

Factors contributing to the level of acceptance of technology in affluent private schools

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Abstract

This research was conducted to explore factors that influence the technology acceptance of teachers who are employed at a school where there is wide access to different types of technology. While previous research identified perceived ease of use and perceived usefulness as variables in technology acceptance, not many studies give details about the determining factors of teachers who are given extensive access to a wide variety of educational technology. The researcher therefore aimed to identify distinct aspects that deter the use of the available technology, while also establishing the motivating factors in the target school.

Semi-structured interviews were conducted with five divergent volunteers. The transcribed interviews were analysed qualitatively using Atlas.ti to assist in identifying emerging patterns. Through the analyses it became evident that, although teachers are presented with technology and recognise the usefulness thereof, flaws in support from the institution are increasingly deterring even teachers with a high technology acceptance, from using available technology.

It is the researcher's recommendation that management set clear implementation goals to staff, while dedicating themselves to prioritising issues such as infrastructure, maintenance of hardware and effective training opportunities.

Keywords: technology acceptance model; perceived ease of use; perceived usefulness

Introduction

The Technology Acceptance Model as suggested by Davis (1989) explains how a user's attitude toward technology can influence his/her position toward rejecting or using available technology. Davis identified two main variables, namely "perceived usefulness" and "perceived ease of use". These variables explain how users consider their position towards technology, firstly in deciding how the technology will benefit them in their work and secondly how easy it will be for them to access and use the level of technology. Both variables reflect a person's internal acceptance of technology.

However, a person's attitude can also be affected by several other issues, such as physical, cultural, ethical, environmental or social, to name but a few. These issues are focused more on external influences. This study was conducted to indicate which of these internal and external factors contribute most to teachers' acceptance of technology when different types of technology, as well as training, are readily available to them, and how these teachers' position toward technology influence their teaching techniques and their willingness to explore alternative teaching strategies to enhance their students' learning.

With technological advancements and the increased use of the Internet, ubiquitous learning has become a reality. Haythornthwaite (2008) stresses the impact that technology and networked learning have on educational practices, while Cope and Kalantzis (2008) raises the concern that the digital divide caused by inequities such as bandwidth problems, financial difficulties or lack of knowledge, can cause educational imbalance in countries, or even institutions in the same country.

It is therefore important for teachers to embrace technology and to incorporate aspects such as Flipped Learning (Mazur, 1997), Just in Time Teaching (Novak, 1999) or Game based learning (Kapp, 2012) in their teaching.

Technology in teaching can be seen as the use of any machinery or devices that can be applied to enhance teaching and learning. For the purpose of this study, the focus was on computer technology, meaning the use of any computerised devices, such as personal computers, laptops, mobile devices, printers, or audio and visual aids (speakers, earphones and/or projectors), to be used by teachers to engage their students in learning, to assist in their administration tasks or to contribute to broadening the scope of their

teaching. The use of computer technology during a lesson can either refer to the student using the device to learn from or with, or to the teacher using it in her presentation or in the creation of the content.

The setting of the study is an affluent private school in the south of Pretoria. The school have a pre-preparatory, preparatory and high school which all reside on the same campus. The school is part of the Independent Schools Association of South Africa and Gr 12s therefore write the Independent Examinations Board exam. The focus of the study was mainly on the technology acceptance of teachers in the preparatory phase, which ranges from Gr 1 to Gr 6 with a learner population of approximately 750.

Being an affluent school and having to meet modern standards, the preparatory school is trying to incorporate technology in all areas. Communication with parents is primarily done via email, assessment reporting is done electronically, and any important documentation is stored to and accessed from a server. It is therefore imperative that all teachers be computer literate to a certain extent.

While teachers have access to computers and the Internet in their classrooms, each also have a data projector installed in her classroom. Interactive whiteboards (Smart and Promethean) have been installed in all but ten classrooms. Unfortunately, these apparatuses are not always functional, as maintenance is costly, and software is outdated. As the school is in a developing area on the edge of town, network coverage is problematic and there is only limited wi-fi connectivity in certain areas of the school.

The school has a well-equipped computer lab and learners attend an hour per week computer lesson from Gr 1 onwards. Learners are also allowed to use the computer lab for research or completion of assignments under supervision, at scheduled times during the week. With the growth of the school in mind, a second computer lab started operation in mid-2017.

Each teacher was given the use of an iPad in 2014. A few teachers attended voluntary iPad training but teachers use iPads mainly for photography and personal matters, while some teachers have not unboxed their devices at all.

In 2017, an iPad lab consisting of 26 devices was purchased. ICT lessons for Gr 5 and Gr 6 learners are currently being used to train the learners to use these iPads effectively in their studies, assignments and presentation of work. The iPad lab became available to be booked by teachers in 2018. All devices have full access to the Internet.

The school is ten years old and has the means to implement technology and advocate itself as a modern, up-to-date school with the latest technology available, yet little evidence is visible that the teachers make more use of technology than their less fortunate colleagues in government institutions.

Problem statement and rationale

Learning in the 21st century requires intensive implementation of technology. Several factors influencing the application of this technology have an impact on the acceptance of technology by primary school teachers and therefore on their eagerness, or lack thereof, to use technology in their teaching practice.

Davis (1989) have identified two variables, namely perceived ease of use and perceived usefulness, influencing the internal motivation of users when accepting technology. It is of importance to establish other factors that can impact upon teachers' technological acceptance and to understand the role these factors play in the teachers' classroom practice. It is necessary to determine whether teachers are embracing the existing technology available at the school and whether they are ready to implement new technology on a higher level. This will establish if more needs to be done to assist the teachers in feeling confident about using technology in their lessons and assessments.

Purpose of the study (objectives/aims)

The use of technology in and outside the classroom for educational purposes can enhance a learner's understanding of the content, can improve their skill level and assist learners with barriers to overcome these. The aim of this study was to analyse teachers' positions towards technology and to identify the factors that motivate or hinder them to successfully harness the possibilities of using technology and assist them in overcoming possible barriers to ensure that they make the move to 21st century teaching by purposeful implementation of technology in their classrooms.

Research question

What are the factors influencing technology acceptance of teachers in a school where technology is available and promoted?

Review of the literature

Factors that influences teachers' adoption and integration of technology into teaching

Buabeng-Andoh (2012) did a review of available literature to establish an overview of the factors that influences teachers' adoption and integration of technology into teaching. He identified barriers such as "lack of teacher ICT skills; lack of teacher confidence; lack of pedagogical teacher training; lack of suitable educational software; limited access to ICT; rigid structure of traditional education systems; restrictive curricula, etc." (p. 136). Buabeng-Andoh classified barriers in different categories, namely personal characteristics (which includes age, gender, self-efficacy, experience and workload), institutional characteristics (including professional development, accessibility and technical support) and technological characteristics (innovation, compatibility, complexity, web technology etc.).

Ertmer (2009) identified first-order barriers to technology integration as extrinsic to teachers and including a lack of access to computers, insufficient time for planning and inadequate training and technical support. Second-order barriers are intrinsic and include beliefs about teaching, computers, established classroom practices and unwillingness to change. First-orders barriers may be eliminated by additional resources and training but confronting second-order barriers requires challenging belief systems and traditional practice (Ertmer, 1999).

Kopcha (2012) aimed his study at the reasons for negative correlation between available technology in classrooms and teachers' effective use of that technology for instructional purposes. He found that by investigating teachers' perceptions to these barriers, a better understanding can be reached in order to implement corrective training and support, so that a higher technology acceptance and use can be achieved.

Mirriahi, Vaid, and Burns (2015) conducted a study amongst foreign language teachers to establish the barriers that hinders them from using the technology that is available to them. This study revealed that teachers who have a high level of computer self-efficacy

will first establish the usefulness of the proposed technology to their students, how it adheres to the curriculum content and to which level it will contribute to making their work easier, before they apply the technology.

A study by Letwinsky (2017) on the use of technology for communication by Maths teachers, resulted in an interesting phenomenon that, although self-efficacy of the respondents was high, the actual use of the technology remained low. Although many teachers use technology for low-level tasks like word processing and Internet research, higher level uses are in the minority and it takes five to six years for teachers to accumulate enough expertise to use technology in a constructivist way. Despite the fact that many teachers describe themselves as having constructivist philosophies, they implement technology in fairly traditional ways like asking students to complete tutorials and learn isolated facts and complete drill and practice exercises (Ertmer, 2005).

The influence of attitudes and beliefs on technology acceptance

Orijji and Amadi (2016) also showed in their research that it is necessary for teacher's attitudes and beliefs concerning the use of technology in teaching, to change before implementation is possible. They observed that many teachers still fail to see the benefit of using technology and that they believe doing their job in the old way, is still the best way. Their research focused on affective factors that negatively influence teacher's acceptance towards technology, ranging from cultural background, to anger, fear, embarrassment and uncertainty that teachers might feel when they are not able to use the technology, and how these factors overrule teachers' willingness to try new technology. If we truly hope to change teachers practice, it is impossible to overestimate the influence of teachers' beliefs (Ertmer, 2005). The three most frequently cited barriers impacting technology integration, is resources, knowledge and skills and teachers' attitude and beliefs (Hew & Brush, 2007).

In a study about the beliefs and practices of award-winning technology-using teachers, they rate the attitudes and beliefs of their fellow teachers (described as afraid, fearful, intimidated, reluctant) as the most powerful barrier, but external barriers like lack of money, technology support, technology access, time and administration still exist (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurer, & Sendurer, 2012). Their own attitudes and beliefs were described as facilitating technology integration. This suggests that the best way to bring more teachers on board, is by increasing the knowledge and skills of

teachers, which in turn, have the potential to change attitudes and beliefs (Ertmer et al., 2012).

Johnson, Wisniewski, Kuhlemeyer, Isaacs, and Krzykowski (2012) supported the notion that older and more seasoned teachers experience more anxiety when it comes to teaching with technology. In their proposed solution to the problem, they suggest that a program be followed where teachers need to write a personal account “that includes the identification of personal values and beliefs in the following categories: the nature of the learners, the purposes/learning outcomes of their courses, the content, the teaching/learning processes, and the role of the educator” (p. 66). This again highlights the need to understand underlying reasons why teachers might be reluctant to change their attitude toward the perceived usefulness of technology.

The influence of training, professional development and support on technology acceptance

In an editorial Anderson (2010) focuses on the frustration that teachers feel when technical and administrative support fall short. She also recognises that most frustration flows from teachers with ineffective skills and experience requesting assistance for mundane issues, a problem which can be solved with better training.

Borthwick and Hansen (2017) acknowledge the importance of teacher competency and therefore acceptance of technology, but also stresses the importance of proper training for teachers in these matters. They suggest commitment to the four guiding principles that were identified in a 2016 summit of innovative educators. These principles are that 1) a focus will be placed on the active use of technology to enable learning, 2) sustainable systems for instruction for higher education will strengthen the use of technological tools in transformative learning, 3) insurance is given that students’ experiences with technology are focused on education, program-deep and program-wide and 4) that the focus should not be on method, but on teaching.

According to Cennamo, Ross and Ertmer (2010), to achieve technology integration that targets student learning, teachers need knowledge that enables them to identify technologies that are needed to support curriculum goals and meet students’ needs. They also need to select and use appropriate technologies to resolve issues related to their own professional practice and growth (Cennamo, Ross, & Ertmer, 2010).

Professional development need to align with teacher beliefs and must be situated within the context of their own curricular needs to lead to teacher change. Professional development nurture teachers' roles as researchers and lifelong learners (Ertmer & Ottenbreit-Leftwich, 2010).

To facilitate teacher change, teachers need to use their existing knowledge as a springboard and take time to experiment with technology in small doses. They need mentoring and coaching sessions, as well as opportunities to witness other teachers using technology in their classrooms and then share success stories at grade-level or in meetings (Ertmer & Ottenbreit-Leftwich, 2010). They also need opportunities to practice managing technology and a culture that encourages and supports experimentation need to be implemented. Support staff needs to be continually available to ensure initial uses are successful experiences (Ertmer & Ottenbreit-Leftwich, 2010). There are a number of different types of support needed, like administrative, technological, professional, peer and school leadership and management (Ertmer et al., 2012).

The Technology Acceptance Model in the literature

In an attempt to investigate measures and developing new scales for predicting or explaining user's acceptance of presented technology, Davis (1989) developed the Technology Acceptance Model (TAM) and through his research focused on two main variables in which user acceptance can be measured, namely perceived usefulness (PU) and perceived ease of use (PEOU). While perceived usefulness indicates the way in which using specific technology or applications will benefit the user's job, perceived ease of use explains how difficult or easy a user might find using the proposed technology. From this research, we can gather that users will use technology based on the decisions whether or not it will be helpful, and by how capable they will be in using it.

Davis acknowledged that other variables existed (self-efficacy, cost-benefits, adoption of complex innovations), but chose to develop PU and PEOU to effective scales with measurable psychometric properties. He found that more users found perceived usefulness more likely to motivate them to use technology and that more users do not use technology due to perceived ease of use. He stated that intrinsic motivation and enjoyment has not been researched well enough yet and that there is room for research in the affective domain of this subject (Davis, 1989).

Fathema and Sutton (2013) conducted a study to establish why faculty members underutilize the Learning Management System available to them. Their study found that the reasons users do or do not use the specific technology, relates to their PEOU, as some respondents found it easy to use and others found it difficult and therefore didn't use it. This study shows that often users do not use specific technologies until modifications are made to the software or hardware itself.

One of the main factors that influence perceived ease of use is teachers' low self-efficacy level in that many respondents of studies indicate that a greater need for training is necessary (Anderson, 2010; Johnson et al., 2012; Kopcha, 2012; Oriji & Amadi, 2016).

Teo (2011) stated that teachers need to accept technology before they will implement it and before learners will benefit from it. In support of this, a Malaysian study was conducted to establish the behavioural intention of teachers after the Ministry of Education pushed for technological implementation in schools, as well as investing in technology training for teachers (Wong, Osman, Goh & Rahmat, 2013). This study was also an opportunity to test the validity of TAM outside developed countries.

Many researchers do not find the variables of Davis's model sufficient and attempt to extend upon the model by adding factors that they discover also have an impact on user acceptance. These factors are more descriptive to the reasons of acceptance but can mostly still be associated with either perceived usefulness (PU) or perceived ease of use (PEOU).

Teo (2008) wanted to explore the possibility that the variables of the TAM model do not effectively determine the attitude towards technology of users in the educational field. In addition to the common variables, he introduced four alternative variables, namely self-efficacy, perception towards the use of computers, technological complexity and application conditions. Teo (2011) also stressed the importance to be able to identify more factors that influence the use of technology by teachers. He used five variables in the development of his testing model, adding subjective norm, attitude towards use and facilitating conditions to the list.

Mitchell and Geva-May (2009) also identified more variables that influences attitudes towards willingness to accept technology. These are intellectual reluctance towards the

use of technology, technical and administrative support from policy makers and other role players, attitudes towards change in institutions or in jobs and cost implications or benefits. An interesting development in the study was that there is a correlation between the respondents' attitudes and the subjects they teach, the level of experience and their position in the faculty, but that there is no correlation between years of experience and their attitudes towards technology.

Bryant, Coombs, and Pazio (2014) not only focused on the reasons behind individuals' resistance to technology use, but also at the possible role that the attitude of the institutions in which they find themselves play in the acceptance and implementation of technology. Infrastructure and costs are two variables that play a role here.

Another variable which has a great impact on user acceptance is perceived enjoyment. Wu and Gao (2011) used an extended TAM (exTAM) model, of which perceived enjoyment is another variable. Perceived enjoyment, perceived ease of use and perceived usefulness are closely interrelated with each other, because technology that is easy to use will be easier adopted to be used and to be seen as useful. Although the study was done on students, the researchers hope that teachers will use the findings of the study to be motivated to implement technology to make learning a more enjoyable experience for both themselves and their learners.

Theoretical framework

The Technology Acceptance Model (TAM) is a theoretical framework in which effective scales with measurable psychometric properties are used to determine or predict an individual's acceptance and use of technology (Davis, 1989). The main variables which is used to measure acceptance, are perceived ease of use (PEOU) and perceived usefulness (PU). (Buabeng-Andoh, 2012; Davis, 1989; Teo, 2011).

Perceived usefulness (PU) can be explained as the user's opinion of how useful the technology will be in the chosen field and if the use of it will contribute to a better result. Perceived ease of use (PEOU) reflects the user's perception of how easy it is to use the technology or program.

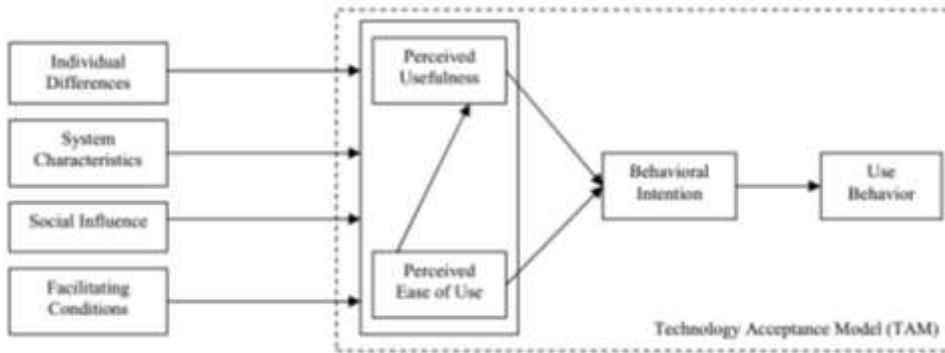


Figure 1: Theoretical Framework (TAM 3) (Venkatesh & Bala, 2008)

Figure 1 shows the TAM 3 model, which is an adapted view of the original TAM model. As this diagram also shows how external influences such as individual differences, system characteristics, social influences and facilitating conditions impact on PU and PEOU, these were the starting point of the study. The research was conducted to find out if these factors impact all teachers in the same way and how teachers differ in how they manage these factors.

Methods

According to Maree, “our choice of methods is indicative of how we see the world and thus of our ontological and epistemological position” (2016, p. 51). With this in mind, it was important to establish the paradigm and methods that would support and shape the research. Successful research relied on a good understanding of how the epistemological paradigm would influence the research methodology, which in turn advocated which research designs sampling and data collection methods and resources were used to ultimately lead to purposeful data interpretation.

As the reality in this study was constructed through social interaction with the participants, an interpretivist approach was evident. New knowledge emerged as interviews were conducted and a better understanding of the nature of the technology acceptance of participants helped in establishing a new reality.

Within the interpretivist approach of this study, the constructivist paradigm was prevalent. The research that was conducted in this study aimed to construct new knowledge about how different factors and circumstances can influence individuals in different ways,

altering a common notion that teachers who fall in a certain demographic will automatically act and react to technology use in a specific way.

The research was conducted qualitatively, subjectively interpreting facts through analysing respondents' own experiences as they conveyed these through spoken words. Maree explains that "words (concepts, terms, symbols) are the only instruments we have to communicate meaning" (2016, p. 50). It was therefore significant that through the words of the participants in this study, a conclusion was reached inductively, as particular cases were observed in an effort to draw a conclusion describing the phenomenon.

An advantage of using a qualitative approach in this study was that, in the process of interviewing participants, previously unexplored issues regarding how people perceive technology came to light. Deeper understanding of how already known influencing factors affect teachers differently under varying circumstances also added to existing knowledge.

A single-site case study formed the focus of this research. The focus of a case study, as described by McMillan and Schumacher (1997), is around a single phenomenon in a specific environment, and this was the case in this study as well. The study focused on the phenomenon of technology acceptance of different teachers in the same environment, having access to and similar training in the use of the same technology.

The decision to focus on a case study was made due to the possibilities of this design to contribute to the development of researched-based knowledge around the phenomenon, in the form of interviews consisting of important questions that would help researchers deduct conclusions about how external and internal factors can influence teachers' acceptance of technology in different ways.

Since the aim of the study was to establish how different individuals react in the same environment, presented with the same technological aids and training, a case study was the best research design to follow.

The study was descriptive in nature and information was collected in a specific environment, with no changes or adaptations made in this environment to alter the responses of the participants. According to Maree, "descriptive case studies describe an intervention or phenomenon and the real-life context in which it occurred" (2016, p. 82).

A descriptive study was chosen because the aim of the research was to describe how, even if the environment is uniform, teachers often have different stances toward technology acceptance and the use of technology in their classroom practice.

Since the environment in which the research took place, already existed of many cases which could contribute equally to the study convenience sampling was followed. An advantage of this type of sampling was that the participants were easily available and familiar with the subject that was being studied.

Five teachers from one private school, willing to participate, were chosen. The participants in the study were representative of the demographics of the teaching staff, although it is not necessarily a proportional sample of the greater teaching population. All five participants were female and have been teaching at the school for more than four years each – the longest being at the school for seven years. There were vast differences in their age: two teachers were in their twenties, one in her thirties, one in her early fifties and one in her late fifties. The teaching duties of each were also divergent, with one teacher being a foundation phase educator, one focussing on remedial education, two focussing on languages and one was a Maths teacher. All the teachers have access to a personal computer and the Internet at school, as well as a school-issued iPad to be used for preparation, research and other administrative tasks at home. Of all five participants, only one does not have access to a computer or the Internet at home. The role that the researcher plays in the school, is that of First Additional Language teacher for Gr 5, as well as ICT teacher for Gr 5 and Gr 6.

The collection of data can be seen as an audit trail for the research (Maree, 2016). Everything from the different instruments used, such as interview notes, documents, notes and photographs, to transcription and final analyses of the data are included in this.

Maree (2016) also stresses the need to keep the original research question in mind when choosing appropriate data collection strategies. As the main inquiry of this study focused on possible reasons why people have a specific acceptance towards technology, interviewing individuals in order to establish what influences their acceptance was the best way to establish this.

Interviews were semi-structured with a set of previously drawn-up interview questions. As this study flowed out of an inquiry into previous research and aimed to add knowledge to existing data, the decision of conducting semi-structured interviews agreed with Maree's (2016) description of it to validate and build upon information from other sources. The interviews lasting approximately 30 minutes each was conducted during a month-long period in September and October of 2017. Interviews were conducted at times and places that were convenient to the interviewees were utilized. It was digitally recorded and transcribed to text by the researcher. These transcriptions were then interpreted and sorted into emerging themes for further analyses.

In observing the classrooms of the respondents, it became evident that there were various levels of technology implemented in all classrooms. Each teacher had access to a desktop computer, although the software on the computers were mostly outdated. Only Participant B had Windows 10 installed on her computer, while the others all had Windows 7 operating systems. All respondents, except Participant A, had projectors in their classrooms, while Participant C and E both had interactive whiteboards as well. Only Participant E utilized the interactive whiteboard functions, while Participant C used it as a substitute for a writing board.

Analysing qualitative data is important, as it is necessary to present the findings of the collected data in some kind of explanatory form (Taylor and Gibbs, 2010). The researcher followed a deductive approach in that the data emerging from the interviews was analysed and similarities emerging from these were grouped into categories. To make this process easier, Atlas.ti was used to assist in the analysis. The use of this computer programme was the logical solution to making complex qualitative data analysis more manageable and therefore making the research trustworthy and credible.

Interviews were first transcribed verbatim, after which the documents were uploaded into the software. The data was then analysed by identifying consistencies, differences and other patterns in participants' responses. By identifying these, certain codes of categories and sub-categories were assigned. The report was written based on these codes. The researcher was the only person that analysed the data.

In analysing the data, three main themes emerged, namely a) strong motivators to using technology, b) institutional challenges that inhibit implementation and c) personal and

internal challenges that inhibit implementation. The codes that supported each theme, were as follows:

Strong motivation indicators

- Enjoys using videos and easy apps/programs
- Internally motivated to use technology that is available
- Learner successes motivates implementation
- Peer encouragement
- Positive support from management
- Social media allows interaction with other teachers – networking
- Technology is imperative in today's society as well as in education
- Usefulness in administration
- Usefulness to learners
- Usefulness to self

Institutional challenges

- Contact time with learners is limited
- Not cost effective
- Inadequate training
- Implementation challenges
- Lack of support
- Lack of sufficient hardware
- Lack of reliable infrastructure
- Inconsistency in expectations leads to lack of motivation

Internal and personal challenges

- Fear that technology is changing social interaction negatively
- Financially not viable
- Limited access to technology in personal life
- Feeling of incompetence inhibits implementation
- Overwhelmed by technological jargon
- Overwhelmed by the rate of progress
- Seeing technology as irrelevant to “getting the job done”
- Technology have limits, people don't

- Technology is time-consuming in planning and implementing

After the interviews were transcribed, each participant was given a copy of their interview to evaluate. All participants were satisfied that their interaction was reproduced correctly and without changes. The final research report was also made available to participants for review, with anonymity ensured by the use of pseudonyms. Participants were able to see how their individual responses contributed to the study.

Results

In assisting to steer clear of bias, it is necessary to look closely at the demographics of the population of the study. Since convenience sampling was used that relied upon voluntary participation as well as time constraints, the sample was limited to only five respondents. Table 1 visualises the demographics of the population of volunteers that were interviewed.

Table 1: Demographics of respondents

	Years of teaching experience	Subject field	Phase
Participant A	Less than 5	Remedial education	Intermediate
Participant B	More than 20	Maths and Science	Intermediate
Participant C	More than 20	Languages	Intermediate
Participant D	5 – 10	Languages	Intermediate
Participant E	Less than 5	General teaching	Foundation

Due to the limited sample, the researcher chose not to draw any inferences based on the variables mentioned in the above table while analysing the data and preferred that it rather reflected the diversity of the respondents' experience and teaching field.

The respondents were asked if they have access to technology at home, which all did. All their replies regarding the extent to which they use technology for administrative purposes in their professional lives were very positive and it is safe to say that all the respondents are computer literate to a certain level. All make use of e-mail for communication purposes with colleagues and parents and reporting of assessment is done electronically. They also all replied that they do their preparation and study notes for learners on the computer.

When asked to which extent they feel comfortable using additional technology that is made available to them in their teaching practice, Participants A, D and E replied that they are extremely confident and often uses additional technology as a tool when teaching. However, Participants B and C felt that they are mostly inept at using new technology in lesson presentation and would be wary to try it.

Respondents were asked a set of questions focussed around their background, the use of technology at their school, the expectations of the management team regarding the use of technology, training and support received, their technology use for administrative purposes, the use of it in their pedagogy, in their personal lives (as well as personal opinions and attitudes) and how they relate to the introduction of new technologies.

In their discussions of these questions, trends emerged that showed certain determinants that motivate the exploration of technology use in their teaching practice. The ten most prevalent factors that contribute to extended technology use in teaching practice were grouped and the number of times each was mentioned by a specific respondent can be witnessed in Table 2.

Table 2: Factors supporting the use of technology in teaching practice

	Subject A	Subject B	Subject C	Subject D	Subject E	Totals
Internally motivated to use any tech that is presented, to the best of ability	1	0	0	2	2	5
Learner successes	5	1	0	1	2	9
Peer encouragement	0	0	0	0	5	5
Positive support from management	0	0	0	0	2	2
Social Media allows interaction with other teachers - Networking	0	0	0	0	1	1
Technology is imperative in today's society as well as in education	1	0	0	2	1	4
Usefulness in administration	3	1	1	1	1	7
Usefulness to learners	5	2	1	5	3	16
Usefulness to self	1	7	0	1	2	11
Video clips and basic applications lend support to lessons	2	3	1	2	4	12
Totals	18	14	3	14	23	72

By analysing this data, it is clear that almost all the respondents experienced successes implementing technology in their pedagogy, with only Participant C not encountering many factors motivating her to attempt the use of technology in her classroom.

The trends that all the respondents mentioned were the usefulness of technology in administration, successes experienced through the showing of video clips and that they use these technologies because it benefits the learners. Of these motivators, the ease of using video clips and other basic programmes, as well as usefulness to learners, were the motivating forces behind increased technology use in lesson presentation.

Another highly motivating factor for the respondents to implement technology in their pedagogy, was the usefulness of technology to the teacher herself, while observing successes experienced by learners when using technology, motivated Subject A especially.

Although only experienced by one respondent (Participant E) the support and encouragement she received from by management and peers, even through social media, were significant determinants in motivating her to use technology in her teaching practice.

Three respondents (Participants A, D and E) also noted that they feel compelled to use technology because it is imperative in today's society and in 21st century learning and will also try to implement technology into their lessons even with the presence of deterring factors.

When interviewing the respondents, they mentioned more factors that hinder their implementation of technology into their teaching, than what would motivate them. In analysing these indicators, it became clear that some were of a more personal nature, while others were related to institutional limitations.

While all respondents encounter hindering factors stemming from institutional restraints, only two respondents (Participants B and C) expressed that they experience pitfalls relating to more personal and internal motivation and which constrain their tenacity when implementing technology into their teaching practice.

Table 3 and Table 4 demonstrate the issues that contribute to the two categories of deterring factors as mentioned. The numbers in the columns reflect the number of times each respondent mentioned that particular obstacle.

Table 3: Personal issues that deters implementation of technology to teaching

	Subject A	Subject B	Subject C	Subject D	Subject E	Totals
Feeling of incompetence inhibit implementation	0	7	1	0	0	8
Limited access to technology in personal life	0	1	2	0	0	3
Overwhelmed by jargon	0	2	6	0	0	8
Overwhelmed with rate of progress	0	1	3	0	0	4
Technology have limits people don't	0	4	0	0	0	4
Technology is irrelevant to "getting the job done"	0	1	3	0	0	4
Time-consuming to plan and incorporate	0	5	0	0	0	5
Totals	0	21	15	0	0	36

Table 4: Institutional issues that deters implementation to technology to teaching

	Subject A	Subject B	Subject C	Subject D	Subject E	Totals
Contact time with learners limited	0	1	0	2	1	4
Implementation challenges	3	2	2	1	1	9
Inadequite training	4	7	9	6	1	27
Inconsistency in expectations leads to low motivation	2	2	2	3	0	9
Lack of effective technical support	3	3	2	0	0	8
Lack of reliable infrastructure	6	3	4	2	1	16
Lack of sufficient hardware	3	2	5	3	1	14
Totals	21	20	24	17	5	87

When looking at Table 3, it is clear that Participant B feels strongly about the need to be very familiar with using specific technology before implementing it. She also sees the time factor as a great obstacle, often mentioning how planning for the use of technology, as well as getting familiar with new technology, takes up lot of personal as well as teaching time. She is also deterred from using technology since she feels that there are too many limitations within the programmes and applications itself that she does not experience when having the human factor coming into play.

Participant C, on the other hand, feels overwhelmed by many aspects of technology, to a point where she would rather not use it. The jargon, rate of progress and what she perceives as complexity of technology, are great deterrents for this respondent.

It is Table 4, however, that gives us the richest data involving factors that deterred all respondents to not use the technologies available at the school. The trends that stood out the most were a feeling that training was either absent or inadequate, the lack of a reliable infrastructure and problems with hardware. Lack of technical support and other implementation challenges closely relates to these issues, while inconsistency in expectations from management further contributes to respondents not being motivated to use technology in their lesson presentation.

The issue with limited contact time with learners was also mentioned as a deterring factor by some respondents.

Discussion

The aim of this study was to identify factors that lead to the technology acceptance of teachers in an environment where a wide range of technology is made available to them. The researcher entered this study with the assumption that some teachers will have a low technology acceptance while others will embrace and utilise technology without hesitation. However, the results of the study show that all the respondents encountered both motivational and deterring influences which impacted on their acceptance on both levels.

In reviewing the theoretical framework of the TAM model that defines this study, it is evident that all the factors revealed by the respondents can be grouped under either of the variables of perceived usefulness (PU) and perceived ease of use (PEOU) as introduced by Davis (1989). In correspondence with the research of Venkatesh and Bala (2008), this study reflected the influences that individual differences, system characteristics, social influences and facilitating conditions have in the PEOU and PU of teachers.

In engaging with all the respondents, it became evident that their experiences in implementing technology are all very similar. While all of them are computer literate and try to implement technology more to their teaching, the obstacles arising from inadequate institutional support are having a negative impact on applying the technology throughout their pedagogy. One respondent's statement that "the frustration of the infrastructure not being in place, the computers being old, the internet always being down ... not always, most of the time being down ... those are the frustrations for me, who uses it so little, for

those teachers who rely on it so heavily, I think that must be hugely frustrating” (Participant C), summarise the impact that these challenges have on the technology acceptance of all the respondents.

As with the findings of Kopcha (2012) in that he found that available technology influences teachers’ acceptance, a comparison can be drawn between the availability of said technology and the technical support and maintenance of these. In the current study, respondents mentioned that they do not effectively use available technologies to the level it can be used, because these devices are often difficult to access, out of order or supplied with outdated software. Examples of these issues are one respondent reflecting on why she does not use the iPads or students’ computers in her lessons by stating “I don’t make use of them because it involves a lot of pre-planning in that the computer room is heavily booked” (Participant B), while Participant D explained that she cannot use her Promethean board for its real purpose because it does not correspond with the software currently installed on her computer. This leads the researcher to understand that while these teachers have a high PU, they perceive that the difficulties of accessing the existing technology outweighs the usefulness.

Since there were two respondents who experienced additional hurdles in their technology acceptance to their peers, it is important to explore the impact of these challenges. When looking at these factors, namely overwhelming feelings regarding technological jargon, the fast pace of development, feelings of incompetence and therefore low self-efficacy, it becomes clear that the findings of Oriji and Amadi (2016) where they identify that affective factors might overrule a teacher’s willingness to try new technologies, have merit. It is important, however, to note that both these respondents are computer literate to a certain extent but are not receiving support or sufficient training to encourage them to overcome their fears pertaining to technology use. Without the necessary support and motivation, these teachers revert back to methods that they feel comfortable with using and they are hesitant to implement technology.

Insufficient training was revealed as the greatest factor influencing the reluctance to implement technology by all respondents. This issue is reflected in many research studies (Anderson, 2010; Borthwick and Hansen, 2017; Buabeng-Andoh, 2012; Kopcha, 2012) and is therefore not unique. The emerging trend in the current study, however, seems to be a need for the way in which training is presented, as all who received training

previously, felt that it was ineffective and irrelevant. During an interview, this phenomenon was vocalised by the respondent stating: “We were put on half an hour’s training one morning, long before we got the programme... by the time the programme was implemented here, I’d forgotten what I’ve learned months before” (Participant C). Three other respondents also voiced their frustration by commenting that training was usually done with the trainees being spectators, instead of participating in practical examples (Participants B, D and E). The PEOU of the teachers would be improved if the training could be done more effectively.

The findings are encouraging, however, in that all respondents identified that learner successes and the benefits that using technology in teaching have on the learners, are some of the strongest factors motivating them to implement it into their lessons. This contradicts the findings of Oriji and Amadi (2016) in which they remark that many teachers do not recognise the benefits that using technology in teaching have on learners’ progress, as even respondents with a lower level of technology acceptance expressed the advantage it has on the enjoyment level as well as progress of the learners.

It is also important to reflect upon further factors that lead to improved technology application in the classroom. During her interview, a Participant E mentioned how the example of her peers, first as a student teacher and later as part of the permanent staff, encouraged her to use technology. She observed the benefit that the learners experienced through mentors’ implementation of technology and this in turn motivated her to implement technology into her own teaching. This challenges Teo’s (2011) statement that teachers first need to accept technology before implementing it and only then will learners start to benefit. In this study, it can be deduced that teachers who are mentored well, and who are seeing learners benefit from their colleagues’ efforts, will feel encouraged to try implementing technology themselves. The impact of peer interaction and mentoring are important aspects to take note of.

Letwinky (2017) identified in his study in 2017 that teachers’ acceptance of technology differs greatly from their use of it and suggested further studies. The research gathered in this study adds to this question, as the respondents provided the researcher with numerous factors preventing them from using the existing technology at their workplace.

The implication of this gives a better understanding of factors which contribute to the technology acceptance of teachers who have wide access to technology. Another result is the knowledge that an individual does not only experience motivational factors to implement technology, but that external factors which can hinder technology acceptance, can easily destroy the grit of a teacher when trying to embrace technology, as one respondent so aptly stated: “although I am someone that’s quite determined and I am quite diligent and I keep on going as best I can. If the same difficulties are constantly met, you do lose your determination to overcome it and use it, so I think even though I’m trying my best to use technology as best as I can, the limitations are starting to outweigh the use of it” (Participant A).

Limitations and weaknesses of the study

Although the inference of the study is of great value, certain limitations and weaknesses have arisen. Due to the constraints of convenient sampling, the population was not evenly spread across age, race or phase. This could lead to generalisations that threaten to compromise the validity of the research.

The issues with inadequate training and poor infrastructure seemed prevalent and it might be possible that respondents in the study were, at the time of the interviews, overwhelmed by this situation. Additional interviews with the same respondents over a longer time period, to see if the same tendencies persisted over time, could have led to better credibility of the study.

Conclusions and recommendations

The study identifies that a disparity exists between teachers’ acceptance and actual implementation of technology and that this is an issue that can be explored further.

When looking at factors supporting the use of technology in teaching practice, the aspect of PU comes to the fore. The usefulness of the technology to learners is most important for the teachers, then usefulness to self and then usefulness in administration. Results such as the recognition of usefulness to self and learners, as well as the respondents’ frequent and unbridled use of technology for administrative purposes, indicate that they all have a high PU level. Their PEOU, however, is negatively influenced by obstacles such as lack of effective training, lack of infrastructure and available hardware,

inconsistent expectations from management, lack of support and motivation, as well as implementation challenges.

While all respondents encounter hindering factors stemming from institutional restraints, only the two older respondents (Participants B and C) expressed that they experience pitfalls relating to more personal motivation. The younger participants, (Participants A, D and E) felt compelled to use technology because it is imperative in today's society and in 21st century learning.

The trends that stood out the most were a feeling that training was either absent or inadequate, a lack of reliable infrastructure and problems with hardware.

In a school where different types of technology are made available to all teachers, it is important to provide adequate training as well as technical and motivational support. A steady infrastructure and upkeep of hardware are all necessary to encourage teachers to be daring and consistent in their implementation of all technology. Without this support, even teachers with a high technology acceptance level lose their grit and tend to use technology less in their pedagogy.

Teachers who feel encouraged by their management, and experience peer support, are more likely to use technology even when faced with institutional challenges. It is therefore important for supporting structures to be in place to give all teachers the assistance and encouragement that they need in order to feel compelled to succeed in implementing technology in their lessons.

Stemming from the factors identified by respondents as to how their technology acceptance is impeded, certain recommendations can be made to assist in improving technology use by all teachers.

Four of the respondents mentioned the limiting impact that unclear and inconsistent expectations from management have on their technology acceptance (Participant A, B C and D), while Participant E mentioned the uplifting effect she experienced by being supported by management. As the respondents who experience inconsistent expectations are all in a different phase than Participant E, it is advisable that whole-school management have a uniform expectancy that is clearly communicated to all staff.

Management should be advised to set explicit goals, and to implement mentorship programmes and opportunities to share ideas and provide all teachers with the support that they need to improve their technology acceptance.

As the need for effective training is prevalent in all of the responses, it is imperative that attention be given to relevant, effective and sustainable training. Alternative ways to present training should be explored, as the teachers are subject to strenuous timetables and extra-mural responsibilities. The financial implications of training should also be considered. Topics for further studies can be the special training needs of teachers, as well as the impact of using the knowledge and skills of teachers who are successfully implementing technology into their pedagogy, to motivate and empower their peers.

Further recommendations are: improved maintenance of the existing infrastructure and hardware, as well as training opportunities that do not require internet access. Establishing a reliable infrastructure is imperative, but as budget constraints might delay this aspect, it is necessary for teachers to brainstorm ways to compensate and work around poor internet connectivity.

It is unfortunate, however, that deterring factors seemed to dominate this study. The issues arising from inadequate training, a poor infrastructure and poor support play an important role in the implementation of technology in teaching. These obstacles will first need to be addressed before teachers start using the technology that is presented to them to its full extent.

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