Factors enhancing mobile technology acceptance: A case study of 15 teachers in a Pretoria secondary school

K Moodley (iD), **P Callaghan** (iD), **WJ Fraser** (iD) **and MA Graham** (iD)
Department of Science, Mathematics and Technology Education, Faculty of Education, University of Pretoria, Pretoria, South Africa
kimera.moodley@up.ac.za

While a considerable body of research has focused on learners' acceptance of or resistance to mobile technologies, fewer studies have focused on teachers. This research study aimed to understand the factors influencing South African teachers' acceptance of or resistance to using mobile technologies in their classroom practice. The Technology Acceptance Model (TAM) was used as a lens to explore factors that enhance mobile technology acceptance. The study consisted of a sequential mixed method, action research approach. Fifteen participants received training at a Mobile Technology workshop, aiming to provide professional development and enhance technological literacy knowledge and skills for teachers. The participants were then tasked to teach with technology and to share and reflect on their experiences and perceptions during the community of practice meetings. Content analysis was used to analyse the transcripts of these meetings and this led to the identification of 2 key factors, which enhanced the teachers' acceptance of mobile technology, namely, perceived usefulness and perceived ease of use. Six sub-factors affecting acceptance were also identified: anxiety, ability, attitude, facilitating conditions, subjective norm and voluntariness. The factors that were identified suggest that additional professional development, infrastructure and resources need to be provided for teachers. We argue that by providing these necessities and eliminating or significantly reducing these factors, the use of mobile technology will be a success.

Keywords: improving classroom teaching; interactive learning environments; learning communities; mobile technology acceptance; secondary education; teaching/learning strategies

Introduction

In the last decade, there has been considerable research into acceptance of mobile technology in education and other fields. As a result of advances in hardware, software, open educational resources and social platforms for the sharing of knowledge, the demand for interactive learning environments as part of pedagogy in teaching has grown (Mayisela, 2013; Teo & Milutinovic, 2015). Findings from large scale international projects and small-scale local projects within South Africa (MobiLED,[i] MoLeNET,[ii] MOBILEARN,[iii] ICT4RED[iv] and Gauteng online) (Herselman & Botha, 2014; Jacobs, 2013), have encouraged departments of education to implement mobile technology and create policy documents to guide and support teachers. Another example is the professional development framework for digital learning (Department of Basic Education, Republic of South Africa, 2018). Various short courses were introduced at universities to try to bridge the technological usage gap that exists between facilitators and learners (examples are the introduction of blended learning design and support at Stellenbosch University, and Mobile learning for the 21st-century facilitation at the University of Pretoria). There is a growing demand to study the intervening variables for technology acceptance (Al-Emran, Mezhuyev & Kamaludin, 2018) across all disciplines and the teachers' experiences in mobile technology implementation (Crompton & Burke, 2018; Teo, Khlaisang, Thammetar, Ruangrit, Satiman & Sunphakitjumnong, 2014) in any country where it is an emerging economic resource.

Therefore, the following research questions informed this study:
1) What factors contribute to mobile technology acceptance by teachers?
2) How do these factors contribute to mobile technology acceptance by teachers?
3) What are the teachers' experiences and perceptions of mobile technology acceptance?

Literature Review

Mobile learning is described as an educational activity that engages learners without limiting them to a physical location (Kukulska-Hulme & Traxler, 2005). Crompton (2013:4) further explains mobile learning as "learning across contexts, through social and content interactions, using electronic devices." The advancements in mobile technology and mobile devices enable a plausible paradigm shift in education from traditional learning methods to mobile learning (Rajasingham, 2011; Teo et al., 2014). Crompton and Burke (2018) found from a review of 23 studies focusing on the impact of mobile learning on student achievement, that 70% of the studies reported positive outcomes, resulting in increased student achievement. Hegedus, Tapper and Dalton (2016) and Okumuş, Lewis, Wiebe and Hollebrands (2016) found that the utilization of technology has a positive impact on learners' learning and achievement.

Research findings from a number of studies indicate that integrating technology into classroom instruction can increase student motivation, learning efficacy, curiosity and creativity (Carle, Jaffee & Miller, 2009; Idris & Nor, 2010; Liu, Tsai & Huang, 2015; Molins-Ruano, Sevilla, Santini, Haya, Rodríguez & Sacha, 2014). However, a study by Govender and Govender (2014) illustrates that teachers with computer competency skills

and access to technology often do not incorporate technology in their teaching. Instead, technology is frequently used to perform non-instructional tasks like monitoring attendance and grading (Gray, Thomas & Lewis, 2010). On the other hand, some teachers are reluctant to use mobile technology because they lack the knowledge and skills to adapt their teaching and learning strategies making technology acceptance problematic. Teachers' instructional practice (Hegedus et al., 2016) and their technological pedagogical content knowledge (Tabach, 2011) affect the use of technology in the classroom.

Teachers who experience unsuccessful technology adoption in the classroom tend to feel demotivated, which strengthens the need for creating successful enriching classroom experiences of technology integration (Slaouti & Barton, 2007). In-service training courses fail to prepare teachers adequately and vary considerably (Lee, Y & Lee, 2014). One cannot simply deliver instructions and technology-related skills (Ferdig, 2006). Technology integration is more complex as proficiency in technological skills does not ensure successful application in classroom practice (Liu et al., 2015; Van Laar, Van Deursen, Van Dijk & De Haan, 2017). Successful collaboration between colleagues and observation of teachers using technology successfully have proved to be more effective as these provide professional development focusing on content and methodology and teachers are then more likely to adopt new technological ways of teaching (Vanderlinde & Van Braak, 2013).

While many teacher education programmes include various courses to assist teachers with technology integration-related knowledge, they often fail to provide opportunities for such knowledge to be applied (Liu et al., 2015). Rastogi and Malhotra (2013) claim that pre-service teachers tend to be more confident and express a higher proficiency in technology use than more experienced teachers. Experienced teachers tend to express fixed teaching philosophies that ignore technological skills (Liu et al., 2015; Teo et al., 2014). However, Mahdi and Sa'ad Al-Dera (2013) argue that there is no significant difference between the age and experience of teachers using technology but rather in respect of gender. For effective technology integration to take place, a combination of technical skills and teaching

experience is required. Nkula and Krauss (2014) emphasise that implementation with integration does not merely mean technical skills and learning **about** a computer or mobile device, but it means learning **through** a computer or mobile device.

Several factors influence a teacher's decision to use technology such as access to resources, incentives to change, commitment to professional learning, quality of software and hardware, ease of use and informal background training (Kihoza, Zlotnikova, Bada & Kalegele, 2016). To understand the link between these factors, and how they influence the use of mobile technology acceptance, the TAM was used.

Theoretical Framework

The TAM was developed by Fred Davis in 1989. In the TAM model, the external factors consist of social factors, cultural factors, contextual factors and political factors. The social factors include skills and language, political factors include technology politics and political crisis and cultural factors include the beliefs of the individual and their desire to employ a particular information system application. "Perceived usefulness is the degree to which a person believes that a particular technology will be beneficial to their lives" (Mac Callum, Jeffrey & Kinshuk, 2014:145). "Perceived ease of use is the measure of the degree an individual believes in a particular technology is free from effort" (Mac Callum et al., 2014:145). The "attitude toward use" is concerned with the desirability and evaluation of the information before use. The behavioural intention is the likelihood of the individual carrying out the task successfully (Surendran, 2012). The study by Teo and Milutinovic (2015) indicated that attitude has a significant influence on behaviour. The TAM illustrated in Figure 1 was chosen for this research because the aspects of perceived usefulness and perceived ease of use play vital roles in mobile technology acceptance. The examination of factors and their effectiveness as external variables of TAM are crucial for m-learning research (Al-Emran et al., 2018). The other factors within the model were not used as the study aimed to investigate and identify factors that influence technology acceptance and classify them within the aspects of perceived usefulness and perceived ease of use.
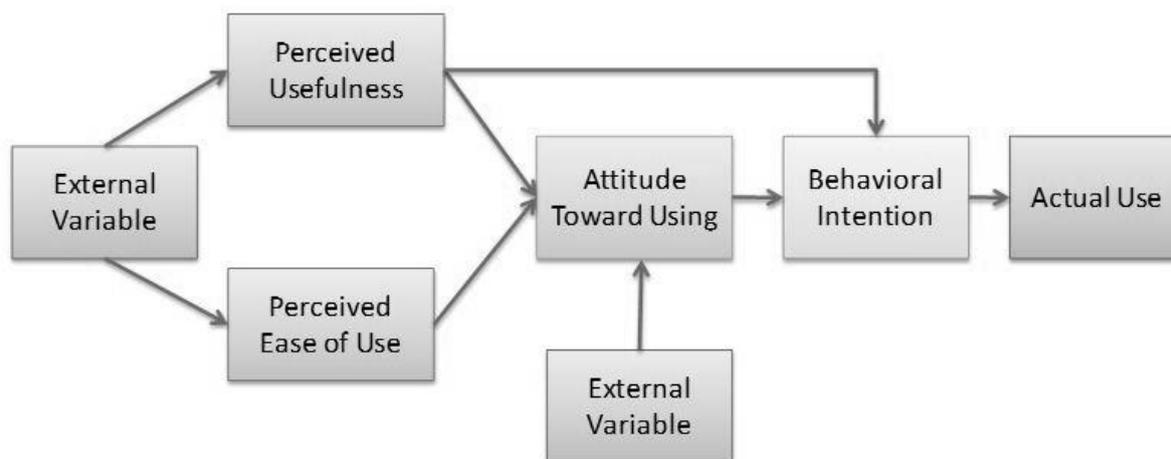
Figure 1 Technology Acceptance Model (adapted from Mac Callum et al., 2014)

It is important to note that while the TAM model has been criticised in recent years, there are several models that have been developed to understand technology acceptance. We chose the TAM model because it has been used widely, has several adaptations and shows higher improvement acceptance when compared to other existing models (Oye, Iahad & Rahim, 2014). The original TAM model was used to identify whether the factors found in this study are similar to those of studies in other countries and contexts.

Research Methodology

A practical action research study involving the team-based effort of implementation and focusing on teacher development and student learning (Cresswell, 2014), was undertaken to gain insight into the identifiable factors that may enhance technology acceptance. An iterative cycle of research through action and reflection was pursued, whereby people or communities affected by a problem, and opportunities to empower those involved through knowledge production, were researched (Kindon, Pain & Kesby, 2008). The study followed a sequential mixed-methods approach including qualitative and quantitative data within an interpretative paradigm to enable a greater degree of understanding that would not have been possible if a single approach were used (Cresswell, 2014). A purposeful sample comprising of teachers of various learning areas/disciplines at a single-sex high school was chosen. This technique provided a representative sample that was expected to be informative for the study (Bless & Higson-Smith, 1995). The teachers held either academic and/or professional qualifications with their experience ranging from one to 35 years. The teachers' technology experience varied, but they were all going to attend the mobile learning workshop to develop their technology skills. The school was purposefully chosen as it already had

the necessary infrastructure such as Wi-Fi and mobile devices available. We chose to focus on the integration of technology in secondary education as it was convenient and the school selected had the necessary infrastructure for the study. The study involved two stages: Stage 1 – the training of the teachers and Stage 2 – the teachers implementing mobile technology and reporting on their experiences and perceptions. The teachers needed to attend a three-day workshop where they were taught the basic functions of a tablet, how to source apps, both generic and subject-specific, and methods of integrating the technology into their lessons. Generalisability was limited by the sample size and the South African context. The data collection was obtained through a written questionnaire, online questionnaire and focus group discussions at a community of practice meeting which explored the teachers' experiences and perceptions.

Data Collection Strategies
1) The written questionnaire was adapted from a study by Mac Callum et al. (2014:141) on the "Factors impacting teachers' adoption of mobile learning." This questionnaire was validated using Cronbach's alpha for checking the trustworthiness of results. A Cronbach Alpha value above 0.5 is regarded as reliable (Goforth, 2015); which in this study was the case. The teachers were given various options of possible experiences from the literature. Likert scale items were used to classify the teachers' perceptions and experiences of mobile technology use. The written questionnaire was completed at the start of the study to understand the teachers' existing perceptions of mobile technology use.
2) The online questionnaire consisted of scaled and ranked items and was developed by the researchers. The results of this questionnaire were analysed using Statistical Package for the Social Sciences (SPSS) software. Minitab was used to produce graphical representations of the experiences and perceptions of the teachers. The results revealed the most likely

experiences and perceptions of teachers' mobile technology acceptance. This questionnaire was completed during the implementation of mobile technology to explore their current perceptions of technology use.

3) The focus group discussions occurred once a week for five weeks. Each session lasted for an hour. We provided guiding questions in a semi-structured manner to prompt responses from the participants. The teachers discussed a variety of aspects, including their experiences, challenges, solutions to their challenges, the different types of technology that they used, and how their learners responded. This form of reflective practice is crucial as it assists in finding new additional information that will develop or point out irrelevance and absurdity in the implementation process (Mathew, Mathew & Peechattu, 2017). It

gave teachers the opportunity to do self-reflection and develop self-awareness about their performance (Royle, Stager & Traxler, 2014). These discussions were done during the implementation process and were then analysed to extract the experiences and perceptions that teachers had about technology acceptance. We analysed the responses to the questionnaires through content analysis and focus group discussions independently and discussed different interpretations to reach consensus.

A summary of the participants' age, gender, qualifications, learning area and years of experience is given in Table 1, using pseudonyms. These criteria were used to ensure that the teachers from all age groups, different genders, different subjects and varying years of experience were used in the study.

Table 1 Biographical information

Name	Age	Gender	Qualifications	Subject	Years of experience
Anna	59	Female	Bachelor of Science (BSc) Honours (Hons) Chemistry, Higher Diploma in Education (HDE)	Science	35
Brenda	55	Female	Bachelor of Arts (BA), HDE	Afrikaans	29
Carol	44	Female	BA Fine Arts (FA)	Art	8
Dora	33	Female	Bachelor of Education ([BEd] Economic & Management Sciences)	Accounting	9
Elize	53	Female	Mathematical Statistics (MSc)	Information Technology (IT)	17
Fred	52	Male	BA, HDE	Geography	30
Gail	56	Female	BA, HDE	French	22
Heidi	57	Female	BA, HDE	Afrikaans	25
Jill	25	Female	BEd Further Education and Training (FET) German	German	2
Kevin	38	Male	HDE	Engineering, Graphics and Design (EGD)	15
Liam	28	Male	Master of Music (MMus) Royal Northern College of Music (RNCM), UNISA Teacher's Licenciate in Music (UTLM), Diploma of The Associated Board of the Royal Schools of Music (Dip ABRSM)	Music	10
Mary	42	Female	BA, HDE	Mathematics	15
Nina	55	Female	BA Hons	English	28
Owen	23	Male	Bachelor of Secondary Education (BSec Ed) (Science)	Science	1
Pam	29	Female	BEd (FET) Natural Sciences	Biology	6

Findings
Since the study involved different phases, the instruments were not all administered at the same time. The written questionnaire was done at the start of the study. This instrument confirmed the findings of previous studies and identified new factors. The online questionnaire was done during the implementation process. It was found that the perceptions of the teachers were changing and confirmed the new factors that were identified during the written questionnaire. The focus group discussions were done during the implementation process and allowed for a more in-depth understanding to how these factors influenced mobile technology acceptance and to what extent teachers found the implementation process easy to use and useful.

For this article, the results for each instrument are discussed separately to highlight the factors that were identified as the study progressed.

Written Questionnaire
The results of the written questionnaire highlighted three factors that affected teacher acceptance of technology. These factors were previously investigated by Mac Callum et al. (2014) and included Information Communication Technologies (ICT) anxiety, ICT ability and ICT attitude, which play crucial roles in the perceived ease of use of technology. Perceived ease of use and perceived usefulness determine the actual use of technology as was concluded by Mac Callum et al. (2014). The participants needed to respond "always", "sometimes" or "never." The results are

discussed below with relevance to the work of other researchers.

ICT anxiety

Most participants (eight of 15) felt that ICT was sometimes difficult to use. This was similar to the findings of Phelps and Ellis (2002) which showed a huge disparity between technological competence and the amount of learning required to use technology effectively. Seven of the 15 participants felt that ICT sometimes frustrated them. Similar feelings associated with this view were fear of looking foolish, insecurity and inadequacy as reported by Nunan and Wong (2005). Some participants (seven of 15) sometimes felt insecure about their ability to use ICT. Teachers' perceptions of their ability to use technology in class play a crucial role in technology adoption (Albion, 2001; Mac Callum, 2010). If a teacher perceives technology use as easy, then the teacher is known to have a high self-efficacy resulting in enjoyment and a feeling of control while using technology to teach (Hammond, Reynolds & Ingram, 2011; Sang, Valcke, Van Braak & Tondeur, 2010). This provides an element of comfort and self-confidence (Okumuş et al., 2016; Ros, Hernández, Caminero, Robles, Babero, Maciá & Holgado, 2015). The majority of the participants (nine of 15) sometimes needed someone to show them the best way to use ICT in their teaching. Teachers often received training as a once-off dissemination of knowledge (Garet, Porter, Desimone, Birman & Yoon, 2001), however, due to their different ICT abilities some teachers may require on-going support to assist them with the implementation process (Shohel & Power, 2010; Summey, 2013). This confirmed that ICT anxiety influenced mobile technology acceptance.

ICT ability

Most of the participants (10 of 15) always see ICT as tools that can complement their teaching. It is interesting to note that none of the participants responded "never" to this statement, and this suggests that the teachers who participated in the study were familiar with technology use. Mac Callum et al. (2014) emphasise that if teachers find teaching with technology to be beneficial, they are more likely to put in an effort into using it. Similarly, there is a tie between the number of participants that stated that ICT provides them with a variety of instruction and content. The tie is between participants choosing "sometimes" and "always" (seven participants chose each category and only one participant stated that ICT never provided a variety in instruction and content), again suggesting that the teachers understand the pedagogical usefulness of technology in teaching, as supported by Benedek (2007) and Ding (2010).

The majority of participants (10 of 15) feel that ICT always allows them to bring current information into the classroom. This is necessary as it allows the teacher to teach according to the context and use examples with which the learners can associate. Summey (2013) describes this as unique needs in terms of technology, proficiency, instructional context and learning environment. Van Eck (2006) claims that this is necessary to address the demands of learners by providing multiple streams of information, inductive reasoning, frequent and quick interactions with content, exceptional literacy skills and games that can offer insight into the context. Most participants (10 of 15) stated that ICT sometimes provide opportunities for individualised instruction. Romrell, Kidder and Wood (2014) and Wu, Hwang, Su and Huang (2012) support this personalised form of instruction. This confirmed that ICT's ability influenced mobile technology acceptance.

ICT attitude

There is a tie between the number of participants when answering a statement about frustration and ICT. The tie is between participants choosing "never" and "sometimes" (seven participants each) with only one participant stating that he/she is always frustrated when using ICT in the classroom. Frustration with ICT is often coupled with ICT ability and determines the use of technology (Nunan & Wong, 2005). However, it is not indicated in the data if the teachers that have ICT anxiety are the same teachers that have poor ICT ability. Six of 15 participants stated that they sometimes had positive experiences with ICT in their classrooms. This was closely followed by "always" (five of 15) and "never" (four of 15). Anderson, Barksdale and Hite (2005) and Tondeur, Kershaw, Vanderlinde and Van Braak (2013) support the viewpoint that positive experiences of ICT are dependent on several factors that are necessary for 21st-century teaching. Most of the participants (seven of 15) stated that they previously always had positive experiences with computers. This was closely followed by "sometimes" having positive experiences (six of 15).

The self-efficacy of a teacher is often determined by their past experiences in computers which in turn will result in their use of technology (Albion, 2001; Sang et al., 2010). Six of 15 stated that they only sometimes felt that they were trained well enough to use a variety of ICT tools when teaching. Surprisingly, five of the 15 participants responded that they never felt trained well enough. This may be explained by the findings of Y Lee and Lee (2014) and Liu et al. (2015) that teachers may receive training however the training does not

provide the opportunity to apply the knowledge nor are the courses consistent in terms of content. Ally, Grimus and Ebner (2014) explain that training needs to include formal and informal instruction, mentoring, opportunities for collaboration and teamwork, ongoing support, online courses, constructive feedback and flexibility with regards to time and place of training sessions that need to be frequent. This confirmed that teachers' ICT ability influenced their willingness to use mobile technology.

Perceived usefulness
All of the participants except one, agreed that mobile technology made teaching and learning more interesting. These findings are similar to those of Mac Callum et al. (2014) and Venkatesh, Morris, Davis and Davis (2003). The majority of participants (12 of 15) agreed that they see mobile learning as a way of encouraging more interaction between teachers and learners, as also supported by the studies of Haddad and Draxler (2002) and Nias (1989). Most of the participants (13 of 15) agreed that they saw mobile learning as a way to improve student learning as it allowed students to access learning content at any time and place. The importance of this was emphasised by Derakhshan and Khodabakhshzadeh (2011) and Rajasingham (2011). The majority of participants (11 of 15) agreed that they saw mobile learning as a way to enhance and encourage their students' self-directed learning as also supported by K Lee, Tsai, Chai and Koh (2014) that found that if teachers found technology useful, they were more inclined to use it.

Perceived ease of use
Most participants (10 of 15) disagreed that they would be anxious about having to use their mobile device to support their teaching. Teo, Lee and Chai (2008) argue that anxiety is one of the greatest factors that impact on the perceived ease of use of technology. There is a tie across all categories for the statement that it might take a while to get comfortable with using a mobile device for teaching, a necessity for teachers to use technology more frequently as supported by Chuttur (2009) and Summey (2013). The majority of the participants (nine of 15) believed that they would find it easy to use a mobile device to support their teaching. Teachers needed to believe that technology would support their teaching, and this belief is shaped by their perception of how easy it is to use (Mac Callum et al., 2014). Eight of 15 participants felt that they had the knowledge necessary to implement and use mobile technology in their teaching. Similarly, teachers that show consistency in their own professional development often have the confidence and knowledge to implement technology in their teaching (Crosswell

& Beutel, 2017; Mansfield, Beltman, Broadley & Weatherby-Fell, 2016). Eight of 15 participants were not anxious about having to use their mobile devices to support their teaching, suggesting that these teachers were not reluctant to use technology to teach (McClure, 2011). Therefore, teachers who find technology easy to use, will likely use it.

Online Questionnaire
The teachers' perceptions of technology use were further investigated using an online questionnaire. For this article, only sections 2 and 3 from the online questionnaire are reported on as they contribute to the contents of this article. The findings of the impact of ICT attitude, ICT anxiety and ICT ability were confirmed and categorised as factors that influence the perceived ease of use of technology. Three new factors that impact on the perceived usefulness of technology were identified. These factors were facilitating conditions, subjective norm and voluntariness. These three factors were also recommended for research by Joo, Park and Lim (2018). A summarised discussion of the three new factors is given below.

Facilitating conditions
The aspect of facilitating conditions, defined as the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system, was investigated (Teo & Milutinovic, 2015). This was highlighted by Makoe (2013) in the literature study, and we found that this would be an important aspect to investigate as it might impact the participant's technology use.

Nikou and Economides (2017) and Teo and Milutinovic (2015) found that facilitating conditions impact on the perceived usefulness and perceived ease of use of technology. This was a new factor that originated from classifying the results of the responses received.

Subjective norm
The subjective norm was investigated as we found that during the workshop the participants were influenced by their colleagues. The subjective norm is defined as a person's perception that most people who are important to him/her have opinions whether he/she should or should not perform the behaviour in question (Teo & Milutinovic, 2015).

This suggests that the teachers felt that they had the support available if they needed assistance with using technology. Studies show that the subjective norm has a significant influence on the perceived usefulness of technology (Motaghian, Hassanzadeh & Moghadam, 2013; Teo, 2011; Teo & Milutinovic, 2015). This was a new factor that originated from classifying the results obtained. Teachers are further motivated by their learners to use technology if they believe that their learners are

benefitting from it, as supported by the work of Okumuş et al. (2016). This confirms that teachers are influenced to use technology by others, such as colleagues and learners.

Voluntariness

Voluntariness was another aspect investigated as we reported that teachers were keen to use technology at the onset of the study and their willingness to try and learn how to implement technology held some value as to how well they would use it (Surendran, 2012). Voluntariness is defined as the extent to which potential adopters perceived the adoption decision to be non-mandatory.

This suggests that teachers were willing to use technology to teach. Surendran (2012) found that technology acceptance needed to be voluntary. Teachers need to be willing and must want to use technology to teach. This was a new factor that originated from classifying the results attained. Section 3 of the questionnaire confirmed the findings in the online questionnaire. For this article, only four of the graphs will be presented as they contribute to the content of the article.
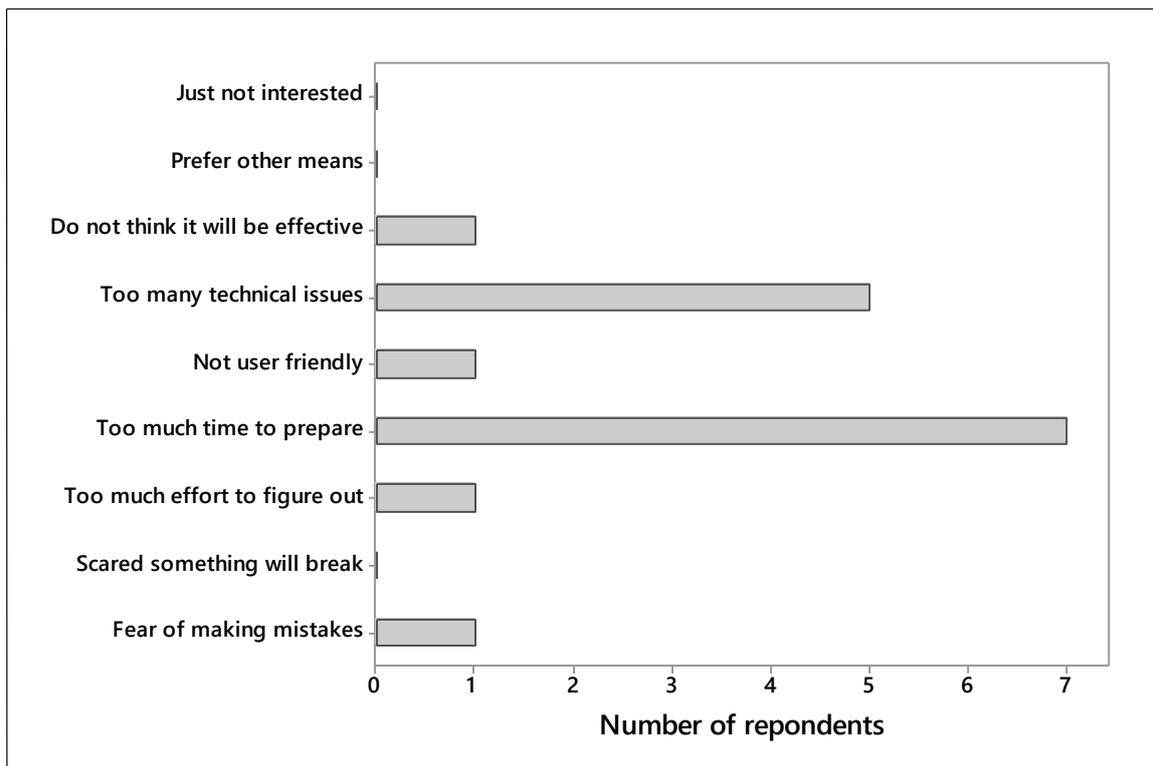
Figure 2 Factors preventing teachers from using specific technology

Figure 2 illustrates that most teachers found that time pressure and technical issues were the leading causes preventing them from using technology to teach. This lends itself to facilitating conditions of high workloads and poor technical support that compromises the teacher's willingness to use technology. Fear of making mistakes can be seen as participants experiencing anxiety. If participants regard the use of technology as too much effort to figure out, it suggests that their attitude is negative towards technology use. Participants that do not find technology to be effective do not perceive technology to be useful. If the participants do not find the technology to be user-friendly, they do not perceive it to be easy to use. Similar findings were generated by Nunan and Wong (2005). It is again confirmed that ICT anxiety influences mobile technology use.
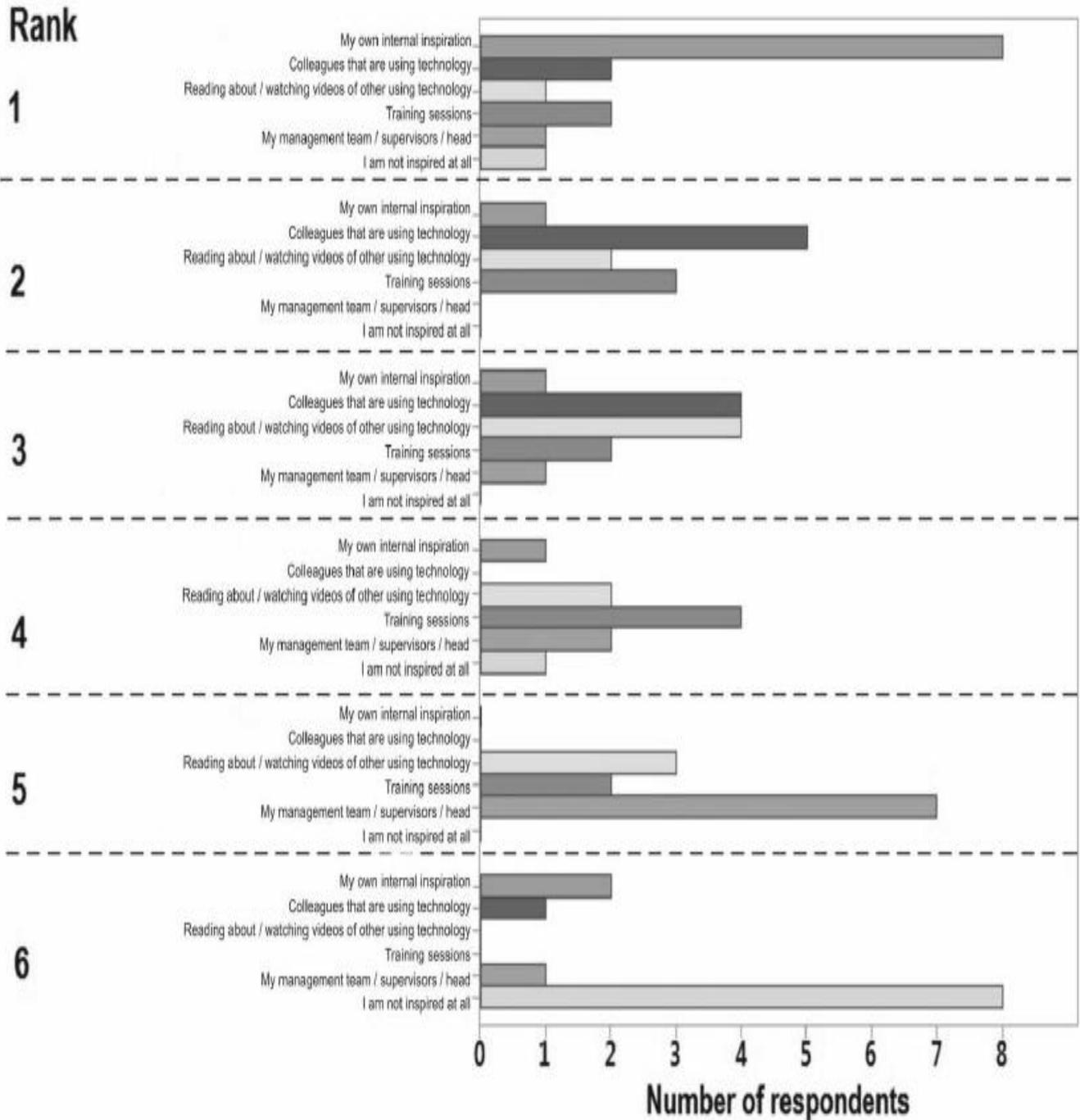
Figure 3 Inspiration to teach with technology

Figure 3 shows that teachers' own internal inspiration encourages them to teach with technology. This suggests that teaching with technology is voluntary. Interestingly, teachers find colleagues who use technology to teach as inspiring, suggesting the subjective norm that if others find it important, they should consider using technology. This highlights the level of support required for implementation as mentioned by Blignaut, Hinostroza, Els and Brun (2010) and Summey (2013). Therefore, ICT attitude and voluntariness influence the use of mobile technology.
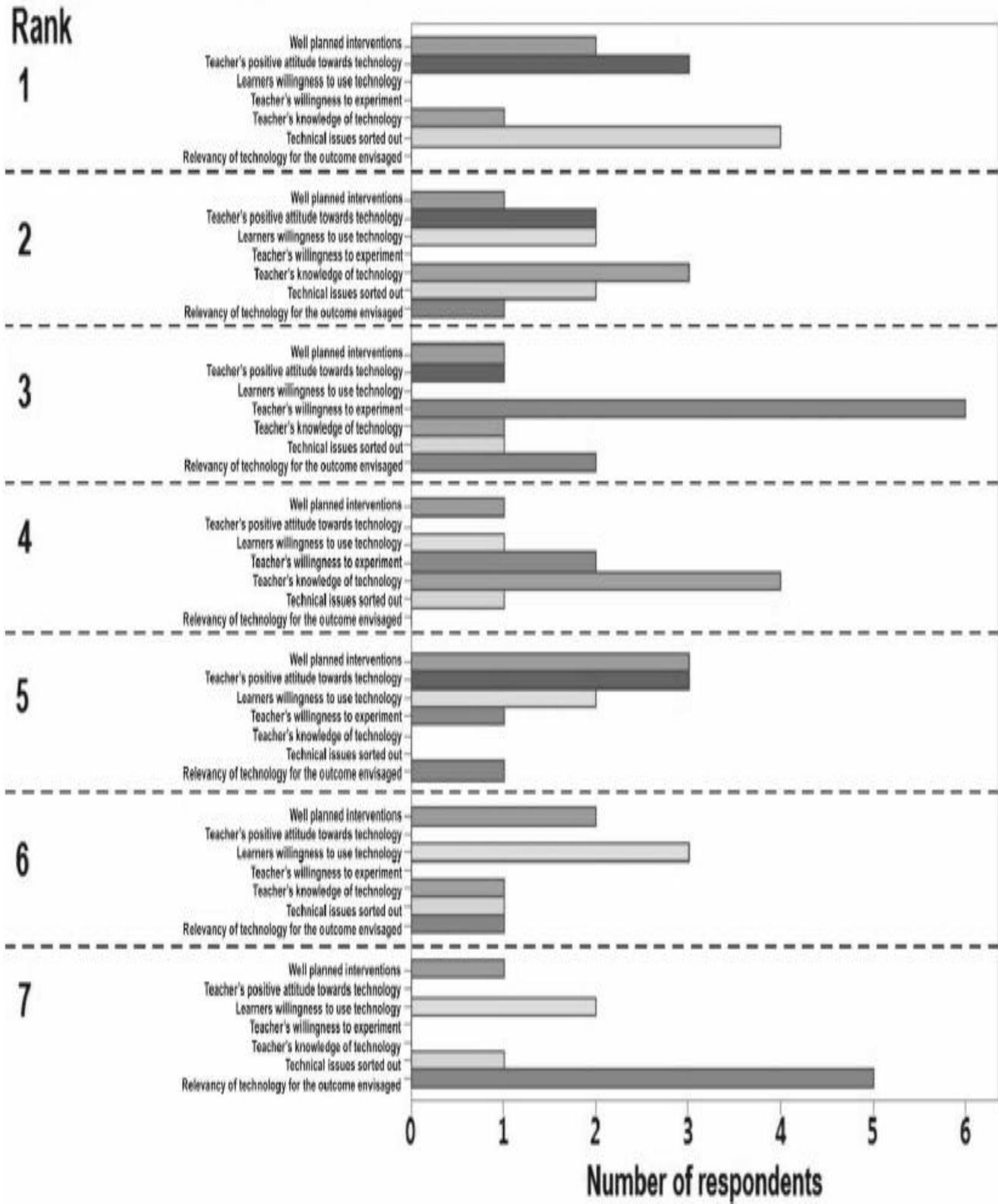
Figure 4 Aspects impacting most of the success of the use of technology

The following observations can be made from Figure 4. Teachers found that technical issues and a positive attitude impacted the use of technology. Interestingly, teachers' knowledge of technology and their willingness to experiment were also ranked very high. This suggests that teachers need to have sufficient technical knowledge to want to experiment, and a positive attitude may bring about

more technology use. This is supported by the findings of Cinque (2013) and confirms that if facilitating conditions are conducive, teachers are more likely to have a positive attitude towards using mobile technology.
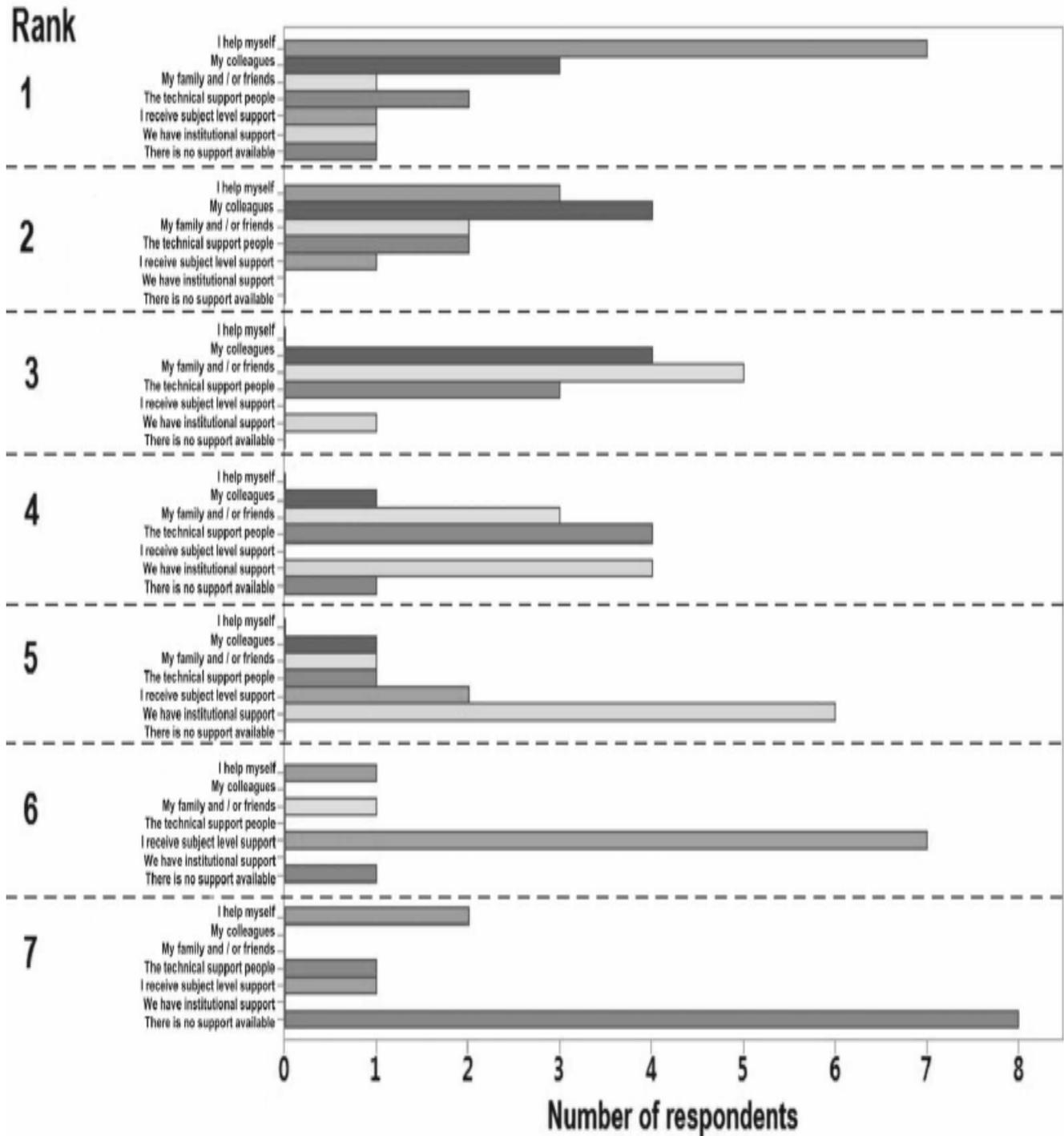

Figure 5 Available support to work with technology

Several observations can be made from Figure 5. Teachers rank helping themselves as the highest priority, then colleagues and family. It is interesting to see that institutional support, subject level support and technical support are ranked very low. This suggests that teachers take it upon themselves to use technology, suggesting voluntariness, but that support in terms of facilitating conditions is poor. It further suggests that teachers must hold a positive attitude towards technology use and must find it useful to want to use it.

Focus Group Discussions

The focus group discussions allowed the teachers to express their feelings, concerns and perceptions while trying to implement technology use. This was necessary to identify whether their perceptions had changed since they started implementing mobile technology. Carol mentioned "control" to be one of the leading factors that prevented technology use. She claimed that "*... people who are more comfortable possibly and they are using it, have implemented already, and then it's kinda happening organically.*" Fred discussed how his teaching and his attitude towards technology use has changed.

> *I had PowerPoints for everything, I've got everything and that's what I used to be quite comfortable with ..., and I've moved away from that and I'm very excited about it, so where ever in terms of my attitude towards it is it's quite positive. So I took to it like fish to water and the boys have responded really ... really well.*

Fred elaborates further on how he uses technology to prepare his learners for the manner in which questions will be asked. His response highlights the perceived usefulness of technology and the preparation involved in teaching with technology. It also expresses the voluntary nature of wanting to teach with technology.

> *Ja, if you start with the outcome, I promise you if you say that's what you gonna be asked ..., this is exactly what you gonna be examined on then they know to work towards that goal, I used to just do content, and then sho ..., when they hit the exam and then they don't really know how it's gonna asked, what the skills are needed, I've started the other side, that's not really technology, that's just ..., pedagogy ... .*

Liam mentions "control" again as a resistant factor. His response shows the anxiety to use technology in the fear of losing control in the classroom. While he understands the usefulness of technology, he chooses not to use it. This suggests an involuntariness towards technology use.

> *I haven't necessarily done too many interactive things with them on their devices, just because I think there's more control if I just use my device, with all the problems like they can't log on and that, then this and this, takes a lot of time trying to sort out all those things.*

Further discussions highlighted various aspects that contributed to the six factors that prevented technology acceptance.

Discussion

The data obtained from the questionnaires and focus group discussions are summarised and illustrated in Figure 6. It was found that for successful technology use to be implemented, teachers needed to find the technology useful and easy to use. Usefulness and ease of use depended on six factors that emerged from the research. Words that were associated with these factors are depicted in Figure 6. It was found that teachers' attitudes toward technology use, ability to use technology and anxiety in using technology determined their perceptions of ease of use of technology. Facilitating conditions need to be catered for, support in terms of the subjective norm and a voluntariness from the teachers themselves determine their perceived usefulness of technology. These findings are similar to those of Al-Emran et al. (2018) in their review of 87 articles on "Technology Acceptance in M-learning context." However, the review focused mainly on learner acceptance of mobile learning and did not focus on teacher acceptance during implementation.
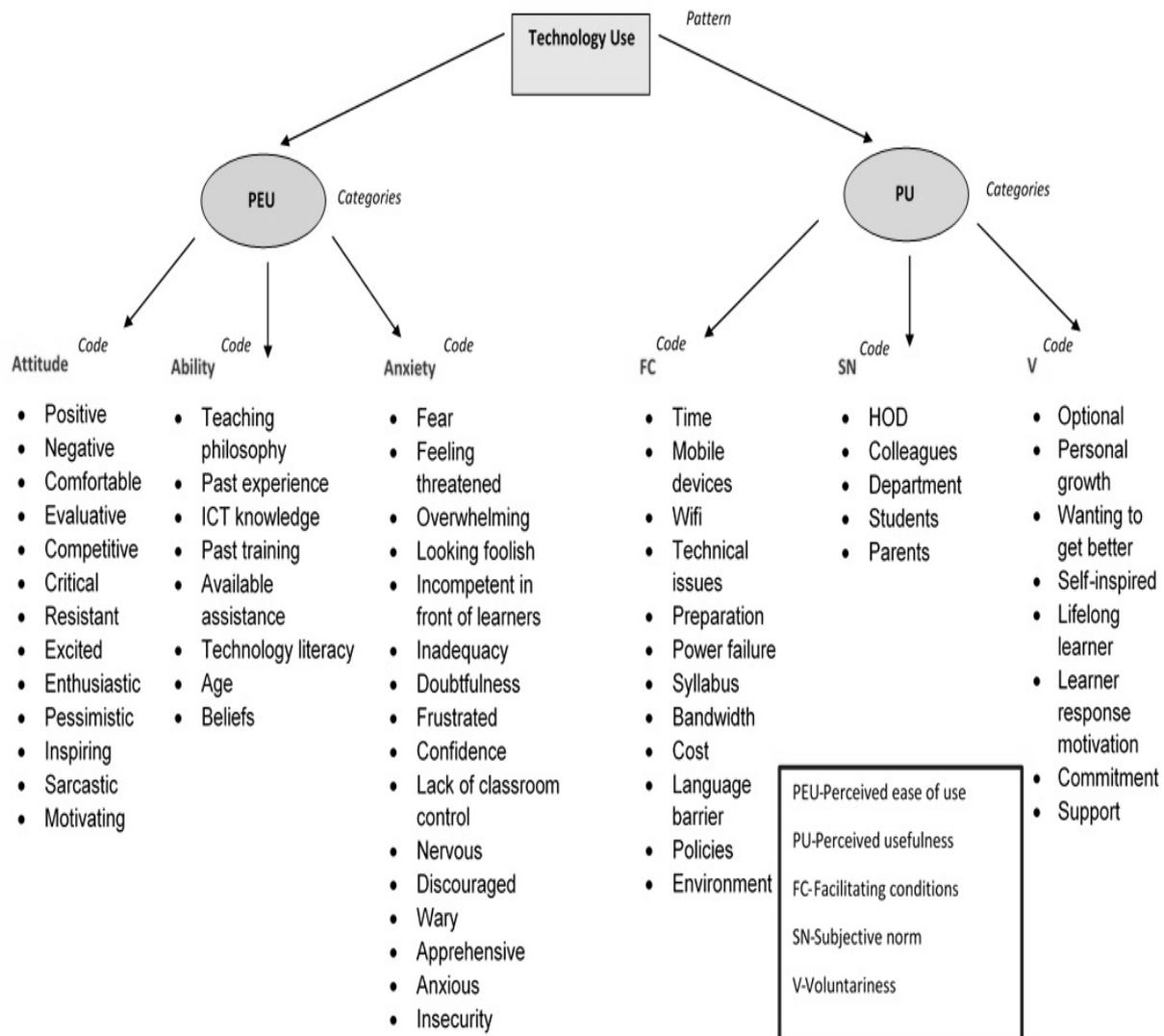
Figure 6 Aspects that contribute to factors that affect mobile technology acceptance

Findings from this study reveal that for teachers' acceptance of technology to improve, many underlying issues need to be addressed. Primarily, teachers need to have a personal desire to want to change their teaching approach (Surendran, 2012) and be open to the use of technology and the challenges it may bring at the outset. Teachers need to aspire to improve their classroom practice. Support and commitment from those around them are necessary as teachers become easily demotivated if surrounded by negative colleagues (Teo & Milutinovic, 2015). This shows the need for a holistic shift towards technology acceptance in schools. Facilitating conditions are a crucial aspect because the complexity of changing one's teaching philosophy and creating that change in identity requires considerable support (Nikou & Economides, 2017). The on-going development process requires teachers to be very patient with themselves and to

be continuously self-reflective and determined. Challenges such as Wi-Fi access, time, language barriers and variety in mobile devices are not easily overcome and have an immediate influence on the perceived usefulness of the technology.

Teachers who have positive attitudes towards technology use are generally more determined and willing to experiment and try new things. However, if they suffer from technology anxiety, they are reluctant to use technology as they fear losing classroom control and being perceived as incompetent in front of learners. Technology anxiety often works hand-in-hand with technological ability as many teachers that have a low technology ability often have high technology anxiety. However, in some instances, teachers with high technological ability opt not to use technology because even though they find it easy to use, the facilitation of a technology-based lesson can be complex and cumbersome.

Conclusion

Teachers' perceptions and experiences of mobile technology are shaped by the manner in which they use it. An implementation process needs continuous support and commitment not only from the teacher but the school as a collective entity. In this study, all six factors identified the needs to be addressed simultaneously. Technology acceptance is firstly a personal choice and embracing the affordances of mobile technology cannot be imposed on in-service teachers.

For this reason, facilitating a paradigm shift and identity change among teachers requires careful planning and assistance that is specific to each individual. This is necessary to not compromise the teacher's self-efficacy, and to promote professional growth and development that will successfully impact on teacher education and education in general. The complexity of such a shift in teaching requires a collective initiative from all role players. An active collaborative effort is likely to influence technology acceptance as teachers overcome challenges and reflect on their practice while continuously monitoring their progress and assessing which methods work best for them. Learning communities provide the platform for this to occur. This study contributes to the holistic understanding of the integration and implementation process of mobile technology acceptance for teachers by providing a comprehensive schematic of the factors that enhance mobile technology acceptance.

Continuous support, infrastructure building and professional development are still a major concern. The alignment of policy to practice needs more attention. Professional development seems to be the core need as this study shows that if infrastructure and resources are available, teachers are more willing to adapt their teaching methods. By eliminating the sub-factors associated with the teacher, the potential to inspire a change in professional teacher technical identity development can be expected. For this reason, teachers need continuous guidance and support from mentors and colleagues. The action-reflection sessions provide a platform for capacity building among teachers. This will promote the smooth implementation of mobile technology through integration. The findings of this study are relevant to any country where mobile learning is an emerging economic resource.

Authors' Contribution

The manuscript was written by Kimera Moodley as part of a PhD dissertation that was supervised by Petronella Callaghan and William J. Fraser. The statistical analysis was done by Marien Graham. All the authors reviewed the manuscript.

Notes

i. Mobile-led and Leading Via Mobile
ii. Mobile Learning Network
iii. Mobile Learning
iv. Information Communication and Technology for Rural Education Development
v. This article is based on the doctoral thesis of Kimera Moodley.
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