smartphones or at home before coming to school. More time can be devoted to actual teaching, and individual attention. Pupils will be motivated to study. This will result in a better use of class time and better classroom management [Participant 6].*

> *There is no need to write lengthy notes on the board for pupils to copy. I just upload my notes on Dropbox and my students are able access these notes via the Internet prior to coming to class. I have more time to attend to my students individually. Students have more time to participate in class discussion and are motivated. There is more interaction in the class. It is very different from the traditional ways of teaching. [Participant 5]*

> *Many students have smartphones and tablets these days. With the increasing availability of WIFI in many places, students can have more learning time outside school hours if they wish. [Participant 9]*

> *So many educational sites are available on the Internet. Students can access these sites easily with their smartphones. [Participant 11]*

5.4.2.3.2 Teaching of abstract concepts

Some of the participants reported that technology can help in the teaching of topics that students usually have difficulties to grasp.

> *Technology helps me make things clearer for my learners. They can now better understand ideas and concepts with visuals. I download videos from YouTube and bring in my classes. It is easier for me to teach biology topics such as metamorphosis or breathing movement using videos. [Participant 14]*

> *Technology allows me to conceptualise phenomena and simulations in my science courses. There are lots of free educational videos that are available online. [Participant 15]*

Some participants felt that having technology in the school environment is favourable to student learning.

> *Technology makes the classroom a much pleasant learning environment. [Participant 12]*

5.4.2.3.3 Motivation

Some of the participants believed both teachers and students are motivated to use Web 2.0 tools in teaching and learning. Teachers' motivation to try out these tools to enhance classroom collaboration was mostly influenced by their decisions to improve the lesson delivery and to engage students with the learning activities. This is expressed in the quotes below.

> *Students are already exposed to technology and using these tools in an efficient way can help them to be equipped for the 21st century job market requirements. [Participant 3]*

> *Involving technological tools that enable critical thinking, collaborative learning, and communicating skills is indeed very crucial both for me and my students as I believe I can capture their attention and enhance their learning and develop the skills our students [need] in the 21st century [Participant 8].*

> *I use technology every day and am almost online all the time. I communicate with people, check my mail, surf on the net with my smartphone. I find it easier to communicate with my students at any time and share my lessons notes with them. [Participant 11]*

According to the participants when Web tools would be used in class, the students would be motivated and more interested in their studies. The possibility that technology can help in the engagement and motivation of students in their study was often mentioned by the participants.

> *Technology would provide unlimited opportunities to engage student in meaningful learning activities by using the tools that students are already familiar with to reach and teach them. [Participant 15]*

The technologies would allow me to engage more children in their learning process. [Participant 4]

According to the participants, activities can be designed with the use of Web 2.0 tools in the class that can motivate students. Several teachers mentioned that their students learnt by adopting the role of the researcher and managed to navigate better through the huge amount of information available on the Internet. This is expressed in the following comments.

Students will be motivated and will show enthusiasm when class activities will involve the use of the Internet. It is something different and something they often ask for. They are already using Facebook or YouTube in their everyday life. Rather than being passive recipients in normal classes, they will enjoy participating and actively engage in online class activities using Web 2.0 tools. [Participant 3]

It can be more interactive. It can make pupils interested in the class. I think it will enhance the teaching. Students will be more involved and interested in the class. [Participant 6]

This will motivate the student more because the new generation is very fond of these technologies, computers etc. ... I think this will enable them to work better because they will feel more comfortable using these technologies, and also to break the routine of everyday life at school and to bring in some new method of teaching. [Participant 2]

It's a good thing to incorporate it in teaching, students will show more interest in their studies as they will be studying with technologies that they use every day. Learners are more engaged as they will actively construct knowledge and it will contribute to a good class management. [Participant 5]

5.4.2.3.4 Autonomous learner

Some participants claimed that technology could enable students to become more autonomous learners and the role of the teacher might become that of a facilitator or collaborator.

With technology I foresee less direct teaching and more facilitating and collaborating role of the teacher, and more self-directed/self-paced learning for the learner. [Participant 15]

I think technology can make students more empowered. The student becomes the main actor of his or her learning. I want it to allow more responsibility to be placed on the students for their own learning. [Participant 14]

5.4.2.3.5 Development of collaboration skills

According to participants' observations, the implementation of class activities using Web 2.0 tools may also support the development of collaboration skills. Many participants believed their students' immersion in collaborative networking sites such as *Facebook* gave them the possibility to foster increased engagement in their learning using learning tasks within these media. Some participants pointed out that this potential has not yet been realised. This is reflected in the following comments.

I agree that social networking is an area which could be developed. Everyone can see how important WhatsApp, Facebook or other social networking are to young people of today. [Participant 1]

I haven't been able to foster collaborative learning using Internet in my classes because we do not have these facilities in my school, but I have heard of it happening through other people. I do believe that collaborative learning is valuable because I think that this style of learning allows the growth of skills that are highly appropriate today. People need to be able to work well together for several reasons. I would place a high priority on facilitating this style of learning with my students. [Participant 2]

Both teachers and students can work collaboratively on same projects. Teachers can share a document on Google Drive with several students to work on a common project. The same document can be moderated by the teacher. It is amazing to see what technology can allow you to do today. [Participant 11]

5.4.2.4 **Usefulness**

The participants were questioned about the usefulness of Web 2.0 tools in their professional practice. The themes under this category are accessibility and social interaction

5.4.2.4.1 Accessibility

The participants claimed that Web 2.0 tools had created a new time-space for communicating, interacting and collaborating among teachers and students. They argued that the educational dialogue could continue after school through social media where teachers might provide relevant material or students can discuss, comment and present their work. In this way, teaching and learning activities can continue to happen after school hours. This is expressed in the comments below.

> *Technology would provide unlimited opportunities to engage student in meaningful learning activities by using the tools that students are already familiar with to reach and teach them. [Participant 15]*

> *I think it's a good idea to use Web 2.0 tools because we can be in touch with our students through Facebook even after school hours to discuss. Students can communicate among themselves doing a common project work or contact their teachers for extra help even after school hours. [Participant 10].*

> *I have used Facebook as a tool to help me in my teaching. I have created a group where my students have become members. It is very easy for us to communicate using that group. I invite students to post any area of difficulty and ask other students to share their views. I can also see what they are sharing and what are their difficulties. [Participant 6]*

> *I think it's a good idea to use Web 2.0 tools because we can be in touch with our students through Facebook even after school hours to discuss. Students can communicate among themselves doing a common project work or contact their teachers for extra help even after school hours. [Participant 10].*

Internet is a great tool because you can access it everywhere. Upload and retrieval of notes become easy. You have Internet at school. You need not bring your notes with you. You must access it at school via the Internet [Participant 3]

I can tell you that my students enjoy learning through Internet. I wrote on my blog about some puzzles in mathematics, since I did not have the time to discuss them in the classroom, I was surprised to see that it aroused students' interest and finally we had to continue the discussion in the classroom. [Participant 5]

5.4.2.4.2 Social interaction

Some participants made use of social networks mainly for communication purposes.

Yes, we do communicate among colleagues through social networks like Facebook when we are planning something for the school, it is easier to communicate via Facebook because it is rapid and does not cost too much. [Participant 1]

I communicate with my friends, colleagues on Facebook, share documents with them and chat with friends, to find what is happening around. [Participant 5]

The participants noted that the use of Web 2.0 tools in the classroom helped reduce the digital gap between them and their students. This is shown in the comments below.

The reactions of my students are positive, too. They understand that I am well conversant with up-to-date technologies, that I can understand them and keep pace with the technology they are using. I think this builds a better relationship with my students. They communicate with me through Facebook. [Participant 4]

They like the idea that their teacher can use these tools. They feel close to him [Participant 6)

My students like to communicate with me through WhatsApp or Facebook. It is easier for them to get in touch with me. [Participant 11]

Sometimes some students do not indulge in conversations that take place in the classroom. Maybe, they are too shy to talk in class. I believe that in such environments

like social networks those students can shine, when they are at home, they have the time to express themselves, something that we don't see very often in the classroom. In other words, the quiet students can surprise us through their participation on the blogs. [Participant 6]

5.5 Some contrasting views

A few participants had divergent views on some themes like collaborative networking sites, immediate feedback and classroom management.

5.5.1 Collaborative networking sites

Many participants believe that their students' involvement in collaborative networking sites such as Facebook contributed to the potential to adopt increased engagement in students' learning through the use of learning tasks within these media.

My students themselves have told me they can use Facebook, Google Drive, Dropbox to download notes. My students like to communicate with me via these tools. So that whenever they have any problem, they can contact me online and I respond to them online. I think that these Web 2.0 tools are capable of providing powerful support in the class. I feel that Web 2.0 tools [are] a support in promoting assimilation and understanding during teaching. [Participant 4]

It has been through social networking, more precisely Facebook, where my students communicate with me, or post a particular question which is their area of difficulty. I comment on the question and invite other students to share their views I have used Facebook as a tool to help me in my teaching. I have created a group where all my students have become members. It is very easy for us to communicate using that group. I can also see what they are sharing and what are their difficulties. [Participant 6]

Some participants pointed out that this potential has yet to be explored. The following comments reflect this experience.

I agree that social networking is an area which could be developed. It is a current phenomenon demonstrated by email, texting, Facebook and Twitter that social communication is important to young people of today. [Participant 7]

I do believe that collaborative learning is valuable because I think that this style of learning allows the development of skills that are highly relevant today. I would place a high priority on facilitating this style of learning with my students. [Participant 6]

However, a few participants expressed doubts about the capacity of Web 2.0 tools to foster collaborative learning and suggested that there were a lot of unsubstantiated claims about its potential. The following comment is representative of this view.

There are problems with collaborative learning. For example, the assessment of the work of individuals within the collaborative group. Has technology overcome this dilemma? Collaborative learning isn't new and there is a lot to learn, both good and bad from experiences without technology. [Participant 1].

Several participants attributed difficulties they have encountered in their attempts to foster collaborative learning using Web 2.0 tools

I often get my students to do group work together. Typically, this would involve them working together to search for information on the Internet. I have had limited success using this approach. Unfortunately, some students seize this as an opportunity to do as little work as possible and get others to carry the load so that they can get away with it. [Participant 13]

My biggest concern is whether students will really adopt this as a learning or educational tool during the class or they might use it for their own purpose. For example, while doing some collaborative work with their peers or instead of downloading the files that the teacher has shared for discussion, students may be seizing the opportunity of being online to communicate with their online friends. Managing such classes can be problematic. [Participant 3]

5.5.2 Immediate feedback

Some participants argued that technology could help in the communication process between teacher and student, but it should not be at the expense of essential human relationships. This is shown in the comments below.

> *I find face-to-face time more valuable with my students than face to online time. [Participant 13]*

> *Technology is an important teaching tool. However, the interaction between a teacher and their students cannot be replaced by technology. [Participant 15]*

The participants had different perceptions about immediate feedback, while some felt that social media allows for immediate feedback and other felt it did not.

> *When I am on Facebook with my students I can provide them with immediate feedback. [Participant 5]*

> *The Web 2.0 tools prevent the teachers from using body language, eye contact to explain something to the student. In class, they may get feedback from the facial expression of the student and that he knows what has not been understood. With Web 2.0 tools, there is no on-spot interaction. [Participant 2]*

5.5.3 Classroom management

According to some teachers, with Web 2.0 tools students are motivated show more interest in their studies. This motivation and interest help teachers to maintain a good class management. This is validated in the comments from Participant 5 and Participant 6.

> *It's a good thing to incorporate it in teaching, students will show more interest in their studies as they will be studying with technologies that they use daily. This will eventually contribute to a good class management. [Participant 5]*

> *With Web tools in the classroom, teachers will save time copying notes. Students can access them online with their smartphones or at home before coming to school. More*

time can be devoted to actual teaching, and individual attention. Students will be motivated to study. This will result in a, better classroom management [Participant 6]

However, Participant 3 and Participant 4 believed that managing Web 2.0 tools in the class can become difficult for teachers.

Students may be seizing the opportunity of being online to communicate with their online friends. Managing such classes can be problematic [Participant 3]

Using technology and social media with 35 students and 35 sets of technology or large class sizes can be extremely challenging for managing the class. Dealing with misbehaviour in such classes would take much of your teaching time [Participant 4]

5.6 Other findings

Different types of teachers and some significant impressions emerged from the interview data.

5.6.1 Categories of teachers in relation to use of Web 2.0 tools in their professional practice

Five types of teachers have emerged from the qualitative data. They are the passionate, the innovative, the undecided, the anxious and the resistant.

5.6.1.1 The passionate teacher

Passionate teachers bring enthusiasm that can make a difference to achievement of learners and commitment to their work performance. This is illustrated in the quotes below.

Involving technological tools that enable critical thinking, collaborative learning, and communicating skills is indeed very crucial both for me and my students as I believe I can capture their attention and enhance their learning and develop the skills our students in the 21st century. [Participant 8]

I use technology every day and am almost online all the time. I communicate with people, check my mail and surf on the net with my smartphone. I find it easier to

communicate with my students at any time and share my lessons notes with them. [Participant 11]

I usually spare some time, about an hour, on Facebook during the weekend to attend to queries, if any, from my students about their work. [Participant 11]

These teachers even spare some time after school hours to be in touch (online) with their students to help them. The researcher believes it is their passion for the use of technology in their professional practice that drives them to excellence in their job. They always try to find new ways to motivate their students to develop through real work in and out of the classroom.

5.6.1.2 The innovative teacher

This type of teaching is bringing new ways of teaching to support instruction and learning by implementing Web 2.0 tools in their professional practice. This is reflected in the quotes below.

Technology helps me make things more visible and real for my learners. They're more able to understand ideas and concepts with better visuals. I download videos from YouTube and bring in my classes. It is easier for me to teach biology topics such as metamorphosis or breathing movement using videos. [Participant 14]

There are tons of free educational videos that are available online through YouTube and TeacherTube. These online tools allow me to download videos that help me teach abstract phenomena and simulations in my science classes. [Participant 15]

These participants are innovative teachers who are looking for ways to enhance the teaching of difficult or abstract topics for the betterment of their students.

5.6.1.3 The undecided teacher

This type of teacher knows how to use the technology tools but are not using Web 2.0 tools in ways that take no advantage of the technology's social affordances, for instance, posting reminders to students about homework and upcoming class tests on Facebook; however, the same task could be achieved by using email. An example of this is the quote from Participant 8:

When I had to remind them about the deadline for submission of their work – I post messages in my wall on Padlet [Participant 8].

5.6.1.4 The anxious teacher

Teachers' anxiety over the management of students' use of the Internet in the class is evident in the quotes below.

I think bringing social media in class is a potential for distractions. How can you prevent some students from indulging in their favourite pastimes like playing online games or chatting with online friends or responding to posts? [Participant 9]

Social media like Facebook is primarily designed as a social networking tool. So, use of Facebook in class might result in students spending more time in off-topic discussion with online friends. The students may have some difficulty balancing their online learning activities and their other non-learning or leisure activities. [Participant 11]

The teachers are anxious about the proper running of class. So, dealing with distraction and managing classes that have Internet connection are major challenges that teachers perceive. The researcher believes that teachers are apprehensive of the risk of their professional and personal privacy being compromised if their Facebook profiles are viewed by students.

5.6.1.5 The resistant teacher

According to the researcher, resistance is a normal response when a teacher lacks knowledge or confidence but is pressurised to integrate technology into his or her professional practice.

I am not sure about my ability to use technology or the need of bringing technology in class. I do not think that it is a good idea for me to move away from my normal teaching style. I feel I am a successful teacher, and therefore I do not think changing my way of teaching through technology will bring learning enhancement. [Participant 1]

Teachers are likely to resist change because they believe that the traditional methods of teaching are the best. This type of teacher is resistant because of their

pedagogical beliefs. These teachers might feel that they would be wasting some teaching time when incorporating new technology into their teaching.

5.6.2 Significant impressions that emerged from the interview data

Before discussing the qualitative data, it is worth noting that, upon conclusion of the interviews, there emerged two significant impressions that contribute somewhat to the qualitative perspective of the quantitative findings.

5.6.2.1 Face-to-face interaction

Firstly, irrespective of their current use of technology, all teachers interviewed greatly valued face-to-face interaction as an effective method of teaching. This was mainly due to the degree of immediacy of feedback that face-to-face interaction makes possible. The comments below are typical of statements that were made by the participants regarding the value of face-to-face teaching.

> *A lot of these Web 2.0 tools can be useful, but they really do not replace the old-fashioned face-to-face where you need to have that eye contact with your students in order to see to it that learning is taking place. [Participant 3]*

> *There's nothing inherent about the Internet technology that's going to make students to interact ... ace-to-face is more appropriate for this. Teachers need to guide their students on how to use collaboration tools. [Participant 2]*

> *Use of online videos from YouTube can be useful but there are subjects that need hands-on activities where the teachers need to be present to guide their students. [Participant 4]*

5.6.2.2 Teacher motivation

The second striking impression was that the teachers were highly motivated to enhance both their teaching, and the learning experience of their students. This is corroborated in the following comments:

> *I'm thinking of ways I can improve my teaching using Web technologies so that my students can learn better and enjoy learning my subject [Participant 3]*

My teaching philosophy is that I must make students … like my subject. It is only then they will learn the subject I am teaching. Since Web tools can get them interested and engaged in learning I will do what is necessary to do that. [Participant 6]

The whole thing is about everyone learns differently so you've got more options with technology. My focus is student-centred teaching, make learning fun, engaging. I'm prepared to do what it takes. I will find the time. [Participant 5]

These two general impressions provide a background to the subsequent detailed discussion of the qualitative data that relates to the quantitative findings.

5.7 Overall implications of the qualitative findings

In today's learning environment teachers are no longer the centre of knowledge. They are now expected to be facilitators who oversee students' learning and offer them appropriate support. The qualitative data findings imply that several conditions need to be attached in teachers' professional practice environment so that emerging technologies can be used to enhance teaching and learning and support teachers to help students acquire the necessary 21st-century skills. These conditions include access to up-to-date technological resources, continued technical support to ensure the smooth implementation of technology in teaching and learning activities, student access to technology in the school environment, continued professional development to enable teachers to adapt to technological change and utilise emerging technologies to effectively assist students in their study, and the appropriate use of technology to assist in the delivery of the curriculum . The connection between the quantitative and the qualitative findings is discussed in detail in the next chapter.

5.8 Summaryn

In this chapter the qualitative data obtained from the 15 survey respondents were analysed and four thematic categories emerged. These categories are: *barriers, enabling factors, perceived pedagogical benefits and usefulness.* The category *barriers* comprises four themes: lack of technology knowledge, misuse of Web 2.0 tools, lack of resources and lack of time. Professional development, technological

support and pedagogical use of technology are the three themes that comprise the category *Enabling factors*. The category *perceived pedagogical benefits* includes four themes: efficient use of class time, teaching of abstract concepts, motivation, autonomous learner and development of students' collaboration skills. Accessibility and social interaction were the two themes of the category *usefulness.*

In the next chapter, the qualitative data findings are discussed in conjunction with the quantitative findings discussed in Chapter Four to add depth of understanding to the quantitative findings.

6 Discussion

6.1 Introduction

This chapter interprets and discusses the findings of this study which were analysed and presented in Chapter Four and Chapter Five. The study sought to determine the extent of the use of Web 2.0 tools by in-service teachers in their classrooms, the teachers' perceptions of the use of Web 2.0 tools in education and the best predictors of teachers' intention to use Web 2.0 tools in teaching and learning. The interpretation and discussion of findings in this chapter are organised around themes related to the research questions for this study.

6.2 Current use of Web 2.0 tools

Survey questionnaires and interviews were used to collect data from in-service teachers to investigate teachers' use of Web 2.0 tools, the teachers' perceptions on the use of Web 2.0 tools in education and the best predictors of teachers' intention to use Web 2.0 tools in teaching and learning. Teachers' use of Web 2.0 tools, both in their personal lives and their professional practice, was analysed and results displayed in Table 4.6 and Table 4.7. Of the applications considered for use in their personal life, social networking sites were the Web 2.0 tool most commonly used by the participants (81.7% of the participants reported daily or weekly use) and more than 60% of them reported daily or weekly use of the other Web tools. Wikis were the Web 2.0 tools most commonly used by the participants (60.7% of the participants reported daily or weekly use) in their professional practice. More than 58.6% of teachers reported daily or weekly use of Google Apps and Multimedia. Almost one-third of the number of teachers did not use other Web 2.0 services in their professional practice (30.6% of the participants reported not using file hosting services and 36.6% not using social networking). Overall, the above findings reveal that the participants use Web 2.0 tools regularly in their personal lives but not in their classrooms. However, the qualitative data revealed that the teachers interviewed had used a variety of Web 2.0 tools and Web 2.0 educational activities in both their personal lives and their professional practice. In Chapter Five, the Web 2.0 tools mentioned by the participants were blogs (for example Blogger,

WordPress), social networks (like Facebook), micro-blogs (like Twitter), presentation tools (like Prezi), video-sharing sites (like YouTube), online calendars (like Google Calendar), cloud storage (like Dropbox), collaborative authoring tools (like Wikis and Google Docs), image sharing services (like Picasa and Flickr), interactive posters (like Glogster), comic creation tools (like Toondoo) and electronic interactive boards (like Padlet). Some sample quotes illustrating the use of Web 2.0 tools for teaching purposes are listed below.

> *I search videos on YouTube to demonstrate visual information to students so that my students can better understand abstract concepts and Google Drive as an online storage where I can easily upload my notes and other educational materials and make accessible to students by providing download links. [Participant 6]*

> *I have also created a group on Facebook for my upper classes where my students are able to contact me after school hours if necessary. When I am on Facebook with my students, I can provide them with immediate feedback. I use the platform Padlet as a digital interactive noticeboard to leave messages for my students of lower classes. [Participant 5]*

> *When I must remind my students about the deadline for submission of their work, I post messages in my wall on Padlet. Padlet is like a digital noticeboard where you can post things and allow other people to read only or to both read and post. [Participant 8].*

The integration of technology in teaching goes beyond the use of any technology, and it can be closely associated with teachers' beliefs about effective ways of teaching to support teaching and learning (Ertmer & Ottenbreit-Leftwich, 2010). These participants are innovative teachers who are using teaching strategies which, in some way, break down traditional classroom practices to foster better student learning. They are trying new digital devices and programs in their instructional practice. These teachers are showing that they have acquired the technology pedagogy knowledge. They are using their technology knowledge together with their pedagogy knowledge. However, the qualitative findings reveal that most of the participants who were interviewed are regular users of Web 2.0 tools in their professional practice whereas the quantitative findings show that of

those who responded to the survey questionnaires, more than 30% did not use Web 2.0 tools in their professional practice. The qualitative findings do not seem to fully corroborate the quantitative findings.

6.2.1 Divergence between quantitative and qualitative findings

Researchers look for convergence in their study with the expectation of combining all the results tidily to strengthen the validity of their findings (Doyle et al., 2016). According to O'Cathain et al. (2010), divergence is not necessarily a sign that there is something wrong with the study. Creswell and Plano Clark (2011) also added that although most researchers strive for congruency between quantitative and qualitative findings, divergent findings can uncover new theories and insights. According to Wagner et al. (2013), conflicting results between quantitative and qualitative findings could give way to a broader understanding of the phenomenon since the researcher has an opportunity to explain the conflicting results and offer his or her own interpretations. Quantitative and qualitative results that appear to contradict each other are frequently explained as a result of methodological issues (Östlund, et al., 2011). For example, inadequate use of questionnaires was the explanation of the divergent results obtained by Skilbeck et al. (2005) in their mixed-methods study. Sampling is another design issue in mixed-methods studies (Östlund, et al., 2011). Sample size and sampling approach may be different for quantitative and qualitative methods. While quantitative methods' main concerns are looking for sufficient statistical power, qualitative methods have more to do with achieving conceptual or theoretical saturation (Wagner et al., 2013). In this study, a convenience sampling approach was adopted. Respondents to the survey questionnaire were invited to provide their contact details in case they were willing to volunteer to participate in a follow-up interview. Thirty-one respondents indicated agreement to an interview on the survey form. From the pool of 31 respondents agreeing to attend an interview, only 15 arrived for the interview. The divergent results obtained could be explained by exploring the dataset comparability (Diloreto & Trudi, 2016), that is, comparing the participants in both quantitative and qualitative methods. According to the researcher, the main reason for the participants to have agreed to participate in the interview exercise is that these

participants were more “tech-savvy” and more likely to show interest to implement technology in their professional practice than the other participants who responded to the survey.

Another potential reason for divergence is methodological differences between the two phases of research. In the sequential explanatory mixed-methods design the second phase cannot be developed until the first phase has been completed (Creswell & Plano Clark, 2011), so there is a time gap between the collection of data for the quantitative and qualitative phases. For this study the qualitative data was collected months after the collection of quantitative data. In the meantime, technology continued to gain in popularity, wireless devices and networks became abundant, and their usefulness started to be seen in the education environment (Hanover Research, 2014). With time the participants in the interviews were becoming more aware of the affordances of technology and started to bring technology into their classes.

Diloreto and Trudi (2016) have argued that quantitative findings of a survey do not result from sufficiently explicit or individualised questions while Lee and Rowlands (2015) contend that qualitative, open-ended questions provide the “space” needed by participants to adequately voice out or explain their responses. Therefore, according to the researcher, the divergence between the quantitative and qualitative findings in this study could also be due to the fact that quantitative measures might not be subtle enough to capture complex experiences that have been reported qualitatively.

6.2.2 Why teachers are using Web 2.0 tools

The findings from the analysis of the interview data gathered in this study have shown that Web 2.0 tools such as Facebook, Cartoon Maker and Padlet are being used in secondary school classrooms. These Web 2.0 tools provide learning opportunities that can be used by both teachers and students. During data analysis, three main themes emerged in connection with the reasons explaining teachers’ integration of Web 2.0 tools in teaching and learning. They were related to motivation and teaching of abstract concepts.

6.2.2.1 Motivation

Teachers' motivation to try out these tools to enhance classroom collaboration were mostly influenced by their decisions to improve the lesson delivery and to engage students with the learning activities. This is expressed in the quotes below.

> *Students are already exposed to technology and using these tools in an efficient way can help them to be equipped for the 21st century job market requirements. [Participant 3]*

> *Involving technological tools that enable critical thinking, collaborative learning, and communicating skills is indeed very crucial both for me and my students as I believe I can capture their attention and enhance their learning and develop the skills our students [need] in the 21st century. [Participant 8]*

> *I use technology every day and am almost online all the time. I communicate with people, check my mail and surf on the net with my smartphone. I find it easier to communicate with my students at any time and share my lessons notes with them. [Participant 11]*

The researcher believes that these teachers have a passion that pushes them to excellence in their job and drives their students to excellence and innovation in their studies. They are always looking forward to improving their practice and finding new ways to motivate students to grow through real work in and out of the classroom. According to the participants, students are more motivated to work when class activities are designed with the use of Web 2.0 tools. This is pointed out in the quotes below.

> *Students are motivated and show enthusiasm when class activities involve the use of the Internet. It is something different and something they often ask for. Rather than being passive recipients, they are active and enjoy participating. [Participant 3]*

> *I have students who rarely participate in class discussion, but they are quite talkative when participating in group discussion on Facebook. They show motivation to contribute in group work when online. [Participant 11]*

This finding is consistent with the study conducted by Jimoyiannis et al. (2013) who claimed that students' critical thinking, writing, and reflection; and engagement in information sharing and social learning can be reinforced by the learning opportunities offered by Web 2.0 tools. If students may be showing more interest in their studies this may be due the fact that students can now create, consume and share independently produced information, remixing content in creating new content with tools that they currently use.

6.2.2.2 Teaching of abstract concepts

Some participants reported that technology can help in the teaching of topics that students usually have difficulties in grasping. These participants reported that with the integration of videos, obtained from YouTube, in their teaching, their students are now able to better understand difficult or abstract topics. This is clearly expressed by Participant 14 and Participant 15 in the following quotes.

> *Technology helps me make things more visible and real for my learners. They're more able to understand ideas and concepts with better visuals. I download videos from YouTube and bring in my classes. It is easier for me to teach biology topics such as metamorphosis or breathing movement using videos [Participant 14]*

> *There are tons of free educational videos that are available online through YouTube and TeacherTube. These online tools allow me to download videos that help me teach abstract phenomena and simulations in my science classes. [Participant 15]*

These participants are innovative teachers who are looking for ways to enhance the teaching of difficult or abstract topics for the betterment of their students. This finding concurs with the outcome from a study conducted by Willmot et al (2012) who argue that the use of video in student-centred learning activities can encourage and engage students to enhance their learning.

Accessibility was another theme that explained the participant's integration of Web 2.0 tools in teaching and learning. According to the participants, Web 2.0 tools are providing a new space for communication, interaction and collaboration among teachers and students. The participants argued that the educational dialogue may

continue after school through social media where teachers may provide relevant material or students can discuss, comment and present their work. The participants in this study have also reported that with tools like Facebook, students can engage in group projects and continue their schoolwork outside the classroom, which reflects the findings of Carter et al. (2008) and Grisham (2014). This is illustrated in the quotes below.

> *I think it's a good idea to use Web 2.0 tools because we can be in touch with our students through Facebook even after school hours to discuss. Students can communicate among themselves doing a common project work or contact their teachers for extra help even after school hours. [Participant 10]*

> *I have used Facebook as a tool to help me in my teaching. I have created a group where my students have become members. It is very easy for us to communicate using that group. I invite students to post any area of difficulty and ask other students to share their views. I can also see what they are sharing and what are their difficulties. [Participant 6]*

> *I usually spare some time, about an hour, on Facebook during the weekend to attend to queries, if any, from my students about their work. [Participant 11]*

These participants are bringing new ways of teaching to support instruction and learning by implementing Web 2.0 tools in their professional practice. They are so passionate about the use of technology in their professional lives that they spare some time after school hours to be in touch (online) with their students in order to help them. Fewkes and McCabe (2012) have also argued that both student–teacher and student–student collaboration, extra help from the teacher concerning homework or revision work are possible when using Facebook for teaching and learning.

However, some teachers are using Web 2.0 tools in ways that take no advantage of the technology's social affordances, for instance, posting to students reminders about homework and upcoming class tests on Facebook; however, the same task could be achieved by using email (Henderson et al., 2013). An example of this is the quote from Participant 8*:*

When I had to remind them about the deadline for submission of their work, I post messages in my wall on Padlet. [Participant 8]

Ertmer & Ottenbreit-Leftwich (2013) and Wang et al. (2014) have also found that technology was still being used in ways that were neither meaningful nor student-centred but in ways that supported traditional practices. Many teachers are not using Web 2.0 technologies to their potentials (An & Williams, 2010) and one possible reason, in the researcher's view, might be that for some teachers social networking technologies were developed for social purposes and were inappropriate for classroom use.

6.2.3 Why teachers are not using Web 2.0 tools

According to An and Reigeluth (2012), current studies have shown that teachers are implementing technology in classrooms, indicating that teacher resistance against technology is becoming less of an issue. For example, in a survey of 620 secondary school teachers in the US, 90% of respondents stated that they use technology in class but also reported that there are barriers due to lack of support, training, and class time for technology integration that are preventing the effective use of technology (Digedu, 2014). The researcher believes some teachers may still show resistance to integrating technology in their practice because the potential benefits of technology integration to student learning are not entirely clear to them and are therefore uncertain about the necessity of bringing technology into their class. This is attested to in the quote below.

Teachers need to know about the benefit of using the technology in class. Many teachers are not aware of the usefulness of these Web 2.0 tools in education, for example I often use Google Drive which is a very capable tool where you can upload all your notes and access it everywhere. If these teachers are made aware of these tools, I am sure they would like these tools very often and especially if Internet is accessible everywhere. [Participant 3]

In the researcher's view, resistance is a normal response when a teacher lacks knowledge or confidence but is pressurised to integrate technology into his or her professional practice

> *I am not sure about my ability to use technology or the need of bringing technology in class. I do not think that it is a good idea for me to move away from my normal teaching style. I feel I am a successful teacher, and therefore I do not think changing my way of teaching through technology will bring learning enhancement [Participant 1].*

Teachers who do not integrate technology in their instructional practice are often branded as 'resistant' to change (Howard, 2013). Teachers are likely to resist change because they believe that the traditional methods of teaching are the best. This type of teacher is resistant because of their pedagogical beliefs. They have had success with their lessons and strategies tried several times and believe that change may appear needless for them (Bohn, 2014). These teachers might feel that they would be wasting some teaching time when incorporating new technology into their teaching (Howard, 2013). Also, these teachers might feel a loss of control of their class. In a traditional classroom, the teachers usually do everything, that is, they oversee all class activities (Bohn, 2014). However, with the integration of technology into teaching and learning, some of these responsibilities may have to be taken away from them. Hence, there is resistance to change, as some of the decisions are taken out of their hands. These teachers may feel that there is a power shift to somebody else other than the teachers. In other words, these teachers have the impression that they are losing control of their classes, thus affecting their authority. Such teachers have no plan to use technology in their classes, even though they might be capable of using it (Oriji & Amadi, 2016).

Previous research (Ertmer 2005; Hew and Brush 2007; Hsu and Sharma, 2008) has shown that lack of technology, lack of administrative and technical support and lack of access to existing technology were the main reasons for teachers not integrating technology in their classrooms. In this study, the main reasons why teachers were not using Web 2.0 tools into their classroom focus more on how to successfully integrate the technology into lessons, such as teachers' lack of both knowledge of how to use technology and knowledge of pedagogical use of technology, access to Internet, teachers' lack of training and teachers' lack of time to implement technology-integrated lessons in their classrooms.

6.2.3.1 Lack of knowledge of technology and pedagogical use of technology

According to Hew and Brush (2007) one main barrier hindering teachers' use of technology in the classrooms is the lack of "specific technology knowledge and skills, technology-supported-pedagogical knowledge and skills, and technology-related-classroom management knowledge and skills" (p. 227). This view is supported by An and Reigeluth (2011) who argued that teachers lacked "knowledge about ways to integrate technology into learner-centred instruction" (p. 59). Similar results were obtained by Archambault and Crippen (2009) who conducted a study with 596 teachers from 25 different states in America. The results of their study have shown that teachers had a high level of knowledge of pedagogy and their subject areas but low level of technology knowledge.

Some participants in this study reported that despite having advanced technology skills they often had trouble in keeping pace with the rapid development of technology (Lindberg et al., 2017). This is illustrated in the quotes below.

> *It is very important for a teacher to keep pace with any new development in technology. As such, I have to always keep myself updated with the latest technology to be able to take advantage of these media to make learning relevant to this generation of young learners. [Participant 10]*

> *These Web tools keep changing, with newer version each time. One is not yet well accustomed to the current tools and you see new things being added. You have to constantly update yourself to be able to follow the trend [Participant 11]*

The digital technologies accessible to schools and teachers are always changing (Ertmer & Ottenbreit-Leftwich, 2010; Harris et al., 2009). Consequently, some teachers may be worried about the use of technology in the classroom because their lack of self-confidence in their capability to integrate technology and a sense of not being ready to use technology in the classroom (Moore-Hayes, 2011). Several studies (Blackwell, Lauricella & Wartella, 2014; Ertmer, et al., 2012; Inan & Lowther, 2010; Ottenbreit-Leftwich, Glazewski, Newby & Ertmer, 2010) have reported inadequate technology skills as an issue in the use of technology in classrooms. Zhou et al. (2011) found that in-service teachers' use of technology in

teaching was very low since they lacked the necessary skills required to integrate technology in their teaching. The lack of appropriate skills to implement technology in teaching is also reported in this study. This is expressed in comment by Participant 6.

> *Teachers do not know how to use these tools properly and how to use these tools efficiently in terms of pedagogy, how to make them implement these tools, how to teach, impart knowledge, how to deliver or share information on a platform that is available to everyone today. [Participant 6]*

> *If teachers don't use Web 2.0 tools there is only one reason: they don't know how to use them. They are not aware of the potentials of these tools in education. If teachers are empowered properly, I think they will make use of these tools. [Participant 9]*

For the researcher, the main reason for this lack of necessary skills to integrate technology in teaching and learning is that these teachers have not had any training on use of technology, where emphasis had been stressed on the acquisition of knowledge to integrate technology, pedagogy and content in teaching.

6.2.3.2 Lack of resources

Participants in this study indicated that they did not have the technology tools available to them to integrate technology in their teaching, the availability of computers in the classroom being a problem. The quotes below illustrate the situation in some schools.

> *All students need equitable access to appropriate technology for each class. We need a laptop (or other device) for every student to actually teach the way I would like to teach! [Participant 8]*

> *By not having access to technology 100% of the time, it is impossible to integrate technology in the class. There is no WiFi at my school. [Participant 12]*

> *The Internet connection in the computer labs is slow and disappointing. The computer labs are always being used for computer classes and there are not enough time slots for teachers of different subject areas to use the resources. There is no WiFi at my*

school. Pupils are not allowed to bring smartphones or laptops at school. [Participant 4]

This finding is consistent with current literature where studies (Hutchison & Reinking, 2010; Lacina, Matthews & Nutt, 2011; Liang & Chen, 2012; Ogwu & Ogwu, 2010) have shown that the lack of availability of the technological tools and resources to facilitate learning was a barrier that prevented teachers from integrating technology in the classroom. Therefore, access to technology resources plays an important role in motivating teachers to use technology.

6.2.3.3 Professional development

Professional development or lack of training was another common theme revealed during the interviews. Participants expressed their concern about the need for training opportunities offered to them in the use of technology.

A lack of training has been frequently quoted as a barrier to teachers' integration of technology in their professional practices (An & Reigeluth, 2011; Ertmer and Ottenbreit-Leftwich 2010; Johnson et al., 2013; Kopcha, 2012). Research has shown that a lack of training or professional development is the most predominant barrier to technology integration in education (Ertmer, 2005; Lawless & Pellegrino, 2007). In the past decade, researchers (Ertmer, 2005; Lawless & Pellegrino, 2007) have argued that professional development regarding technology use in education needed to place emphasis on curriculum-related applications, active involvement of teachers in hands-on technology use and of diverse learning experiences that are linked to student learning, technical and administrative support, appropriate resources and built-in evaluation. In this decade, researchers (Buckenmeyer, 2012; Schrum & Levin, 2013) have added that professional development needed also to be a continuing process with job-embedded support, and continuous program adjustments to keep pace with ever-evolving technology. The need for on-the-job professional development is expressed in the quotes below.

Technology can only have an impact if all teachers are provided with appropriate professional development in the school environment and also equitable access to

technology for all students so that teachers are able to put into practice whatever they have learnt immediately. [Participant 12]

Technology is changing so fast and we will not be able to incorporate it in class. Teachers will need proper professional development to help them make use of technology in their classroom. With online facilities teachers can have their professional development at school and hence no need to travel. Consequently, there is no disruption of work. [Participant 10]

Several participants expressed the need for a training with a focus on infusion of technology in pedagogy to improve student learning. The participants also reported that training should not only be on the latest technology, but also how to use that technology within their specific subject areas to enable them to create effective technology-integrated learning opportunities for their students. The participants' concern for professional development is shown in the quotes below.

Teachers need guidance, technological knowledge. They need training in applying these tools for teaching, though they already have pedagogical knowledge. [Participant 6]

Teachers need to know to use the technology. Teachers need training that will help them to know how to incorporate technologies in their teaching, training from people who know how to teach with technology. [Participant 1]

This is in alignment with the argument of Wright (2010) that it is a mistake to believe that because teachers who are skilful in using technology will automatically be able to bring their technology skills into use in the classroom and transform their teaching practices. Twenty-first century teachers need have more than just access to technology tools and devices (Richardson, 2013). Also, for teachers to engage fully in the adoption and integration of technology within their teaching and learning, during their professional development there must be a focus on pedagogy and relevance for their teaching of the different subject areas (Greener & Wakefield, 2015). According to Ertmer and Ottenbreit-Leftwich (2010), there will probably be a need for changes in teachers' knowledge, self-efficacy and pedagogical beliefs in order to empower teachers to use technology in ways that sustain 21st century

goals. According to Tondeur et al. (2012), because of their strong pedagogical beliefs, developed from their experiences as secondary school students and earlier classroom teaching practices, in-service teachers are likely to resist change. However, Koehler and Mishra (2005) argue that a change is to be expected when professional development takes into consideration the teachers' curricular needs. Several studies (Lau & Yuen, 2013; Peeraer & Van Petegem, 2012; Shu & Franklin, 2011) have shown that due to professional development there has been consistent increase of technology integration in the classroom. Therefore, since the power of using technology in the classroom relies on the premise that technology is integrated into existing pedagogy (Hennessy & London, 2013), the focus of professional development must not only be on the use of the technology but also on learning outcomes and how technology helps the development of these outcomes.

6.2.3.4 Lack of time

Findings from recent studies (Biancarosa & Griffiths, 2012; Buckenmeyer, 2010; Kopcha, 2012; Wachira & Keengwe, 2010) tally with what the participants in this study have reported about the time constraints for using Web 2.0 tools in teaching and learning. The participants indicated that they would need time to learn how to use the Web 2.0 tools and then how to plan and effectively implement these technologies in their classrooms, in line with with the findings of Buckenmeyer (2010) in her analysis of a survey conducted with 144 secondary school teachers. The participants also claimed that they would not have time for more or new activities to be added into their already overloaded curriculum. These claims agree with the results obtained by Biancarosa and Griffiths, (2012), Buabeng-Andoh, (2012) and Kale and Goh, (2012) who also found workload and lack of time to be significant barriers to teachers' integration of Web 2.0 tools in their professional practice. The participants also reported that implementing Web 2.0 tools in classroom would require more of their time because they might have to handle students' misbehaviour when using the Internet in the classroom, confirming findings by Kopcha, (2012), and Wachira and Keengwe, (2010). The participants'

concerns about the time constraints for implementing Web 2.0 tools in their professional practice can be seen in the quotes below.

> *I would like to use technology in my class, but itis not easy to look for time to study first and then start using it in my teaching. [Participant 7]*
>
> *Planning with technology takes longer time, but we do not have more time to plan our lessons, being busy with other tasks. [Participant 14]*
>
> *Bringing social networking sites in teaching would mean additional stress added to an already heavy workload. [Participant 1]*
>
> *Perhaps when we have more free time, which is very rare, we will be able to make use of these social networking sites in the class. [Participant 2].*

Some of the above participants are of the type of “fence sitters”, that is, they would integrate technology if they have had training in use of technology and/or are forced to do so by their school administration. Other fence sitters are those who wait and see what others are going to do about technology integration and then do same. In a more recent study, Lindberg et al. (2017) also found that although teachers were conscious of the potential of emerging technologies in education but are not implementing them in their practice due to unavailability of sufficient time. The researcher is of the opinion that there is a need to work out proper management of time in teaching and learning so that teachers are able to implement technology in their professional practice.

6.3 Teachers’ perceptions of the use of Web 2.0 tools in teaching and learning

The participants in this study responded to a survey questionnaire where they indicated their level of agreement or disagreement to 5-point Likert statements regarding the use of Web 2.0 tools for teaching and learning. Table 4.8 displays the percentage of teachers’ level of agreement which indicated that teachers strongly agreed that most Web 2.0 tools were relevant for teaching and learning. For items regarding self-efficacy beliefs on the use of Web 2.0 tools in teaching and learning, the responses were quite high, with 64.5% to 73.1% indicating strong agreement

or agreement about their self-efficacy beliefs on use of Web 2.0 tools in teaching and learning.

Findings of prior research (Ajjan & Hartshorne, 2008; Crook et al., 2008) also confirm that teachers have positive opinions regarding the usefulness of Web 2.0 tools in education. Although the participants reported a limited use of Web 2.0 tools in their professional practice, they had high regard for the pedagogical benefits of Web 2.0 tools. The above findings on teachers' perceptions of Web 2.0 tools in teaching and learning from the quantitative analysis are reinforced by those obtained from this study's qualitative data. Both positive and negative themes have emerged from the analysis of the qualitative data.

6.3.1 Positive themes

The positive themes that emerged from qualitative data in this study are efficient use of class time, student motivation and engagement, improved teacher–student interaction, accessibility of learning and development of collaboration skills.

6.3.1.1 Efficient use of class time

The participants reported that social media can help teachers to use teaching time at school judiciously. This is expressed by Participant 6 in the comment below.

> *With Web tools in the classroom, teachers will save time copying notes. Students can access them online with their smartphones or at home before coming to school. More time can be devoted to actual teaching, and individual attention. Pupils will be motivated to study. This will result in a better use of class time and better classroom management. [Participant 6]*

This finding is in line with other researchers (Greenhow et al., 2009; Weller, 2013) who have reported that today's learners have more choices, in particular the use of smartphone and tablets, about how and where to spend their learning time (for example in classrooms and outside formal face-to-face teaching- at home, in private and public places) than they did a decade ago.

This is corroborated in the quotes below.

There is no need to write lengthy notes on the board for pupils to copy. Teachers can upload their notes online on Google Drive and provide students access to the notes prior to coming to class. Students will not have to copy notes. Students can have more time to participate in class discussion. There will be more interaction in the class. [Participant 5]

Many students have smartphones and tablets these days. With the increasing availability of WIFI in many places, students can have more learning time outside school hours if they wish. [Participant 9]

So many educational sites are available on the Internet. Students can access these sites easily with their smartphones. [Participant 11]

These participants are also examples of innovative teachers who use their creativity to help students in easing their learning activities. So, according to the researcher, if learning with digital devices can happen outside classroom, then teachers will have more classroom time for individual attention, remedial work and the development of higher order skills.

6.3.1.2 Student motivation and engagement

The participants stated that the use Web 2.0 tools in class may have a positive impact on student engagement because students are already using these tools in in their daily lives and they will be learning in "their" environment.

Students will be motivated and will show enthusiasm when class activities will involve the use of the Internet. It is something different and something they often ask for. They are already using Facebook or YouTube in their everyday life. Rather than being passive recipients in normal classes, they will enjoy participating and actively engage in online class activities using Web 2.0 tools. [Participant 3]

It's a good thing to incorporate Web 2.0 tools in teaching, students will be motivated and show more interest in their studies as they will be studying with technologies that they use daily. This will eventually contribute to a good class management. [Participant 5]

Similar findings have been reported by Clark et al. (2009) who stated that some research studies also found that students using social networking sites like Facebook and YouTube were showing more interest in their studies, were more engaged and used these sites to facilitate their learning. This may be due the fact that students may already be regular users of Facebook, YouTube and other social networking sites for recreational purposes and communication with peers, friends and parents. So, they are used to create, consume and share produced information and communicate with Web 2.0 tools. They are now just using the skills that they already acquired using social media and incorporate in the learning of their different subjects. So, students show motivation and engagement in their study because they are in a learning environment in which they feel comfortable to study.

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6.3.1.3 Improved teacher-student interaction

According to the participants, the use of Web 2.0 tools in the classroom can help to improve communication between teachers and students.

> *The reactions of my students are positive, too. They understand that I am well conversant with up-to-date technologies, that I can understand them and keep pace with the technology they are using. I think this builds a better relation with my students. They communicate with me through Facebook. [Participant 4]*

> *They like the idea that their teacher can use these tools. They feel close to him. [Participant 6]*

> *My students like to communicate with me through WhatsApp or Facebook. It is easier for them to get in touch with me. [Participant 11]*

This finding concurs with Capo and Orellana (2011) and Hunter-Brown (2012) who also found that teachers perceived that social media would improve student-teacher communications and that some students prefer using Facebook groups to easily get in touch with their teachers. The researcher believes that there is improved teacher-student interaction because a sort of relation of trust is developed, as

teachers show their students that they have also embraced students' digital practices and are therefore able to understand their "digital world".

6.3.1.4 Accessibility of learning

Participants reported that Web 2.0 tools were providing a new time-space for communicating, interacting and collaborating among teachers and students. According to them, teaching and learning can continue after school hours through social media. This is pointed out in the quotes below.

> *I think it's a good idea to use Web 2.0 tools because we can be in touch with our students through Facebook even after school hours to discuss. Students can communicate among themselves doing a common project work or contact their teachers for extra help even after school hours. [Participant 10]*

> *Internet is a great tool because you can access it everywhere. Upload and retrieval of notes become easy. You have Internet at school. You need not bring your notes with you. You have to access it at school via the Internet [Participant 3]*

> *I wrote on my blog about some puzzles in mathematics, since I did not have the time to discuss them in the classroom, I was surprised to see that it aroused students' interest and finally we had to continue the discussion in the classroom. [Participant 5]*

These participants are passionate about using technology in their teaching. They bring innovations into their classes, encourage collaborative work among students and are willing to help their students even after class hours by keeping in touch with them online. This is due to their pedagogical beliefs. They work for a better student achievement, create an effective learning environment and increase the learning potential of their students (Mart, 2014). In the same vein, Meabon Bartow (2014) and Mao (2014) have argued that social media are enabling the contact among students and teachers outside normal school hours and facilitating the inclusion of multimedia into teaching and learning activities. So, Web 2.0 tools can help in easing lesson content delivery and make learning activities more attractive.

6.3.1.5 Development of collaboration skills.

According to participants' testimonies, the implementation of class activities using Web 2.0 tools may also support the development of collaboration skills. This is illustrated by Participant 1 in the comment below.

> *I agree that social networking is an area which could be developed. Everyone can see how important WhatsApp, Facebook or other social networking sites represent to young people. They use social networking sites to share videos or collaborate with other persons on common documents. [Participant 1]*

> *I haven't been able to foster collaborative learning using Internet in my classes because we do not have these facilities in my school but I have heard of it happening through other people. I do believe that collaborative learning is valuable because I think that this style of learning allows the growth of skills that are highly appropriate today. People need to be able to work well together for several reasons. I would place a high priority on facilitating this style of learning with my students. [Participant 2]*

> *Both teachers and students can work collaboratively on same projects. Teachers can share a document on Google Drive with several students to work on a common project. The same document can be moderated by the teacher. It is amazing to see what technology can allow you to do today. [Participant 11]*

Several studies (den Exter et al., 2012; Meishar-Tal and Gorsky, 2010; Elgort et al., 2008; Trentin, 2009) have also shown that with Web 2.0 tools students can work collaboratively to build knowledge. In the same vein, Fewkes and McCabe (2012) contend that using Facebook encourages self-regulation and accountability both individually and collaboratively among students. The researcher believes it is the students' immersion in social networking sites such as Facebook that develops their collaborative skills and eventually gives them the possibility to engage more in their learning through the use of learning tasks within these tools.

6.3.2 Negative themes

Technology distraction and inappropriate use of Internet were the two negative themes that surfaced from this study.

6.3.2.1 Technology distraction

In this study, the participants reported concerns about the use of wireless networks, computers, smartphones and other digital devices which may lead to some students indulging in some activities that are not necessarily relevant to the class. These fears arise from the participants being unsure about what would be happening in their classroom since while they would be writing on the board, students could be listening to music, texting others, playing games or even connecting with people outside the classroom. This is expressed in the quotes below.

> *Using technology and social media with 35 students in a class with Internet access can be extremely challenging for managing the class. When the Internet is available to students in class they can engage in activities that are not linked with their studies. For example, chatting with friends on social networking sites or playing online games. Dealing with such kind of misbehaviours in classes would take much of your teaching time. [Participant 4]*

> *My biggest concern is whether students will really adopt social media as a learning tool during the class or they might use it for other purposes. For example, while doing some collaborative work with their peers or instead of downloading the files that the teacher has shared for discussion, students may be seizing the opportunity of being online to communicate with their online friends or play games. Managing such classes can be problematic. [Participant 3]*

> *I think bringing social media in class is a potential for distractions. How can you prevent some students from indulging in their favourite pastimes like playing online games or chatting with online friends or responding to posts? [Participant 9]*

> *Social media like Facebook is primarily designed as a social networking tool. So, use of Facebook in class might result in students spending more time in off-topic discussion with online friends. The students may have some difficulty balancing their online learning activities and their other non-learning or leisure activities. [Participant 11]*

From the above quotes, teachers' anxiety over the management of students' use of the Internet in the class is evident. The teachers are anxious about the proper

running of class. So, dealing with distraction and managing classes that have Internet connection are major challenges that teachers perceive. These challenges coincide with the findings of Bate et al. (2014) who argue that managing ICT-rich classrooms and minimising distractions in classrooms are issues that teachers must deal with regularly. Thus, instead of Web 2.0 tools helping students to participate and collaborate formally and informally with others, these tools could turn out to be a distraction in the class.

6.3.2.2 Inappropriate use of technology

The participants also expressed concerns about inappropriate use of technology in schools that are related to their privacy, cheating, plagiarism, texting and sexting. The fear and anxiety about using online tools for teaching and learning were based on the possibility that students may have access to the participants' personal information through social networking sites. These concerns are voiced in the quotes below.

> *The nature of social media itself is that it allows individuals post whatever they want, without any restrictions. If you have some kids who are not very happy with you right now, they can voice their frustrations on Facebook and everybody sees the nasty comments they may publish on you. [Participant 6]*

> *I'm afraid that students are so obsessive about technology that they barely read books or newspapers and that they need some type of animation or digital to understand things. Also, students love to copy paste, not thinking this is plagiarism. [Participant 13].*

> *Just a Google search for an image can bring up something that they should not see. [Participant 4]*

> *Students can misuse our pictures or publish anything on us which can ruin our reputation as a teacher. We can't trust anyone. [Participant 1]*

These fears were also reported by Howard (2013) and Tindell and Bohlander (2012) who have shown that texting, game playing and social networking were common wrong uses of technology in school. The researcher's view is that teachers are

apprehensive of the risk of their professional and personal privacy being compromised if their Facebook profiles are viewed by students. According to the researcher, there will always be people who abuse social media in the ways mentioned above. But, fortunately, there are useful resources available for teachers. For example, plagiarism checkers like Turnitin and Viper make it easy to verify the authenticity of students' work, thus discouraging cheating.

6.4 Influence of teachers' expertise on their intention to use Web 2.0 technology in their practice

According to the TPACK model it is essential that teachers acquire technological pedagogical and content knowledge rather than simply technology knowledge (Koehler & Mishra, 2009). Koehler and Mishra (2009) defined TPACK as the set of knowledge that teachers need in order to teach their students a subject, teach effectively, and use technology, comprising content knowledge (what to teach), pedagogical knowledge (how to teach), technological knowledge (how to do so using technology). According to the TPACK model, teachers need to know how technology, pedagogy and content can interrelate with one another in order to effectively integrate technology in their professional practice. (Shin et al., 2009).

As shown Chapter Four, the EFA run for all items constituting the different TPACK constructs yielded three factors, namely technological content knowledge and TPACK (technology content knowledge together with pedagogy knowledge), technology pedagogy knowledge and technology knowledge. The technological content knowledge and TPACK were lumped together onto one factor. The merging of factors is not uncommon in survey studies for TPACK (Archambault & Barnett, 2010; Koh, et al., 2010; Lee & Tsai, 2010). In this study, the findings also indicated that the technological content knowledge items loaded with TPACK, resulting in the elimination of technological content knowledge as a discrete domain. This finding is consistent with literature that shows that teachers may not be at ease with conceptualising technological content knowledge as a distinct knowledge domain (Hofer & Harris, 2012). Also, in their reviewing a range of studies on experienced teachers' technological content knowledge and technology pedagogy knowledge,

Hofer and Harris (2012) established that there is more documentation on teachers' technology pedagogy knowledge than their technological content knowledge.

Multiple regression analysis on the regression scores obtained from the EFA revealed that the technology knowledge construct accounted for 74.8% variance of prediction of teachers' intention to use Web 2.0 tools. The Stepwise regression has also shown that technology pedagogy knowledge and Technology Content Knowledge together with Technology Pedagogy and Content Knowledge (technological content knowledge and TPACK) and) accounted for 3.5% and 2.9% respectively to variance in teachers' intention to use Web 2.0 tools.

These results indicate that technology knowledge has the greatest influence on in-service teachers' intention to use Web 2.0 technology in their practice, followed by technology pedagogy knowledge and the combination of technology content knowledge with TPACK. These findings are consistent with those obtained from the qualitative data analysis.

6.4.1 Technology knowledge

The interview participants reported that many teachers appeared to have had very little knowledge of the range of Web 2.0 tools that are available and the benefits of using online tools to enhance the learning of their students. This is pointed out in the quotes below.

> *Many teachers are not aware of the facilities of these Web 2.0 tools; for example, I often use Google Drive which is a very capable tool where you can upload all your notes and access [them] everywhere. If these teachers are made aware of these tools, I am sure they would like these tools very often and especially if Internet is accessible everywhere. [Participant 3]*

> *If teachers don't use Web 2.0 tools there is only one reason: They don't know how to use them. They are not aware of the potentials of these tools in education. If teachers are empowered properly, I think they will make use of these tools. [Participant 9]*

These findings strengthen the idea that confidence in technology knowledge is essential to developing confidence in the other three forms of knowledge measured

where technology is involved (technology pedagogy knowledge, technological content knowledge and TPACK). This implies that even though teachers are regular users of technology, they may still need to acquire the skills required to keep up with the changes in the use of the latest technology tools in teaching and learning. This is because the continuous introduction of new technology tools together with upgrades of current digital devices, and educational software will impact on the integration of technology in the classroom (Lindberg et al., 2017). According to the researcher, some basic skills in using Web 2.0 tools are a prerequisite to being able to meaningfully integrate Web technology into teaching.

6.4.2 Technology pedagogy knowledge

It also was not surprising that technology pedagogy knowledge was the second highest predictor because practising teachers may have to focus more of their attention upon how to teach with technology (technology pedagogy knowledge) since they may be more knowledgeable about pedagogy and content. This is apparent in the quotes below where the participants are looking for professional development with emphasis on use of technology in pedagogy

> *Technology should make the curriculum more accessible, interactive and engaging. Professional development of teachers should ensure that emphasis is laid on use of technology in pedagogy. [Participant 12]*

> *There is a need to look at the present/future professional developments that caters for the use of technology to support pedagogy. [Participant 10]*

6.4.3 Technological content knowledge and TPACK

For this study technology pedagogy knowledge is slightly more significant than technological content knowledge and TPACK combined together. However, according to Koh and Divaharan (2013), statistical modelling of in-service teachers' TPACK conceptions show technological content knowledge to be slightly more influential than technology pedagogy knowledge, arguing that this may be since teachers are more experienced with school-based curriculum demands (Koh, Chai, & Tsai, 2012). The third predictor was the combination of technological content

knowledge and TPACK which could be an indication of a lack of capability to make the relevant links to the use of technology tools in their subject areas. Also, in the prediction of educational use of the Internet by pre-service teachers, Sahin et al. (2013) found that the technology knowledge, content knowledge and technological content knowledge were statistically significant factors. They also indicated that teachers who understand TPACK will have better integration habits around using the Internet (Sahin et al., 2013). As expected, in-service and pre-service teachers are different with regard to the process and the content of their instructional decisions. The researcher believes that due to experienced teachers' greater familiarity with teaching and curriculum, the nature and development of their technological pedagogical, technological content knowledge and technological pedagogical content (TPACK) knowledge may be different from that of pre-service teachers in many ways.

According to the TPACK model (Mishra & Koehler, 2006), the greater understanding of the interrelationships of TPACK constructs a teacher has the more succesful technology integration in teaching is demonstrated by the teacher. The current study has shown technology knowledge, technology pedagogy knowledge, technological content knowledge and TPACK have an influence on teachers' intention to use Web 2.0 tools in their professional practice and thus supports the assumption of the TPACK model that concentrating on teachers' technology knowledge alone is not enough to successfully implement technology in teaching and learning. Also, this finding supports the TPACK model in that technological knowledge is one of the important domains of knowledge of TPACK. Mishra and Koehler (2006), in their TPACK model, asserted that it is essential that teachers are able to learn and adapt to new and emerging technologies. This could also partly explain why the teachers in the current study demonstrated a low level of use of Web 2.0 tools in their professional practice.

6.5 Predictors of teachers' intention to use Web 2.0 tools in their professional practice

As shown in Chapter Four, the EFA run for all items constituting the different UTAUT and TPACK constructs yielded five factors, namely facilitating conditions, technology pedagogy knowledge, ease of use, perceived usefulness and technology knowledge. Multiple regression analysis on the regression scores obtained from the EFA revealed that the five predictors teacher knowledge, technology pedagogy knowledge, ease of use, facilitating conditions and perceived usefulness accounted for variance in teachers' intention to use Web 2.0 tools of 72.0% ,4.2%, 3.6%, 3.1% and 2.9% respectively.

6.5.1 Technology knowledge and technology pedagogy knowledge

These results indicate that technology knowledge has the greatest influence on in-service teachers' intention to use Web 2.0 technology in their practice. As already pointed out in Section 6.3.1, sample quotes from Participant 1 and Participant 3 have expressed the need for technology knowledge in order to use Web 2.0 tools in their teaching. One explanation for these findings could be that technological knowledge, compared to pedagogical knowledge and content knowledge, is always in a state of flux given the rate at which technology changes (Harris et al., 2009) and teachers have to keep themselves updated with emerging technologies. This finding strengthens the idea that basic skills in technology knowledge are essential to developing confidence in the other three forms of knowledge measured where technology is involved (technology pedagogy knowledge, technological content knowledge and TPACK). It also was not surprising that technology pedagogy knowledge was the second-highest predictor because practising teachers may focus more of their attention upon pedagogy and content, therefore being more aware of pedagogical knowledge than technological pedagogy knowledge. The above findings are further reinforced by the qualitative data findings. The interview participants also reported that they need to acquire the knowledge of technology and knowledge of technology in pedagogy in order to integrate technology in their professional practice. As already pointed out in Section 6.3.2, sample quotes from

Participant 12 and Participant 10 have indicated the need for professional development in the use of technology in pedagogy so that they may be able to implement Web 2.0 tools in their teaching.

However, in a study conducted by Banas and York (2014), PCK had the greatest influence on pre-service teachers' intention to integrate technology in their professional practice (Sahin, et al., 2013). One explanation could be that these teachers were simultaneously developing their understanding of content, technology and pedagogy knowledge, in contrast to practising teachers who are more experienced with school-based curriculum demands (Koh, Chai, & Tsai, 2012). Also, in the prediction of educational use of Internet by pre-service teachers, (Sahin, et al., 2013) found that the technology knowledge,content knowledge and technological content knowledge were statistically significant factors. They also indicated that teachers who understand TPACK would have better integration habits around using the Internet. As expected, in-service and pre-service teachers are different with regard to the process and the content of their instructional decisions given experienced teachers' greater familiarity with teaching and curriculum, the nature and development of their technological pedagogical, technological content and technological pedagogical content (TPACK).

6.5.2 Effort Expectancy

In the UTAUT model effort expectancy is described as the degree of ease associated with the use of a technology. In this study, effort expectancy refers to the volume of effort a teacher must spend for the use of Web 2.0 tools. The factor ease of use was obtained from the survey items that measured effort expectancy.

The multiple regression analysis results show that effort expectancy (β=0.190) has a moderate effect on Intention to use, accounting for 3.6% of the variance in in-service teachers' intention to use Web 2.0 in their future teaching approaches. The association between effort expectancy and in-service teachers' intention was a positive value. The survey items that considered effort expectancy concerned the ease of using Web 2.0 tools. This means that the more the teacher considered it easy to use the technology the more probable it was that they would be to have the

intention to use technology in their future professional practices. The researcher believes that the availability of professional development in the use of Web 2.0 tools use might increase teachers' intention and use of Web 2.0 tools in their classrooms by lessening the individual anxieties over the effort required to study Web 2.0 tools. Self-efficacy beliefs as depicted by the item "I possess the necessary skills to use Web 2.0 tools" also forms part of the effort expectancy factor. Similar findings were obtained from the qualitative data. This is clearly expressed in the quote below.

> *It has been through social networking, more precisely Facebook, where my students communicate with me, or post a particular question which is their area of difficulty. I comment on the question and invite other students to share their views. I have used Facebook as a tool to help me in my teaching. I have created a group where all my students have become members. It is very easy for us to communicate using that group. I can also see what they are sharing and what are their difficulties. [Participant 6]*

The participants had strong self-efficacy beliefs about Web 2.0 tools and were integrating these tools in their professional practice. In a study of 599 teachers, Pan and Franklin (2011) found self-efficacy to be a significant predictor of teachers' use of Web 2.0 technology in their classrooms. This is corroborated by the findings of previous studies, which showed computer self-efficacy to positively influence teachers' views and intentions to use and integrate computers (Anderson &Maninger, 2007; Giallamas & Nikolopoulou, 2010). For Ertmer and Ottenbreit-Leftwich (2010) self-efficacy may be more important than skills and knowledge among teachers who implement technology in their classrooms. Although teachers expressed high self-efficacy in using Web 2.0 applications, their self-efficacy related to integrating Web 2.0 applications in lessons within classrooms was low. The researcher thinks that this might be due to their lack of actual classroom experience.

6.5.3 Performance expectancy

In the UTAUT model, performance expectancy is described as the degree to which the teachers believe that using a technology will help them accomplish a task. In this study, the task is defined as using Web 2.0 tools with the expectancy of

improving instruction in their classes. The factor perceived usefulness was obtained from the survey items that measured performance expectancy. According to Venkatesh et al. (2003), performance expectancy is the strongest predictor of behavioural intention. However, this present study, performance expectancy (β=0.141) explained the smallest amount of variance (1.7%) of prediction in in-service teachers' intention to use Web 2.0 in their future teaching approaches. From the qualitative data analysis, the participants also revealed that Web 2.0 tools would motivate students and help in the development of collaboration and communication skills. Being able to continue the educational dialogue after school through social media where teachers may provide relevant material or students can discuss, comment and present their work was another useful feature of Web 2.0 tools perceived by the interview participants. This is illustrated in the quotes below.

> *Technology would provide unlimited opportunities to engage students in meaningful learning activities by using the tools that students are already familiar with to reach and teach them. [Participant 15]*

> *I think it's a good idea to use Web 2.0 tools because we can be in touch with our students through Facebook even after school hours to discuss. Students can communicate among themselves doing a common project work or contact their teachers for extra help even after school hours. [Participant 10]*

> *I have used Facebook as a tool to help me in my teaching. I have created a group where my students have become members. It is very easy for us to communicate using that group. I invite students to post any area of difficulty and ask other students to share their views. I can also see what they are sharing and what are their difficulties. [Participant 6]*

Perceived usefulness and perceived ease of use are two determinants that predict behavioural intention to use technology. In a study on pre-service teachers' intention to use Web 2.0 tools in their professional practice, Chiou and Franklin (2011) found that perceived usefulness was a significant predictor in predicting intention to use Web 2.0 in future teaching approaches, but perceived ease of use did not contribute significantly as a predictor of intention to use in future. This view is partly supported by Sadaf et al. (2012), who argue that both perceived usefulness

and ease of use are among the most significant predictors of intentions by pre-service teachers to use Web 2.0 technologies in the future. Findings from this present study support the conclusion that both perceived usefulness and perceived ease of use are significant predictors of in-service teachers' intention to use Web 2.0 in their future teaching approaches. One reason, in the researcher's view, could be that the in-service teachers might not have known what the Web 2.0 applications were because they might not have received adequate training in terms of using these applications for educational purposes before answering the survey questionnaire.

6.5.4 Facilitating conditions

In the UTAUT model, facilitating conditions are described as the teachers' perceptions about the organisational support and technical infrastructure available to support use of Web 2.0 tools in teaching and learning. According to Venkatesh et al. (2003), the construct facilitating conditions did not affect intention to use technology but did instead have a positive influence of the actual use of technology. However, in this study, facilitating conditions were found to be a predictor of moderate significance (β=0.177) explaining the 3.1% variance of in-service teachers' intention to use Web 2.0 in their future teaching approaches. The interview participants also confirmed the need for technical and administrative support and resources like computers and access to Internet. This is expressed in the quotes below.

> *Use of technology is sometimes more of a problem, especially when it doesn't work. You can lose a lot of the time meant for actual teaching when you have technical difficulties. [Participant 8]*

> *The computers in the school always have technical problems so it is frustrating when you have planned to use computers in your class and they do not function properly. So technical support should be available in the school. [Participant 9]*

These findings are consistent with those of Pan and Franklin (2011) who found that school administrative support was a predictor for integration of Web 2.0 tools in instructional settings. Venkatesh et al. (2003) found that facilitating conditions and

intention to use were direct determining factors of actual usage. However, for their study, actual usage was established by reevaluating participants at the end of a six-month period to assess the actual use and compare it to their original intention to use technology. The nature of this study was not set up to have a post-test, but further research that would take post-testing into account can be envisaged for the future.

6.6 Statistical significance between the UTAUT constructs and the TPACK constructs

While TPACK has non-technology elements including pedagogical knowledge and content knowledge, UTAUT is mostly about acceptance and use of technology. If any correlation with UTAUT constructs was to be found, the researcher thought it would be in the technology components, those representing technology knowledge, technological content knowledge, technology pedagogy knowledge and/or technological pedagogical content knowledge.

For the present study, data analysis has shown that there was no significant relationship between the UTAUT constructs (performance expectation, effort expectation, social influence and facilitating conditions) and the TPACK constructs content knowledge (content knowledge) and pedagogy knowledge. This might be due to the fact that these two constructs do not have a technology component.

Social influence has little correlation with technology knowledge and technology pedagogy knowledge.

Only the construct technology knowledge appears to have some significant correlation with facilitating conditions. This finding implies that the more facilitating conditions exist, the more likely it is for technology knowledge to increase.

The construct intention to use seems to correlate mostly with technology knowledge and technology pedagogy knowledge. This finding implies that as technology knowledge and technology pedagogy knowledge increases, the intention to use technology increases as well.

All the performance expectancy (PE1 to PE7) constructs and effort expectancy (EE1 to EE5) had a significant relationship with all the TPACK constructs (technology knowledge, technology pedagogy knowledge, PCK, technological content knowledge and TPACK) except for content knowledge and pedagogy knowledge. A surprising finding was the association between performance expectancy and PCK and effort expectancy and PCK. PCK is only about pedagogy and content knowledge and has no technology component. This might be because of the type of knowledge the participants already have acquired since they are in-service teachers. Participants that reported having higher levels of PCK might be expected to find Web 2.0 tools easy to use or perceive the usefulness of Web 2.0 tools for teaching and learning. One explanation could be that teachers having higher levels of PCK are more likely to find Web 2.0 tools easy to use or perceive the usefulness of Web 2.0 tools for teaching and learning.

PCK refers to the intersection of information about subject knowledge, that is knowledge of the subject being taught, and pedagogic knowledge, that is knowledge of how to teach (like instructional planning and strategies, class activities, assessment, among others). What Shulman (1986) refers to as PCK includes:

> the most regularly taught topics in one's subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations and demonstrations – in a word, the ways of representing the subject that make it comprehensible to others. … It also includes an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to learning (Shulman, 1986 p. 9).

When Shulman first made his argument about PCK, there were barely issues around technologies to the extent that they are today. In the 1980s traditional classrooms used a variety of technologies, from whiteboards, charts, textbooks, encyclopaedias, to overhead projectors. Today's technologies have come to the

forefront of the educational environment mainly because of the availability of a range of new digital technologies and the necessity for learning how to apply them to teaching and learning. These new technologies, which exist in forms that could not have been imagined a few years ago, include computers, tablets, smartphones and the Internet. These new technologies have changed the nature of the classroom or have the potential to do so. Reflecting on the different features or instances that Shulman considered as being central to PCK, such as “the most powerful analogies, illustrations, examples, explanations and demonstrations” (Shulman, 1986, p. 9) or, in other words, “the ways of representing and formulating subject” (Shulman, 1986, p. 9) to make it more accessible and comprehensible, one can clearly see that technologies play a critical role in each of these aspects, implying that Shulman's basic model still holds true. Obviously, technologies can offer affordances over a range of representations, analogies, examples, explanations and demonstrations that can help make subject matter more accessible to the learner. At present, teachers must learn not only how to handle the technology tools currently available, but also how to implement technology for pedagogical purposes. This is like the earlier concept of Shulman’s teacher knowledge except that knowledge of technology forms an important integral part of teacher knowledge. Thus, knowledge of technology becomes an important aspect of overall teacher knowledge. The fact that PCK has a significant relationship with the UTAUT constructs performance expectancy and effort expectancy is, in the researcher’s view, an indication that in the 21st century the Shulman’s PCK model should be revisited.

The comparison between TPACK and UTAUT has revealed some surprising correlations between seemingly unrelated constructs. To the researcher’s knowledge, there is a scarcity of literature on the combination of the constructs of these two different frameworks (UTAUT and TPACK).

6.7 Categories of teachers in relation to use of Web 2.0 tools in their professional practice

Five types of teachers have emerged from the qualitative data. They are the passionate, the innovative, the undecided, the anxious and the resistant.

6.7.1 The passionate teacher

Passionate teachers are recognised by their interest about ideas that can change the world for the better, enthusiasm that can make a difference to achievement of learners and commitment to their work performance (Serin, 2017). Thus, passionate teachers always look forward to bringing about change not only in their teaching profession but also in the promoting learning (Altun, 2017; Yildiz & Celik, 2017). This is illustrated in the quotes below.

> *Involving technological tools that enable critical thinking, collaborative learning, and communicating skills is indeed very crucial both for me and my students as I believe I can capture their attention and enhance their learning and develop the skills our students in the 21st century. [Participant 8]*

> *I use technology every day and am almost online all the time. I communicate with people, check my mail and surf on the net with my smartphone. I find it easier to communicate with my students at any time and share my lessons notes with them. [Participant 11]*

> *I usually spare some time, about an hour, on Facebook during the weekend to attend to queries, if any, from my students about their work. [Participant 11]*

They are so passionate with the use of technology in their professional that they spare some time after school hours to be in touch (online) with their students to help them. The researcher believes these teachers have a passion that pushes them to excellence in their job and drives their students to excellence and innovation in their studies. They are always looking forward to improving their practice and finding new ways to motivate students to grow through real work inside and outside the classroom. Mart (2014) argues that passionate teachers influence student achievement and there is a robust relationship between the passionate teacher and

successful student learning. These teachers want the best for their students and use new technologies in their lessons. In the same vein, in a study with secondary school teachers, Ertmer et al. (2012) found that internal factors such as passion for technology and having a problem-solving mentality influence teachers' use of Web 2.0 tools in their practices. Also, these teachers are passionate about using Web 2.0 tools in their professional practice because they are regular users of these tools in their daily lives and more importantly, they have understood the affordances of these tools for use in teaching and learning.

6.7.2 The innovative teacher

This type of teaching is bringing new ways of teaching to support instruction and learning by implementing Web 2.0 tools in their professional practice. This is reflected in the quotes below.

> *Technology helps me make things more visible and real for my learners. They're more able to understand ideas and concepts with better visuals. I download videos from YouTube and bring in my classes. It is easier for me to teach biology topics such as metamorphosis or breathing movement using videos. [Participant 14]*

> There are tons *of free educational videos that are available online through YouTube and TeacherTube. These online tools allow me to download videos that help me teach abstract phenomena and simulations in my science classes. [Participant 15]*

These participants are innovative teachers who are looking for ways to enhance the teaching of difficult or abstract topics for the betterment of their students. This finding concurs with the outcome of a study conducted by Willmot et al. (2012) who argue that the use of video in student-centred learning activities can encourage and engage students to enhance their learning.

6.7.3 The undecided teacher

These teachers are not making use of the learning opportunities that Web 2.0 tools offer. For example, for teachers to improve communication, productivity and sharing within their classes (Brown, 2010; Greenhow, Robelia, & Hughes, 2009) and learners to take more control of their learning through producing content for their

learning community and exposing learning materials for re-use by others (Crook & Harrison, 2008).

An example of this is the quote from Participant 8:

> *When I had to remind them about the deadline for submission of their work I post messages in my wall on Padlet. [Participant 8]*

Ertmer & Ottenbreit-Leftwich (2013) and Wang et al. (2014) have also found that technology was still being used in ways that were neither meaningful nor student-centred but in ways that supported traditional practices. Also, the undecided teacher will integrate technology in their teaching if they have been trained to do so or are requested to by the school administration.

6.7.4 The anxious teacher

Teachers' anxiety over the management of students' use of the Internet in the class is evident in the quotes below.

> *I think bringing social media in class is a potential for distractions. How can you prevent some students from indulging in their favourite pastimes like playing online games or chatting with online friends or responding to posts? [Participant 9]*

> *Social media like Facebook is primarily designed as a social networking tool. So, use of Facebook in class might result in students spending more time in off-topic discussion with online friends. The students may have some difficulty balancing their online learning activities and their other non-learning or leisure activities. [Participant 11]*

The teachers are anxious about the proper running of class. So, dealing with distraction and managing classes that have Internet connection are major challenges that teachers perceive. These challenges concur with the findings of Bate et al. (2014) who argue that managing ICT-rich classrooms and minimising distractions in classrooms are issues that teachers must deal with regularly. These fears were also reported by Howard (2013) and Tindell and Bohlander (2012) who have shown that texting, game playing and social networking were common wrong

uses of technology in school. According to the researcher, teachers are apprehensive of the risk of their professional and personal privacy being compromised if their Facebook profiles are viewed by students.

6.7.5 The resistant teacher

In the researcher's view, resistance is a normal response when a teacher lacks knowledge or confidence but is pressurised to integrate technology into his or her professional practice

> *I am not sure about my ability to use technology or the need of bringing technology in class. I do not think that it is a good idea for me to move away from my normal teaching style. I feel I am a successful teacher, and therefore I do not think changing my way of teaching through technology will bring learning enhancement. [Participant 1]*

Teachers who do not integrate technology in their instructional practice are often branded as "resistant" to change (Howard, 2013). Teachers are likely to resist change because they believe that the traditional methods of teaching are the best. This type of teacher is resistant because of their pedagogical beliefs. They have had success with their lessons and strategies tried several times and believe that change may appear needless for them (Bohn, 2014). These teachers might feel that they would be wasting some teaching time when incorporating new technology into their teaching (Howard, 2013). Also, these teachers might feel a loss of control of their class. In a traditional classroom, the teachers usually do everything, that is, they oversee all class activities (Bohn, 2014). However, with the integration of technology in teaching and learning, some of these responsibilities may have to be taken away from them. Hence, there is resistance to change, as some of the decisions are taken out of their hands. These teachers may feel that there is a power shift to somebody else other than the teachers. In other words, these teachers have the impression that they are losing control of their classes, thus affecting their authority. Such kind of teachers have no plan for using technology in their classes, even though they can use it (Oriji & Amadi, 2016).

6.8 Summary

In this chapter the findings from quantitative analysis were discussed in conjunction with those obtained from the qualitative data. The discussion has been centred on the research questions, that is, on teachers' use of Web 2.0 tools, their perceptions of these tools in teaching and learning and their intention to use these tools in their professional practice. The relationship between the TPACK and UTAUT constructs has also been discussed.

7 Conclusion

7.1 Introduction

A sequential explanatory mixed design-based research approach was used to investigate secondary school in-service teachers' use of Web 2.0 tools, their perceptions of the use of Web 2.0 tools in teaching and learning, and the best predictors of intention to use Web 2.0 tools in their professional practice. In this final chapter, an overview of the research is presented. Findings connecting to the research questions that directed the study, and the limitations and implications of the study are discussed. In the light of the findings from this study, some recommendations and suggestions for further research are formulated in this chapter and a model for the best predictors on teachers' intention to use Web 2.0 tools in their professional practice is proposed.

7.2 Overview of the research study

The need to explore teachers' perceptions and use of Web 2.0 tools and determine the best possible predictors of Web 2.0 tools adoption in teaching and learning was established in Chapter One. In Chapter Two a review of the related literature on Web 2.0 tools and their application in education, teachers' perceptions on technology use in teaching and learning and the conceptual frameworks (TPACK and UTAUT) were presented. The research methodology was discussed in Chapter Three. The quantitative data collected through survey questionnaires and qualitative data obtained through interviews were analysed and findings presented in Chapter Four and Chapter Five respectively. In Chapter Six the findings from Chapter Four and Chapter Five were discussed in conjunction with the literature review presented in Chapter Two.

7.3 Addressing the research questions

The findings which were discussed in Chapter Six have helped the researcher to address the research questions that guided this study.

7.3.1 **Research question 1**

Research question 1 was designed to acquire information about the justifications of teachers' use or non-use of Web 2.0 tools in their professional practice. What are the reasons for teachers using or not using Web 2.0 tools in their professional practice? During the data analysis, three main themes emerged in connection with the reasons explaining teachers' use of Web 2.0 tools in their professional practice. They were related to motivation, accessibility and teaching of abstract concepts. Five themes emerged from the data analysis that justified the non-use of Web 2.0 tools by teachers in their professional practice. They are associated with lack of knowledge of how to use technology, lack of knowledge of pedagogical use of technology, limited access to the Internet, lack of training and lack of time to implement technology-integrated lessons in their classrooms.

7.3.1.1 **Why teachers are using Web 2.0 tools**

The findings from the analysis of data gathered in this study have shown that several Web 2.0 tools such as Wikis, Blogs, Cartoon Maker and Padlet are being used in secondary school classrooms. The motivation to try out these tools in classrooms was mostly influenced by teachers' decisions to improve their lesson delivery and to engage students in learning activities, consequently leading to enhanced learning outcomes. In the same line of thought, Ertmer et al. (2012), have argued that internal factors such as passion for technology and having a problem-solving mentality influence teachers' use of Web 2.0 tools in their practices.

Accessibility was another reason for teachers' use of Web 2.0 tools in their professional practice. Web 2.0 tools are providing a new space for communication, interaction and collaboration among teachers and students. Consequently, teaching and learning may continue after school through social media where teachers may provide relevant study materials or students can discuss, comment on and present their work. Teachers are using tools like Facebook where students can engage in group projects and continue their schoolwork outside of the classroom. Collaboration between both student and teacher and student and student, extra help from the teacher concerning homework or revision work are

possible when using Facebook in the classroom. This implies that teachers may have more time to devote to students since part of the teaching activities can be done outside school hours. Other studies (Carter et al., 2008; Grisham, 2014; Fewkes& McCabe, 2012) have had similar findings.

Teachers are using technology to facilitate the teaching of concepts that are difficult to grasp (for example through illustration, simulation, animation, among others). With the integration of videos (obtained from YouTube) in teaching activities, students are now able to better understand difficult or abstract topics. The pedagogical implications of the use of videos are that student-centred learning activities can be carried out in class, thus motivating students to enhance their learning. Willmot et al. (2012) have also found that the use of videos in class is helpful in engaging students in their studies.

However, some teachers have been using Web 2.0 tools in ways that take no advantage of the technology's social affordances, for instance, posting reminders about homework or upcoming class tests on Facebook; however, the same task could be achieved by using email. Other researchers (Ertmer & Ottenbreit-Leftwich, 2013; Henderson et al., 2013; Wang et al., 2014) have found that technology is still being used in ways that are not meaningful or student-centred but in ways that supported traditional practices. So, these teachers are missing the opportunities of using the affordances of Web 2.0 tools which could have enhanced their teaching practices and eventually enhance students' learning.

7.3.1.2 **Why teachers are not using Web 2.0 tools**

In this study, the main reasons why teachers are not using Web 2.0 tools in their classrooms appear to be teachers' lack of both knowledge of how to use technology and knowledge of pedagogical use of technology, access to the Internet, teachers' lack of training and teachers' lack of time to implement technology-integrated lessons in their classrooms.

Inadequate knowledge of technology and lacking the knowledge of pedagogical use of technology were common reasons for the participants' non-use of Web 2.0 tools.

Similar findings were also noted in other studies (Blackwell et al., 2014; Ertmer, et al., 2012; Inan & Lowther, 2010; Ottenbreit-Leftwich et al., 2010; Zhou et al., 2011). Some of the reasons cited were that digital technologies accessible to schools and teachers are always changing. As Moore-Hayes (2011) noted, it may be possible that some of these teachers may also be worried about the use of technology because of their lack of confidence. Another reason for this lack of pedagogical use of technology reported in this study could be that some of these teachers have had some training or have attended some workshops on use of technology. However, they were not well trained, emphasis not being placed on the acquisition of knowledge to integrate technology, pedagogy and content by their teacher education programmes to use technology in teaching but rather how to use the technology. Zhou, Zhang and Li (2011) obtained similar findings in their study.

Participants in this study indicated that they did not have the technology tools available to them to integrate technology in their teaching, the availability of computers in the classroom and the Internet being a problem. Some of the participants pointed out that there was no Wi-Fi connection in their schools and that the Internet was available in the computer labs only; however, the computer labs were being used for computer classes and there were not enough time slots for teachers of different subject areas to use the resources. The lack of availability of the technological tools and resources to facilitate learning was a barrier that prevented teachers from integrating technology in the classroom (Lacina et al., 2011; Ogwu & Ogwu, 2010). Access to technology resources thus plays an important role in motivating teachers to use technology (Ebsworth et al., 2010; Hutchison & Reinking, 2010; Liang & Chen, 2012).

Lack of training was another common theme revealed during the interviews. The participants expressed their concern about the need for training opportunities offered to them in the use of technology. A lack of training has been frequently quoted as a barrier to teachers' integration of technology in their professional practices (An & Reigeluth, 2011; Ertmer and Ottenbreit-Leftwich 2010; Johnson et al., 2013; Kopcha, 2012). A lack of training is the most predominant barrier to technology integration in education (Ertmer, 2005; Lawless & Pellegrino, 2007).

Several participants expressed the need for training with a focus on infusion of technology into pedagogy to improve student learning. The participants also reported that training should not only be on the latest technology, but also how to use that technology within their specific subject areas to enable them to create effective technology-integrated learning opportunities for their students. The use of the technology should not be the focus of technology integration but rather on the learning outcomes and how technology helps the development of these outcomes (Davies, 2011; Ghamrawi, 2013).

The unavailability of enough time for implementing Web 2.0 tools was another reason that was reported by the participants in this study. Teachers do not have enough time available to them for using Web 2.0 tools in their classroom practices. Other studies (Biancarosa & Griffiths, 2012; Buckenmeyer, 2010; Kopcha, 2012; Wachira & Keengwe, 2010) have reported similar findings. Teachers need time to learn how to use Web 2.0 tools and then how to effectively implement these technologies in their classrooms (Buckenmeyer, 2010). According to Biancarosa and Griffiths (2012), Buabeng-Andoh (2012), Kale and Goh (2012), teachers do not have time for more or new activities to be added into their already overloaded curriculum. Also, other researchers (Kopcha, 2012; Wachira &Keengwe, 2010) have argued that implementing Web 2.0 tools in the classroom requires more of teachers' time because they will have to handle students' misbehaviour when using the Internet in the classroom.

7.3.2 **Research question 2**

Research Question 2 was designed to acquire information about the teachers' perceptions towards the use of Web 2.0 technologies in teaching and learning. What are teachers' perceptions of the use of Web 2.0 technologies in teaching and learning? The findings from the data analysis in this study revealed that teachers had both positive and negative perceptions towards the use of Web 2.0 technologies in teaching and learning.

7.3.2.1 **Teachers' positive perceptions of Web 2.0 tools**

The positive perceptions are efficient use of class time, student motivation and engagement, improved teacher–student interaction, accessibility of learning and development of collaboration skills.

Web 2.0 tools can help teachers to make effective use of teaching time at school. Today's learners have more choices, the use of mobile/tablet devices, about how and where to spend their learning time (for example in classrooms and outside formal face-to-face teaching – at home, in private and public places) than they did a decade ago (Weller, 2013). So, when learning with digital devices is happening outside the classroom, then teachers will have more classroom time for the development of higher-order skills, such as critical thinking, problem solving, collaboration and communication. Use of Web 2.0 tools in class has a positive impact on student motivation and engagement. Students are already using Web 2.0 tools like Facebook and YouTube in in their daily lives and are motivated to learn in "their" environment (Clark et al., 2009). Jimoyiannis et al. (2013) also concur, in their studies, that with Web 2.0 tools students' skills in critical thinking, writing and reflection can be reinforced. Web 2.0 tools enable students to create, consume and share independently produced information, remixing content in creating new content (Greenhow, 2009). In their study involving university students Al-Rahmi, Othman and Yusuf (2015) also concluded that social media brings about collaborative learning, engagement and improved educational experience among the study participants.

The use of Web 2.0 tools in the classroom helps to improve the teacher–student relationship. Capo and Orellana (2011) have also found that teachers perceive that social media would improve student-teacher communications and that some students prefer using Facebook groups to easily get in touch with their teachers. They argued that a relationship of trust develops between a student and his or her teacher when the student uses Facebook groups to easily get in touch with their teachers. Abu-Alruz (2014), who investigated the use of Facebook in university

education students also found that students develop a better relationship with their classmates and their lecturers using Facebook.

Web 2.0 tools are providing a new time-space for communication, interaction and collaboration among teachers and students. Teaching and learning can continue after school hours through Web 2.0 tools where teachers may provide relevant material or students can discuss, comment on and present their work. By allowing the access of students to teachers outside normal school hours and facilitating the inclusion of multimedia into teaching activities, Web 2.0 tools can help in making content delivery easier and can make learning activities more attractive (Bartow, 2014; Mao, 2014).

The implementation of class activities using Web 2.0 tools supports the development of collaboration skills. With Web 2.0 tools students can collaboratively build knowledge (Exter et al., 2012; Meishar-Tal and Gorsky, 2010; Elgort et al., 2008; Trentin, 2009). Collaborative networking sites such as Facebook provide students with the potential to foster increased engagement in their learning through the use of learning tasks within these media by encouraging self-regulation and accountability both individually and collaboratively among students (Fewkes & McCabe, 2012). The researcher believes incorporating Web 2.0 tools into class activities may be the key to making students more interested in school.

7.3.2.2 Teachers' negative perceptions of Web 2.0 tools

Technology distraction and inappropriate use of the Internet were the two negative themes that surfaced from this study. Other studies (Bate, et al., 2014; Howard, 2013; Tindell & Bohlander, 2012) have shown similar results and some of the reasons cited were listening to music, texting others, playing online games, cheating, plagiarism and sexting.

The use of wireless networks, computers, smartphones and other digital devices may lead to some technology distractions. Students may be indulging in some activities that are not necessarily relevant to the class. With the use of Web 2.0 tools in class, students may be listening to music, texting others, playing games or

even connecting with people outside the classroom during instruction time (Bate, et al., 2014). Also managing ICT-rich classrooms and minimising distractions in classrooms are issues that teachers must deal with regularly (Bate et al., 2014). Hence, there is a need for proper professional development for teachers on the management of classes that are equipped with access to the Internet.

Inappropriate uses of technology in schools that are related to privacy, cheating, plagiarism, texting and sexting arer a matter of concern. The fear and anxiety about using online tools for teaching and learning is that students may have access to the teachers' personal information through social networking sites. Texting, game playing, and social networking are common wrong uses of technology in school (Tindell & Bohlander, 2012). Also, with the use of Web 2.0 tools in teaching and learning, there is the apprehension of the risk of teachers' professional and personal privacy being compromised via the Internet (Howard, 2013). Hence, there is a need for supervision of the students especially from inappropriate websites (Kahveci, 2015).

7.3.3 **Research question 3**

Research question 3 was intended to explore the types of knowledge that could encourage teachers to use Web 2.0 tools in their professional practice. To what extent does teachers' expertise influence their intention to use Web 2.0 technology in their practice?

Research question 3 was addressed through the lens of the TPACK model. According to the TPACK model, it is essential that teachers understand that the interaction of technology, pedagogy and content can lead to effective subject-based teaching with technology (Shin et al., 2009). The findings from the quantitative analysis have shown that technology knowledge had the greatest influence on in-service teachers' intention to use Web 2.0 technology in their practice, followed by technology pedagogy knowledge and the combination of technology content knowledge with TPACK. These findings strengthen the idea that confidence in technology knowledge is essential to developing confidence in the other three forms of knowledge measured where technology is involved (technology pedagogy

knowledge, technological content knowledge and TPACK). Though teachers are regular users of technology, they may still need to acquire the necessary skills required to keep up with the changes in the use of the latest technology tools in teaching and learning. This is because new technology tools together with upgrades of current digital devices, and educational software will continue to have an influence on the integration of technology in the classroom (Olofsson, et al., 2017). Technology pedagogy knowledge is the second-highest predictor because practising teachers may have to focus more of their attention upon how to teach with technology (technology pedagogy knowledge) since they may be more knowledgeable about pedagogy and content (content knowledge).

The greater grasp of the interrelationships of TPACK constructs a teacher has, the more successfully technology integration in teaching is demonstrated by the teacher (Mishra & Koehler, 2006). Technology knowledge, technology pedagogy knowledge, technological content knowledge and TPACK have an influence on teachers' intention to use Web 2.0 tools in their professional practice and this supports the assumption of the TPACK model that concentrating on teachers' technology competency alone is not sufficient to achieve successful technology implementation.

7.3.4 Research question 4

Research question 4 was meant to examine the predictors for teachers' intention to use Web 2.0 tools in their professional practice. What are the best predictors of Web 2.0 technology acceptance and teachers' intention to use Web 2.0 tools in their professional practice?

Research question 4 was addressed through the lens of the combination of the constructs of the TPACK model and the UTAUT model. The results obtained from the analysis of the quantitative data revealed that teacher knowledge, technology pedagogy knowledge, effort expectancy, facilitating conditions and performance expectancy are the best predictors of teachers' intention to use Web 2.0 tools. Technology knowledge has the greatest influence on in-service teachers' intention to use Web 2.0 technology in their practice. Technology knowledge, compared to

pedagogy knowledge and content knowledge, is always in a state of flux, given the rate at which technology changes (Harris et al., 2009) and consequently teachers have to keep themselves updated with emerging technologies. Technology knowledge is essential to developing confidence in the other three forms of knowledge measured where technology is involved (technology pedagogy knowledge, technological content knowledge and TPACK). Technology pedagogy knowledge is the second highest predictor because practising teachers may focus more of their attention upon pedagogy and content, therefore being more aware of PCK than technological pedagogy knowledge.

Effort expectancy refers to the amount of effort a teacher must spend on the use of Web 2.0 tools. Perceived ease of use, which forms part of the construct effort expectancy, is a significant predictor of intention to use technology. Hence, teachers who feel that Web 2.0 tools are easy to use and useful are more likely to adopt Web 2.0 tools for teaching (Howard, 2013). Self-efficacy, which also forms part of the effort expectancy construct, is also a significant predictor of teachers' use of Web 2.0 technology in their classrooms (Pan & Franklin, 2011). The perception of the usefulness, ease of use and strong self-efficacy beliefs could be due to the teachers' exposure to Web 2.0 technologies during their normal daily activities that helped them understand the value of using these technologies in their professional practice.

Facilitating conditions are defined as the teachers' perceptions about the organisational support and technical infrastructure available to support use of Web 2.0 tools in teaching and learning. In this study, facilitating conditions were found to be a predictor of moderate significance. Facilitating conditions such as technical and administrative support, resources like computers and access to the Internet, and professional development are predictors for integration of Web 2.0 tools in instructional settings (Pan & Franklin, 2011). The availability of professional development in the use of Web 2.0 tools use might increase teachers' intention to use and use of Web 2.0 tools in their classrooms by reducing the individual concerns over the effort required to study Web 2.0 tools.

In this study the UTAUT construct performance expectancy is defined as using Web 2.0 tools with the expectation of improving the instruction in their classes. The factor perceived usefulness forms part of performance expectancy. The fact that Web 2.0 tools motivate students and help in the development of collaboration and communication skills and enable teachers and students to pursue teaching and learning activities after school hours through the use of Web 2.0 tools is perceived as a usefulness of Web 2.0 tools (Sadaf, Newby & Ertmer, 2012). In this study, Performance Expectancy is a predictor to in-service teachers' intention to use Web 2.0 in their future teaching approaches.

This study has revealed that the constructs teacher knowledge and technology pedagogy knowledge technology pedagogy knowledge from the TPACK model and the constructs effort expectancy, facilitating conditions and performance expectancy are the best predictors of teachers' intentions to use Web 2.0 tools in their professional practice.

7.4 Other findings

7.4.1 Statistical significance between the UTAUT and the TPACK constructs

While the TPACK model has non-technology components including pedagogical content and knowledge content, the UTAUT model is mainly about acceptance and use of technology. Data analysis has shown that there was no significant relationship between the UTAUT constructs (performance expectation, effort expectation, social influence and facilitating conditions) and the TPACK constructs content knowledge and pedagogy knowledge. This might be since these two constructs do not have a technology component. Social influence has little correlation with technology knowledge and technology pedagogy knowledge. Only the construct technology knowledge appears to have some significant correlation with facilitating conditions, suggesting that the more facilitating conditions exist, the more likely it is for technology knowledge to increase. The construct intention to use seems to correlate mostly with technology knowledge and technology pedagogy knowledge, indicating that as technology knowledge and technology pedagogy knowledge increase, the intention to use technology increases as well. However,

the constructs performance expectancy and effort expectancy had a significant relationship with all the TPACK constructs (technology knowledge, technology pedagogy knowledge, PCK and technological content knowledge) except for the components content knowledge and PK. The association between the TPACK construct PCK with the UTAUT constructs performance expectancy and effort expectancy was an unexpected finding, because PCK is only about pedagogy and content knowledge and has no technology component. This finding is in line with Pamuk (2011) who argued that developing PCK is an essential component in technology integration and that teachers need to acquire PCK before integrating technology in their practice. One explanation could be that teachers having higher levels of PCK are more likely to find Web 2.0 tools easy to use or perceive the usefulness of Web 2.0 tools for teaching and learning because they are already familiar with other tools or strategies for teaching. At present, teachers must learn not only how to use the technology tools currently available, but also how to use technology for the pedagogy of specific subject matter. Thus, knowledge of technology becomes an important aspect of overall teacher knowledge. The PCK has a significant relationship with the UTAUT constructs performance expectancy and effort expectancy. In the researcher's view, this calls for some further exploration of Shulman's PCK model to shed light on the dialogue around teaching and learning in this ever-increasingly technological world.

7.4.2 Categories of teachers that emerged from this study

This study is about teachers' perceptions of the use of Web 2.0 tools and teachers' intention to use Web 2.0 tools in their professional practice, but the findings of this study have also revealed a deeper aspect of the relationships between teachers and their use of technology for teaching and learning. Different categories of teachers with different temperaments have emerged in this study. They are the passionate, the innovative, the undecided, the anxious and the resistant. Passionate teachers are committed to the achievement of their students. They care for the development of their students. They create an effective learning environment where they encourage students' curiosity and interest in learning and thus increase the learning potential of their students. They are life-long learners who are

constantly seeking out new ways to teach by integrating new digital tools in their professional practice. They are risk-takers who explore digital tools to negotiate new ways to improve the processes of teaching and learning. The undecided are teachers who will implement technology in their teaching if they have been trained to do so or are requested to by the school administration. They would not take the initiative on their own or take risks in bringing innovations into the classroom. The anxious teachers are the ones who are worried about the management of students' use of the Internet in the classroom. These teachers are concerned about dealing with distraction in class, students becoming disengaged and disruptive of the proper running of class. They may feel that the time taken from instruction to deal with students being off task in class will have negative effects on learning. These teachers may finally end up becoming resistant to integrating technology in teaching and learning. Teachers who are less confident in using new digital devices than their students are resistant to making changes in their teaching practice. They are resistant to implement technology in their class because they feel that with technology in class they may not have much control, thus affecting their authority. There is also another type of resistant teacher. They are those who believe that the traditional methods of teaching are the best and have had success with their lessons and strategies tried several times are likely to resist implementation of technology in the class. They are resistant because of their pedagogical beliefs and feel that they may be wasting some teaching time when incorporating new technology into their teaching.

7.5 Limitations

Research studies usually have some limitations in relation to the application of findings.

One major limitation of the study was the context and nature of the sample. The sample consisted only of in-service teachers who were studying for a PGCE course at a teacher education institution where the researcher works.

Frequencies, EFA and multiple regression have been used as part of the first phase of this study. Future research can be conducted that allows the use of other

statistical analyses that could revealed more information on the interrelationships among variables. Moreover, that research could also examine the degree of importance of one variable from another in influencing intention of teachers to use Web 2.0 tools.

7.6 Summary of findings

7.6.1 Why teachers are using Web 2.0 tools:

- Motivation;
- Accessibility; and
- Teaching of abstract concepts.

7.6.2 Why teachers are not using Web 2.0 tools:

- Lack of both knowledge of how to use technology;
- Lack of knowledge of pedagogical use of technology;
- Access to the Internet;
- Lack of training; and
- Lack of time to implement technology-integrated lessons in their classrooms.

7.6.3 Teachers' perceptions towards the use of Web 2.0 technologies in teaching and learning:

- The positive perceptions;
  - Efficient use of class time;
  - Student motivation and engagement;
  - Improved teacher-student interaction;
  - Accessibility of learning; and
  - Development of collaboration skills.
- The negative perceptions
  - Technology distraction; and
  - Inappropriate use of the Internet.

7.6.4 Influence of teachers' expertise on their intention to use Web 2.0 technology in their practice

Technology knowledge has the greatest influence on in-service teachers' intention to use Web 2.0 technology in their practice, followed by technology pedagogy knowledge and the combination of technological content knowledge with TPACK.

7.6.5 Best predictors of Web 2.0 technology acceptance and teachers' intention to use Web 2.0 tools in their professional practice

The constructs teacher knowledge and technology pedagogy knowledge from the TPACK model and the constructs effort expectancy, facilitating conditions and performance expectancy are the best predictors of teachers' intentions to use Web 2.0 tools in their professional practice.

7.6.6 Relationship between UTAUT and TPACK

The constructs performance expectancy and effort expectancy had a significant relationship with all the TPACK constructs (technology knowledge, technology pedagogy knowledge, PCK, technological content knowledge) except for content knowledge and PK. The association between of the TPACK construct PCK with the UTAUT constructs performance expectancy and effort expectancy was an unexpected finding because. PCK is only about pedagogy and content knowledge and has no technology component.

7.6.7 Categories of teachers in relation to use of Web 2.0 tools in their professional practice

Five types of teachers have emerged from the qualitative data. They are the passionate, the innovative, the undecided, the anxious and the resistant.

7.7 A proposed model

The research found empirical evidence that it was a combination of constructs from the two models (TPACK and UTAUT) that emerged as best predictors and accounted for 85% of the variance. The constructs effort expectancy, facilitating

conditions and performance expectancy (from the UTAUT model) and the constructs technology knowledge and technology pedagogy knowledge (from the TPACK model) have surfaced as the best predictors of teachers' intentions to use Web 2.0 tools in their professional practice. A proposed model on the best predictors of teachers' intention to use Web 2.0 tools in their professional practice is shown in figure 7.1.

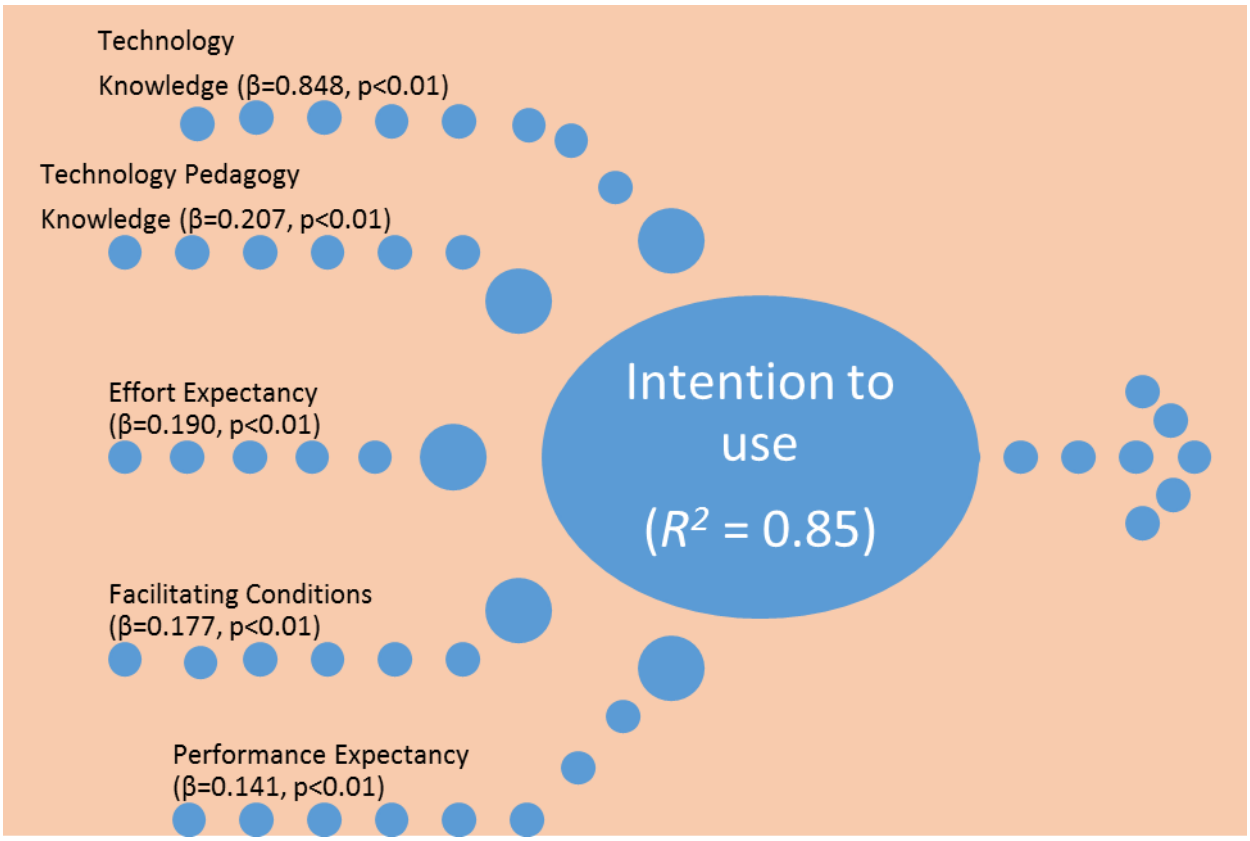

Figure 7.1: A proposed model on the best predictors of teachers' intention to use Web 2.0 tools in their professional practice

The main contribution of this research is that when considering teachers' intention to use Web 2.0 tools in their professional practice, it is a combination of constructs from both TPACK and UTAUT models that must be looked at. This research has formulated a model, developed from a combination of constructs from the TPACK and UTAUT models, which would best predict teachers' intention to use Web 2.0 tools in their professional practice. These predictors are: technology knowledge,

technology pedagogy knowledge, ease of use, facilitating conditions and perceived usefulness. Teachers need to be empowered not only in specific technology knowledge and skills, but also in technology-supported-pedagogical knowledge and skills, and technology-related classroom-management knowledge and skills. Teachers' self-efficacy beliefs and perception of ease of use of technology are important factors for teachers' intention to adopt technology in their professional practice. Facilitating conditions such as continued professional development of teachers, technical and administrative support, resources like computers and access to the Internet and professional development are predictors for integration of Web 2.0 tools in instructional settings. The perceived usefulness of technology, such as being able to pursue teaching and learning activities after school hours through the use of Web 2.0 tools, is also crucial for teachers to use Web 2.0 in their future teaching approaches.

7.8 Recommendations and further study

In the light of the findings from this study, the researcher has some recommendations and suggestions for further study on the implementation of Web 2.0 tools in teaching and learning.

7.8.1 Recommendations

At the beginning of this thesis it was explained that the main purpose of this study was to contribute to the body of knowledge that informs the best predictors of Web 2.0 technology acceptance and future intention to use Web 2.0 tools by in-service teachers in their professional practice. In this way, based on the findings above, three key recommendations are made:

7.8.1.1 School infrastructure

This study has found that one of the reasons for teachers' non-use of technology was the lack of access to the Internet. Today's students must have access to the tools they need to become successful online learners and eventually survive as competitors in the current workforce. The relevant authorities must make sure that the school infrastructure is able to provide adequate wired and wireless connectivity

anywhere within the school compound. Every student and teacher must have at least one Internet access device and suitable software and resources for research, communication, multimedia content creation and collaboration for use in each school and in its vicinity. It is only when students and teachers are equipped with the appropriate tools that they will able to appreciate the possibilities that are offered by the educational technologies. Provision must also be made for infrastructure concerns that include upgrades of wired and wireless access as well as renewal of digital devices necessary to meet the requirements of user needs as well as speeds essential for the use of fast-changing digital tools. Whenever additional computers are purchased, it is preferable that they be laptops in order to enable mobility to different parts of the school. The use of mobile laptop carts is highly recommended in schools. A mobile laptop cart is a suitable way to store a number of devices (laptops, tablets etc.) and charge them simultaneously. The mobile cart can easily be moved from one classroom to other classrooms, thus enabling technology-related lessons to be carried out anywhere around the school.

7.8.1.2 **Professional development**

With technology changing at the pace it is, without proper professional development, technology integration could become even more difficult. The 21st-century learner needs teachers who are using technology in the classroom and who support their students' use of technology in their classrooms. Teachers must become a part of the learning process and facilitate their students' learning process without fear. The findings of this study have revealed that technology knowledge and technology pedagogy knowledge are the best predictors for teachers' intention to integrate technology into their professional practice. Hence, teachers must be offered professional development opportunities in order to be able to successfully implement technology in their classrooms. By creating ongoing professional development and support, administrators and policy makers can help in-service teachers to acquire the necessary technology skills, while also enhancing teachers' pedagogical beliefs in the use of technology. The goal of technology-related professional development needs now to shift from the previously traditional teaching only about how to use the technology tools themselves, towards how to

integrate technology into the teaching of course curriculum materials. Throughout the development of technology integration through professional development, in-service teachers must not only be involved in training from experts but also in the active, hands-on, collaborative work alongside their peers. Teachers should be provided with professional development opportunities within their school and classroom environments where they are already at ease. These teachers would then be able to put into practice what they have just learnt. For the professional development of teachers to be more fruitful, the researcher is of the opinion that teachers should be grouped according to their subject area or department, where they might have the occasion to work on projects from their actual classes together with their colleagues. Teachers would then feel that they are being supported by their peers and this would, hopefully, help them to be prepared and confident using technology in their classrooms. Since the findings of this study have shown that teachers are regular users of the Internet, online professional development can also be envisaged.

Inappropriate use of technology by students was also found to be a reason for teachers not to implement technology in their professional practice. Teachers need to first acquire understanding and fluency with Web 2.0 tools to reduce feelings of fear and anxiety. Fears and anxieties need to be addressed before teachers can appraise the potential affordances these modern tools offer for teaching and learning. Mostly, teachers voicing perceived risks related to the implementation of technology in their professional practice need to be exposed to constructive and encouraging experiences using technology in order to gain familiarity and ease anxiety with technology adoption in the classroom. This can be attained through professional development that includes a course component on risk concerns about technology integration that includes appropriate coping strategies, such as managing technology failure, dealing with plagiarism, safety and security when using the Internet, inappropriate materials for students and off-task students. Through this type of interaction and the creation of positive experiences, teachers' negative responses and perception of risks may ease. Only at this point will they be able to move past their initial perception of technology and engage in the implementation of technology in teaching.

In each school a teacher skilful in ICT must to be chosen from each department to help propel the technology initiatives in school. This ICT “champion” needs to help teachers who are resistant to the integration of technology in their professional practice due to lack of confidence or knowledge in technology usage. The ICT “champion” can assist these teachers by getting them in a one-to-one setting to reveal their concerns about use of technology in teaching and learning or new technology initiatives in the school. Digital tools nowadays offer affordances for new ways to teach and learn. The ICT “champion” in the school needs to explain to resistant teachers how the benefits to learning from these tools may (or may not) be significantly greater than a non-digital approach. This can be done by i) acquainting teachers with various Web 2.0 applications used in education; ii) explaining how these digital tools can be relevant to their specific subject area for teaching and learning; and iii) showing how the use of the digital tools can align with the aims and goals of their teaching.

7.8.1.3 ICT learning environment

This study has also revealed that teachers need to have technology pedagogical knowledge in order to be able to integrate technology in their professional practice. The Ministry of Education should i) provide online platforms to schools where teachers can share their ICT lessons among peers and students can engage in learning anywhere and anytime; ii) provide teachers with tools to design different learning experiences and monitor students’ learning progress; iii) provide teachers and students with quality curriculum-aligned digital teaching and learning resources; and iv) develop a panel of teachers to develop curriculum-aligned ICT lessons for the different subject areas.

7.8.2 Areas of further study

The findings of this research have stimulated some thoughts for further research as suggested below.

A study the researcher recommends could involve finding out detailed information from students regarding the types of technology they use, how they use it and when

they use it. This information would enhance the body of knowledge regarding technology use in schools. The results of his study did not provide any major insights regarding teachers' perceptions about their students being technologically prepared as 21st-century professionals. So, conducting a study with secondary school students, investigating how their secondary school education is technologically preparing them for the workforce in the future, would provide more insight to this area of research.

Since this study has explicitly revealed that some teachers are using Web 2.0 tools in class, a study needs to be conducted targeting teachers to find out how the technology tools are benefiting them in their professional practice. The researcher recommends a qualitative study which could provide details about the teacher's thoughts regarding the type of technology they use in their classrooms, the issues they might have experienced, and whether their students had effective learning opportunities when they used a specific technology. Conducting in-depth interviews with teachers would provide a better understanding of the pedagogical perspectives they think are needed for technology to be used, how they assess their students' use of technology, and their confidence levels when using certain technology.

The findings of this study have shown that there exists a significant relationship between the TPACK constructs and the UTAUT constructs. Further studies involving a combination of both TPACK and UTAUT models might show how certain key variables can be changed to impact on each other.

7.9 **Summary**

In this study, the researcher explored perceptions of in-service teachers regarding the implementation of Web 2.0 tools in teaching and learning and their intention to use the Web 2.0 tools in their professional practice. The findings in this study support the current literature. The main contribution of this research is that it has formulated a model with a combination of constructs from the TPACK model and UTAUT model that would best predict teachers' intention to use Web 2.0 tools in their professional practice. This research has opened many areas for study that can further shape our understanding of teachers' perceptions of using the Internet for

educational purposes and their intention to adopt the Internet in their professional practice.

When looking at the future of implementation of technology in teaching and learning, it is certain that teachers will frequently be called upon to experiment with new digital technologies. To help teachers to make clear decisions about effectively engaging with the pedagogical use of technology, it is important to understand the pros and cons of the implementation of technology in class. The researcher does not think that teachers should use Web 2.0 tools in each class. However, teachers must ensure that students' school practices assist them in the responsible use of these tools in their daily personal and social lives. The researcher believes that Web 2.0 tools must have a place in school environment to educate children in the 21st century.

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APPENDIX A: Ethical clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

05 April 2013

Mr Marday Pyneandee (212558034)
School of Education
Edgewood Campus

Protocol Reference Number: HSS/0167/013D
Project Title: The adoption of Web 2.0 tools in teaching and learning by in-service secondary school t
The Mauritian context

Dear Mr Pyneandee

Expedited A
I wish to inform you that your application has been granted Full Approval through an expedited review proc

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed
Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviev
approved through the amendment/modification prior to its implementation. In case you have further
please quote the above reference number. PLEASE NOTE: Research data should be securely store
school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Professor Steven Collings (Chair)
/ms

cc Supervisor: Dr DW Govender
cc Academic Leader: Dr MN Davids
cc School Admin: Ms Bongekile Bhengu

Humanities & Social Sc Research Ethics Committee
Professor S Collings (Chair)
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban, 4000, South Africa
Telephone: +27 (0)31 260 3587/8350/4557 **Facsimile:** +27 (0)31 260 4609 **Email:** ximbap@ukzn.ac.za / snymanm@ukzn.ac.za / mohunp@ukzn.ac.za
Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

APPENDIX B: Request for gatekeeper permission

GATEKEEPER PERMISSION

Director
Mauritius Institute of Education
Reduit
This 31 October 2012

Dear Sir,

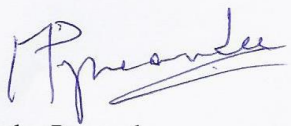
I am a Doctoral scholar, under the supervision of Dr Desmond Govender, in the School of Education, University of Kwazulu Natal, South Africa and Dr. Brinda Pratab-Oogarah, School of Education, Mauritius Institute of Education. As part of my doctoral development, I am undertaking a study entitled " The adoption of Web 2.0 tools in teaching and learning by in-service secondary school teachers: The Mauritian context ". The participants for this study will be inservice secondary teachers. I am seeking your permission to conduct the study with the inservice secondary teachers who are in their second year of the Post-Graduate Certificate of Education (PGCE) programme for a period not exceeding six months.

The purpose of this study is to facilitate teachers learning about, adopting, and integrating Web 2.0 technologies into their professional practice by finding out whether teachers have the necessary skills and attitudes to adopt web technologies and determining the predictors to web technology adoption in teaching and learning.

The teachers will fill in a Survey Questionnaire and participate in an interview. Interviews will be scheduled at times and places convenient to them. The duration of each of these interviews/focus group discussions will be approximately 30 minutes. The interview will be audio taped. Every effort will be made to ensure that no one will be able to identify participants. To protect their identities, I will ask them to provide a different name during the interview. They will be free to withdraw from the research at any stage without negative or undesirable consequences. All information is only intended for the research purposes. All data recordings and transcripts will be stored in a locked cabinet. Participation in this study is voluntary and will not be renumerated.

Further clarification can be obtained from Dr D Govender email: Govenderd50@ukzn.ac.za) and Dr B Brinda Oogarah-Pratab (email: b.oogarah@mieonline.org).

Yours faithfully,



Marday Pyneandee

APPENDIX C: Gatekeeper permission from director

Mauritius Institute of Education
Réduit

7th Floor – MIE New building

Tel : (230) 401 6555
Fax : (230) 454 1037

08 March 2013

Mr M Pyneandee
Senior Lecturer

Dear Sir

Re: Gatekeeper Permission

I refer to your letter dated 08 March 2013.

I have no objection that you proceed with data collection as planned. It is understood that you will abide to the ethical principles and rules that have been indicated in your letter.

Yours faithfully

Dr O Nath Varma
Director

APPENDIX D: Informed consent form for in-service teachers

Project Title: The adoption of Web 2.0 tools in teaching and learning by in-service secondary school teachers: The Mauritian context

Student Researcher: Marday Pyneandee

1. WHAT IS THE PURPOSE OF THIS FORM?

This form contains information that you will need to help you decide whether or not to be in this study. Please read the form carefully. You may ask questions about the research, the possible risks and benefits, your rights as a volunteer, and anything else that is not clear. When all of your questions have been answered, you can decide whether or not you want to be in this study.

2. WHY IS THIS STUDY BEING DONE?

The purpose of this study is find out whether teachers have the necessary skills and attitudes to adopt Web 2.0 technologies and determine the predictors to Web 2.0 technology adoption in teaching and learning.

The information in this study will be used for a doctoral dissertation as well as future publication.

3. WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because you are an in-service teacher following a course in "Use of ICT in teaching within a teacher education program".

4. WHAT WILL HAPPEN IF I TAKE PART IN THIS RESEARCH STUDY?

You will complete questionnaire. You can then indicate whether you may wish to participate in an interview and a focus group discussion. Interviews and focus group discussion will be scheduled at times and places convenient to you. Because of the need for the researcher to have accurate data, the interview and focus group discussion will be audio recorded and then transcribed. Participants will be sent a

copy of the transcripts for their verification and will be able to adjust their comments in the transcript.

5. WHAT ARE THE RISKS AND POSSIBLE DISCOMFORTS OF THIS STUDY?

I do not know of any risks to you if you decide to participate in this study. I guarantee that your responses will not be identified with you personally. I promise not to share any information that identifies you with anyone outside of my supervisors and me

6. WHAT ARE THE BENEFITS OF THIS STUDY?

This study is not designed to benefit you directly. However, taking time to examine and reflect on the integration Web 2.0 tools in teaching and learning may help you be familiar with the possibilities of using those tools to enhance teaching and learning.

7. WILL I BE PAID FOR BEING IN THIS STUDY?

You will not be paid in this study.

8. WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential. All research records will be stored securely me. I shall be the only person to have access to the records. All the informed consent forms will be secured in a locked file cabinet by me and will be retained and kept secure for five years post study termination. After data have been collected, you will have the opportunity to check the interview and discussion transcripts for accuracy. To help ensure confidentiality, your name will not be used in the study.

9. WHAT OTHER CHOICES DO I HAVE IF I DO NOT TAKE PART IN THIS STUDY?

Participation in this study is voluntary. If you decide to participate, you are free to withdraw at any time without penalty. You will not be treated differently if you decide to stop taking part in the study. If you choose to withdraw from this project before it ends, I may keep results from the questionnaires you complete, and this information may be included in study reports. If you volunteer to participate in the interview and focus group discussion, you are free at any time to not answer a question.

10. WHO DO I CONTACT IF I HAVE QUESTIONS?

This research is being conducted by Marday Pyneandee, Ph.D. student at Kwa Zulu Natal University. You may contact my supervisors Dr Desmond Govender and Dr Brinda Oogarah-Pratap, or by email at govenderd50@ukzn.ac.za and

b.oogarah@mieonline.org if you have any questions or comments regarding your rights as a subject in the research

11. WHAT DOES MY SIGNATURE ON THIS CONSENT FORM MEAN?

Your signature indicates that this study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Participant's Name: _____.

(Optional: Phone no. or email for a follow-up discussion: _____)

Signature of Participant _____ Date: _____

Student Researcher: Marday Pyneandee

Signature _____ Date_____

APPENDIX E: Survey questionnaire

Part I: Demographic Information (Please tick where appropriate)

1. **Age** ☐ 2. **Gender**: ☐ Male ☐ Female

3. Educational level (Highest Qualification)
Bachelor's degree ☐
Master's degree ☐
Other qualifications ☐
(please specify) ☐

4. Teaching Experience (No. years):	
1-5 ☐	6-10 ☐
11-15 ☐	16-20 ☐
Above 20 ☐	

5. Subject(s) I teach					
English ☐	French ☐	Maths ☐	Social Studies ☐	Physical Education ☐	Home Economics ☐
Chemistr ☐	Physics ☐	Biology ☐	Compute Studies ☐	Other subject Please specify ☐	

Part II: Please tick the response that best reflects the frequency of your use of these Web 2.0 tools in your **personal life**

Web 2.0 tools	Everyday	At least once a week	At least once a month	At least once a year	Never
Weblogs (e.g. Google Blog, Edublogs)					
Wikis (e.g. Wikipedia,)					
Social Networking sites (e.g. Facebook,)					
Google applications (e.g. Google Docs, Calendar)					
Multimedia sharing sites (e.g YouTube)					
File hosting services (e.g Dropbox, Google Drive)					

Part III. Please tick the response that best reflects the frequency of your use of these Web 2.0 tools in your **professional practice**

Web 2.0 tools I use for teaching purposes	Everyday	At least one a week	At least once a month	At least once a year	Never
Weblogs (blogs)					
Wikis (Wikipedia)					
Social Networking sites (eg Facebook)					

Google applications (eg Calendar					
Multimedia sharing sites (eg Youtube)					
File hosting services (eg Dropbox)					

Part IV. Please indicate the extent to which you agree with each of the following statements. Please tick one answer for each statement.

SA for Strongly Agree **A** for Agree N for Neutral **D** for Disagree
SD for Strongly Disagree **NA** for Not Applicable

	SA	A	N	D	SD	NA
Using Web 2.0 tools helps me to teach my subject area.						
Using Web 2.0 tools in teaching will enable me to accomplish tasks (e.g. teach the topic, assess assignments) more quickly.						
Web 2.0 tools will be useful in my teaching.						
Using Web 2.0 tools will enhance my efficiency as a teacher.						
Using Web 2.0 tools will reduce my work load considerably.						
Using Web 2.0 tools will allow me to interact with the students and clarify their doubts in reasonable time.						

Web 2.0 tools will enable me to teach at my pace.						
Web 2.0 tools will provide me the flexibility to teach anytime, from any place.						
I find it easy to get Web 2.0 tools to do what I want to do.						
It is easy for me to become competent at using Web 2.0 tools						
I find Web 2.0 tools easy to use.						
My interaction with Web 2.0 tools is clear and understandable.						
I possess the skills necessary to use Web 2.0 tools.						
In my school, teachers who use Web 2.0 tools have more prestige than those who do not.						
Using Web 2.0 tools adds to my status among my colleagues.						
My school provides me all the facilities I need for Web 2.0 tools.						
The ICT infrastructure at my school is available when I need it.						
My school provides incentives to teachers who use Web 2.0 tools.						
My school provides incentives to students who use Web 2.0 tools.						
Technical help is available at my school if required while using Web 2.0 tools.						

SA for Strongly Agree **A** for Agree N for Neutral **D** for Disagree
SD for Strongly Disagree **NA** for Not Applicable

	SA	A	N	D	SD	NA
My superiors (head of department or rector) supports teachers using Web 2.0 tools						
I intend to use Web 2.0 tools next year						
I predict I would use Web 2.0 tools next year						
I plan to implement activities that require my students to use Web 2.0 tools next year.						
I am able to use Web 2.0 (e.g blog, wiki) for personal purpose						
I am able to teach my student to use web 2.0 tools (e.g. blog, wiki).						
I am able to integrate the use of Web 2.0 tools (e.g blog, wiki) for students' learning.						
I am able to use conferencing software (Yahoo Instant Messaging, Skype, etc) for collaboration purposes.						
I teach my students to adopt appropriate learning strategies.						
I know how to guide my students to discuss effectively during group work.						
I know how to guide my student to learn independently.						
I have sufficient knowledge about my subject area.						

I have various ways and strategies of developing my understanding of my subject area.						
I will encourage my students to use web 2.0 tools to work with other students.						
I will encourage my students to use web 2.0 tools to analyse information with their classmates.						
I will encourage my students to use web 2.0 tools to communicate with other people about their ideas.						
I can help my students to understand the content knowledge of my subject area through various ways.						
I know how to select effective teaching approaches to guide student thinking and learning in my subject area.						
I know about technologies that I can use for understanding and doing my subject area.						
I can use appropriate technologies (e.g. multimedia resources, simulation) to represent the content of my subject area.						
I can teach lessons that appropriately combine my subject area, technologies and teaching approaches.						
I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.						

(Optional: Phone no. or email for a follow-up discussion: ----------)

APPENDIX F: Sample interview questions

1. Have you used Web 2.0 tools before, if so, describe briefly your use of Web 2.0 tools?

2. How do you feel about using Web 2.0 tools to support your teaching?

3. How would you describe your knowledge of technology integration in teaching?

4. Do you intend to use technology in your teaching? Why or why not? How?

5. Tell me about an instance (if you have) when you used Web 2.0 tools to help you in your teaching.

6. Tell me about a situation where you may have used a social networking service to communicate with your students or colleagues.

7. What features of Web 2.0 tools would be important to you when deciding to use them in your teaching?

8. Is there anything that makes you reluctant to use Web 2.0 tools in your teaching?

9. What would be the most important thing that would help you to feel adequately prepared to use Web 2.0 tools for teaching purposes?

10. What is your biggest concern with using Web 2.0 tools for teaching purposes?

APPENDIX F: Sample interview transcript

Sample interview transcript (Participant 6)

Have you used Web 2.0 tools before, if so, describe briefly your use of Web 2.0 tools?

Yes. I am a regular user of Internet, of online tools. Like almost all people of my age I use Facebook to socialize with friends, parents, YouTube to watch videos, WhatsApp to communicate with people very often.

What are your views about using Web 2.0 tools to support your teaching?

With Web 2.0 tools you can go for online collaborative learning through discussion, group work. I do believe that collaborative learning is valuable because I think that this style of learning allows the development of skills that are highly relevant today. I would place a high priority on facilitating this style of learning with my students. With web tools in the classroom, teachers will save time copying notes. Students can access them online with their smartphones or at home before coming to school. More time can be devoted to actual teaching, and individual attention. Pupils will be motivated to study. They like the idea that their teacher can use these tools. They feel close to him. This will result in a better use of class time and better classroom management

Tell me about an instance where you have used Web 2.0 tools to help you in your teaching

I have used Facebook as a tool to help me in my teaching. I have created a group where my students have become members. It is very easy for us to communicate

using that group. I invite students to post any area of difficulty and ask other students to share their views. I can also see what they are sharing and what are their difficulties. It can be more interactive. It can make pupils interested in the class. I think it will enhance the teaching. Students will be more involved and interested in the class. Sometimes I search videos on YouTube to demonstrate visual information to students so that my students can better understand abstract concepts and Google Drive as an online storage where I can easily upload my notes and other educational materials and make accessible to students by providing download links

Tell me about a situation where you may have used a social networking service to communicate with your students or colleagues

I use online tools to communicate. It is free. It has been through social networking more precisely Facebook where my students communicate with me or post a particular question which their area of difficulty is. I comment on the question and invite other students to share their views. My teaching philosophy is that I must make students should like my subject. It is only then they will learn the subject I am teaching. Since web tools can get them interested and engaged in learning I will do what is necessary to do that

Sometimes some students do not indulge in conversations that take place in the classroom. Maybe, they are too shy to talk in class. I believe that in such environments like social networks those students can shine, when they are at home, they have the time to express themselves, something that we don't see very often in the classroom. In other words, the quiet students can surprise us through their participation on the blogs.

What are the reasons, you think, for teachers not to use Web 2.0 tools in their professional practice?

I think the main reason is that teachers do not know how to use these tools properly and how to use these tools efficiently in terms of pedagogy, how to make them implement these tools, how to teach, impart knowledge, how to deliver or share information on a platform that is available to everyone today.

What would be the most important thing that would help teachers to feel adequately prepared to use Web 2.0 tools for teaching purposes?

I think teachers need to know how to integrate technology in their teaching. Teachers need guidance, technological knowledge. They need training in applying these tools for teaching, though they already have pedagogical knowledge.

What is your biggest concern with using Web 2.0 tools for teaching purposes?

The nature of social media itself is that it allows individuals post whatever they want, without any restrictions. If you have some kids who are not very happy with you right now, they can voice their frustrations on Facebook and everybody sees the nasty comments they may publish on you.