INDIVIDUAL DIFFERENCES IN EMERGING TECHNOLOGY ENABLED INNOVATIVE PEDAGOGICAL PRACTICES: A LITERATURE REVIEW

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Abstract

The paper investigates the influence of individual differences on emerging-technology enabled innovative pedagogical practices amongst schools in a developing world context, particularly South Africa. In South Africa, poor quality education has led to a vast skills gap. Subjects such as Mathematics and Science that are drivers of technological innovation and critical thinking are under-performed with a lack of foundational competencies. Inability to address the skills shortage problem can have a crippling effect on the economic growth of the country. To ensure a competitive work force, major remedial efforts are required so as to improve the quality of education. Although emerging technologies (ETs) have potential to improve teaching and learning processes, second-order barriers such as teacher individual differences can hinder the effective adoption and use of ETs for teaching and learning. There is however little information on how individual differences of teachers affects the use of ETs for teaching and learning. Through a review of models for the successful integration of ICT into schools curricula, the study derives a framework that allows for the identification of how individual differences of teachers influence the integration of emerging technologies in pedagogical practices.

Research question and key words

How do teacher individual differences influence the use of emerging technologies in innovative pedagogical practices?

Key words: *ICT Access, ICT Integration, ICT in Education, emerging technologies, pedagogical innovations, individual differences.*

1 Introduction

There remains a disconnection between curriculum design and the skill requirements of working professionals. As a result learners matriculate with inadequate skills to meet the demands of the 21st century tasks force. In South Africa, poor quality education has led to a vast skills gap with a lack of skilled expertise to fill employment vacancies in the work force (Mateus, Iwu, & Allen-Ile, 2014). The Department of Basic Education (DBE) attributes the lack of competitive skills to poor learner performances of core subjects. Subjects like Mathematics and Science (Mateus et al., 2014), that are drivers of technological innovation and critical thinking, are under-performed with a lack of foundational competencies. Inability to address the skills shortage problem can have a crippling effect on the economic growth of the country. To ensure a competitive work force there are calls to steer pedagogies away from traditional to more innovative ones (Veletsianos, 2013; Ng'ambi & Bozalek 2013). Emerging technologies are enablers of innovative pedagogical practices.

1.1   Emerging technologies

Emerging technologies are tools, ideas and technological innovations used to enhance the teaching and learning process (Veletsianos, 2013). Due to its transformative nature, emerging technologies are effective tools that engage learners in critical tasks. Emerging technologies enable anytime and anywhere learning, as well as synchronous and asynchronous communication. They support collaborative, self-directed, lifelong and distance learning, enabling learners to effectively participate in the knowledge economy (Dede, 1996). Technologies are considered emerging due to their context and not necessarily their newness. For example, technologies such as geographical information systems (GIS) may be considered as emerging (coming into being) in the teaching of geography, whilst it has already been established in real estate and agricultural industries (Doering & Veletsianos, 2008). Also, when considering the school context, it is possible for technologies to be emerging in one school and established within another school. For example, an interactive whiteboards may be commonly used to aid the teaching and learning practices in schools in the United Kingdom (Hall & Higgins, 2005; Kennewell & Beauchamp, 2007). However due to its disadvantaged state, under-resourced schools in South African may not have access to this tool. Benefits of emerging technologies namely podcasts, blogs and e-books, are that they are effective tools that support the teaching and learning process. Starting with podcasts, these technologies provide effective, portable and affordable ways for developing and delivering content. Blogs on the other hand, can be used to support the teaching and learning process by providing a way for learners to study and develop their writing and cognitive skills. E-books present learners with the opportunity to access critical subject contents online.

1.2   Innovation and new pedagogical Practices

Innovative pedagogical practices can be better defined through concepts such as innovation and pedagogical practices.

1.2.1   Innovation

In education, innovation can be defined as the process of steering away from traditional pedagogical practices (Levine, 1997). An innovative activity involves the implementation of a new or an acquired idea. Although innovation can refer to a new idea, device or method, the concept of newness is dependant on the perception of the innovator (Rogers, 2010). An innovator within the educational setting is the first instructor to incorporate emerging technologies in their teaching and learning processes (Surry & Land, 2000) Here innovation can be considered as the process of bringing a new problem solving idea to use (Rogers, 2010). In a more practical sense innovation is concerned with the progression from the conception of a new idea to a solution to the problem and then to the actual use of the new idea or item that is of a socio-economic value.

1.2.2   Pedagogical practices

Pedagogy as an instructional theory is the art of teaching or education. It is primarily concerned with the role of the instructor, which is to systematically develop conceptual knowledge and manage learning activities within the educational setting (Mishra & Koehler, 2006). Pedagogical practices refer to the tasks, methods, beliefs, ideas and activities that a teacher instructs a learner to carry out within an educational setting (Raymond, 1997). Pedagogical practices that are innovative provide new ways of using and creating knowledge (Kampylis, Bocconi, & Punie, 2012). These practices are developed through interaction with innovative activities (Owston, 2007). Pedagogical innovations can be carried out with or without technology. With the current emerging information society, first world countries have recognized the need to transform schools' curricula from traditional to innovative and creative, so as to remain at the forefront of the global economy. Alongside the need for innovative and creative skills in the

work place, traditional educational environments, which lack computer-facilitated aspects, are not effective in preparing learners to be productive in the work environment. Technology facilitated innovative pedagogical practices are considered as key in equipping learners to effectively participate in the information age (Yelland, 2006). For the goals of innovative pedagogical practices to be realized, they need to be supported by the necessary pedagogical changes (e.g. practices, values and infrastructure) at both institutional and individual levels. In other words, technology needs to be at the forefront of the innovative goals. An emerging technology is seen as a tool that is key in aiding the creation of innovative pedagogical practices (Redecker, Ala-Mutka, & Punie, 2010). It provides teachers and learners with new ways of dealing with tasks, such as, data gathering in the field. It changes the nature of an activity and encourages innovative thinking and sense making. Emerging technology-enabled pedagogical innovations refer to novel approaches to using ICT to create information and knowledge as oppose to reinforcing traditional teaching practices (Bocconi, Kampylis, & Punie, 2013).

Although emerging technologies have great potential to improve teaching and learning processes, a lack of skilled teachers and training means that they are often neglected and not used to their full potential. Despite the widespread adoption of Information and Communication Technology (ICT), since 1990, ICT has failed to have a significant impact on the teaching and learning process (Collis & Wende, 2002; Zemsky & Massy, 2004). With efforts by the South African government to ensure universal access to ICT, studies indicate the status of ICT deployment into schools and its integration into schools' curricula in South Africa is far from favourable (Koranteng, 2012; Mlitwa & Koranteng, 2013; Nonyane & Mlitwa, 2008). In essence focus of ICT implementation goals seems to be solely on physical deployment and not on how to successfully integrate ICT into schools' curricula. Although world governments and policy decision makers recognize the importance of ICT in education, efforts to integrate it into schools curricula are often inhibited by barriers to implementation.

Condie & Munro (2007), indicates that second-order barriers such as individual differences can hinder the effective adoption and use of ICT as well as the diffusion of new pedagogical practices. Individual differences of teachers (i.e. gender, income, age, level of education and skills) influence their innovative usage of emerging technologies to create new pedagogical practices (Buabeng-Andoh, 2012). There is however little information on how teacher individual differences affect their usage of emerging technology to create new pedagogical practices (Inan & Lowther, 2010). In addition few studies focus on how individual differences influence their adoption and use of emerging technologies in the teaching and learning process.

The assertions in the study stem from:
- Buabeng-Andoh (2012), who advocates for *"an understanding of personal characteristics that influence teachers' adoption and integration of ICT into teaching is relevant"*.
- Ng'ambi & Bozalek (2013), who advocates for clear guidelines to aid in transforming the use of emerging technologies among educator in order to create innovative pedagogical practices.
- Batchelor (2011), who advocate for the *"exploration of how individual teachers at the subject area level within a particular school environment, can further organisational change through emerging technologies in their practices"*

A clarification of the key concepts is provided in Table 1.

Table 1: Clarification of concepts

ICT	In this study, Information Communication Technology (ICT) refers to any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. For example, personal computers, digital television, email, robots (Howie, 2005).
Computer-based programs	Specific software to deliver some or all aspects of a course within a curriculum. Examples include a Master Maths, Cami Maths programs.
Integration	Implies the alignment of educational technologies with pedagogy and their usage to enhance learning and teaching (Cashman *et al*., 2004)
Curriculum	A Curriculum entails the philosophy, the content, the approach and the assessment of the programme of learning (Harvey, 2004).
ICT literacy	Refers to learners, teachers, managers and administrators having the knowledge, skills and support needed to integrate ICT in teaching and learning (DoE, 2003)
ICT Access	Availability of ICT and computer-based programs specifically for teaching and learning.
Individual Differences	Factors that influencing the use of ICT including: gender, income, age, level of education and skills (World Bank, 1998).
Innovative Pedagogical Practices	ICT-enabled pedagogical innovations within the context of the study refer to novel approaches to using ICT to create information and knowledge as oppose to reinforcing traditional teaching practices (bocconi, kampylis, & punie, 2013)
Emerging Technologies	An emerging technology is a device, idea and technology-based innovation that can enhance the teaching and learning process (Veletsianos, 2013). Technologies are considered emerging due to their context and not necessarily their newness.

2   Methodology and data sources

The research methodology selected was to survey the relevant literature, analyse it and to formulate a general framework for the integration of ICT into schools curricula. The research paradigm selected for this study is interpretivism. The interpretive paradigm is selected to help provide an in-depth understanding of the micro level factors affecting the successful integration of emerging technologies into teaching and learning processes (Walsham, 1995).

The review concentrated on research findings published or cited in Education Resource Information Centre (Eric), Institute of Electrical and Electronics Engineers (IEEE), Proquest and Sage. These databases were selected as a representative of the core literature indexes in the areas of ICT in education. The key search terms used were:
- Educational technologies,
- Emerging technologies for teaching and learning,
- Innovative pedagogical practices and,
- Existing ICT integration into school curricula frameworks.

From the 100 journal papers reviewed 37 articles were selected based on the inclusion and exclusion method. The reason for inclusion of the 37 articles in the paper is due to their relevance to the study and scope. The articles selected cover the key search terms namely educational technology, emerging technologies for teaching and learning, innovative pedagogical practices and existing ICT integration into school curricula frameworks

Data for the study was gained from literature and policy documents. The e-schools initiative policy documents produced by the government department of education as well as local school policies was used to gain insight into the status of the deployment of ICT into schools and its integration into the teaching and learning process.

3   Discussion

The study seeks to answer the question of how teacher individual differences influence use of emerging technologies in innovative pedagogical practices? To answer the research question the study draws on literature in order to derive frameworks that best explain the influence of individual differences on emerging technology-enabled innovative pedagogical practices. The theory based design framework, technology pedagogical and content knowledge (TPACK) as well as individual differences concepts are explored in the following section.

3.1   Use of emerging technologies to create innovative pedagogical practices

With pedagogical practices needing to be transformed from traditional to more innovative, usage of emerging technologies alone cannot ensure the achievement of innovative pedagogical practices. Therefore teachers require clear guidelines to aid towards achieving the goals of innovative pedagogical practices (Bates & Sangra, 2011; Ng'ambi, Gachago, Ivala, Bozalek, & Watters, 2012). In effect, Dabbagh (2005) postulates a theory-based design framework which consists of three interrelated components working together to create meaningful learning interactions. These components include;
*   The pedagogical models (e.g. demonstrating teaching with emerging technologies within knowledge building communities),
*   The instructional and learning strategies (i.e. focus on the practices of blogging podcasting and writing collaboratively), and
*   Pedagogical tools (i.e. demonstrating affordances of technologies such as blogs, podcasts, wikis).

Dabbagh (2005), posits that an increase in access to technologies creates new opportunities for technologies to be used. This results in new pedagogical practices being continuously transformed.

An adaptation of the theory-based design framework is provided in Figure 1
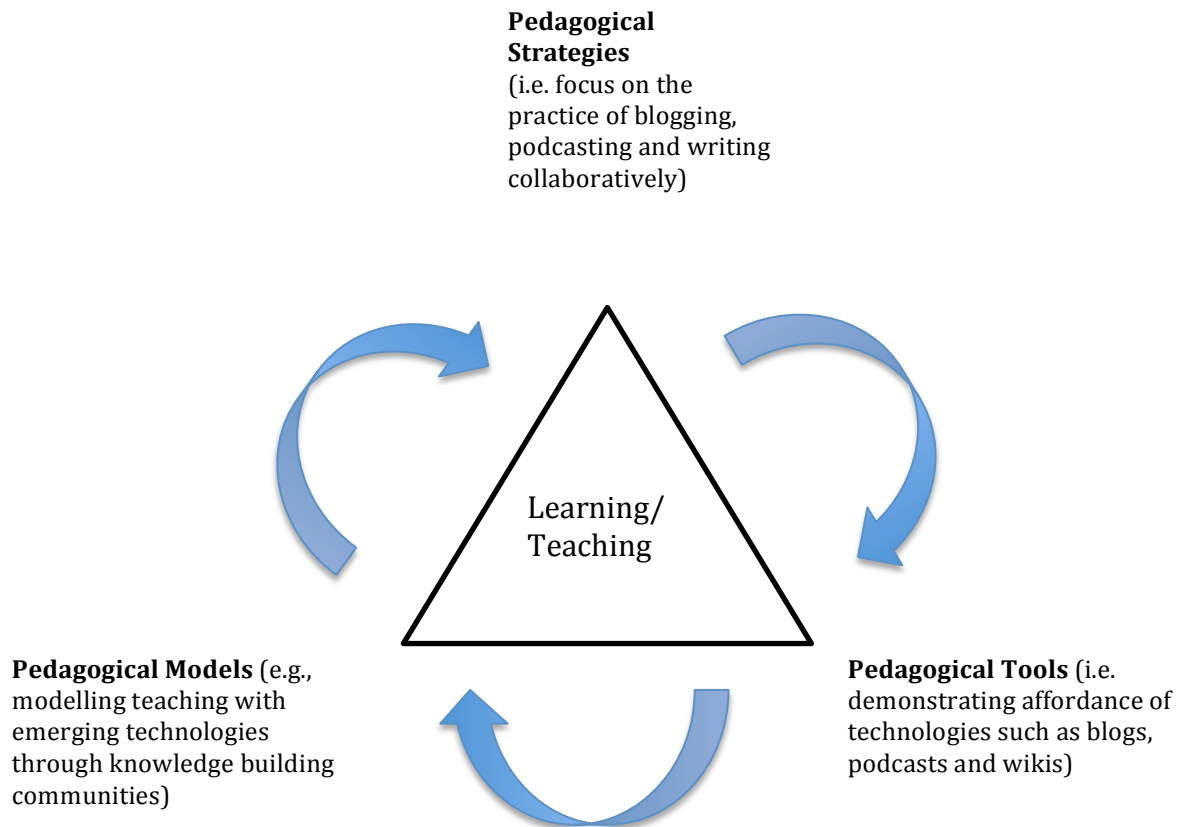
Pedagogical Strategies (i.e. focus on the practice of blogging, podcasting and writing collaboratively)

Pedagogical Models (e.g., modelling teaching with emerging technologies through knowledge building communities)

Pedagogical Tools (i.e. demonstrating affordance of technologies such as blogs, podcasts and wikis)

Learning/ Teaching

Figure 1: Adaptation of Theory-based Design Framework (Dabbagh, 2005)

The first key component in the theory-based design framework Figure 1, is pedagogical models. Pedagogical models are theoretical constructs that are built from knowledge acquisition models derived from learning theories. They provide the link between theory and practices. Pedagogical models result in pedagogical strategies, which is the second key component of the theory-based design framework for teaching and learning. Pedagogical strategies refer to the approaches used by instructors to facilitate the teaching and learning process. In essence, the goal of the instructor is to develop a learning environment that promotes collaborative learning, learner independence, problem solving, creative and critical thinking skills. The third key component of the theory-based design framework is pedagogical tools. Pedagogical tools such as asynchronous and synchronous communication tools, multimedia tools, learning management tools (LMS) aid the teaching and learning processes by enabling; anytime, anywhere learning, collaborative learning, information searches, simplification of difficult concepts.

3.2   Effective teaching with technology

The technology pedagogical and content knowledge (TPACK) is a framework that seeks to aid effective teaching with technology. It can be used to explain how teachers understand educational technologies and pedagogical content knowledge (PCK). The framework consists of three interrelated components. These are based on teacher's knowledge namely; content, pedagogy and technology

knowledge. Equally important to the model, are the interactions between and among the bodies of knowledge, represented as PCK, technological content knowledge (TCK), technological pedagogical knowledge (TPK) and TPACK.
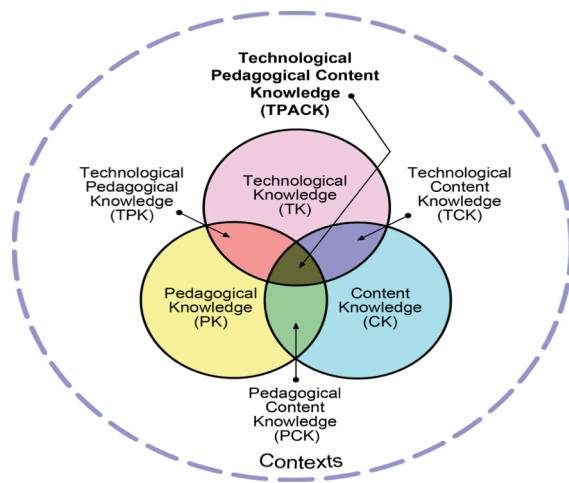

Figure 2: The TPACK framework and its knowledge components (Dabbagh, 2005; Ng'ambi & Bozalek, 2013)

The components of the TPACK framework Figure 2, are further explained below:

- **Content knowledge**
The content knowledge refers to educator's knowledge about the subject to be taught. This knowledge includes concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof as well as established practices and approaches toward developing such knowledge (Graham, 2011) .

- **Pedagogical knowledge**

Pedagogical knowledge (PK) refers to educators' understanding of the factors involved in carrying out teaching and learning processes and practice (Harris & Hofer, 2011). These factors include general classroom management skills, lesson planning and student assessment. It is also concerned with knowledge about techniques or methods used in the classroom. It seeks to understand the attributes concerning the learner. These include the cognitive capacities and strategies that can be used to assess a learners' understanding of the subject content. In essence, the goal of pedagogical knowledge is to ensure that teachers understand how students create knowledge and develop skills. How they develop good learning habits and positive attitudes towards learning (Harris & Hofer, 2011).

- **Pedagogical content knowledge**

Pedagogical content knowledge (PCK) refers to the instructional theories that are specific to content. PCK is based on the central idea of the transformative power of individual teachers as they present, modify and customize instructional material according to their interpretation of the subject matter (Abbitt, 2011).

- **Technology knowledge**

With technology enabled teaching and learning practices, educators are expected to have at the least basic computer literacy skills in order to integrate ICT into the schools' curricula. Technology Knowledge, advocates that basic computer literacy alone is not adequate and that ICT skills should transcend beyond the traditional idea of computer literacy to a broader understanding of information technology (Koehler & Mishra, 2009).

- **Technological content knowledge**

With ICT enabled educational practices, the choice of technology influences (affords or constrain) the type of content ideas that can be taught (Sahin, 2011). Similarly, decisions on the subject content can limit the types of technologies that can be used. As a result teachers need to master the subject content in which they teach. Therefore, technology and content knowledge (TCK) signifies the understanding of the relationship between technology and content and how they influence and restrict one another. It is the understanding of how teaching and learning can change when particular technologies are used in particular ways. It requires one to know pedagogical affordances and constraints of a range of technological tools as they relate to disciplinary and developmentally appropriate pedagogical designs and strategies. Understanding the impact of technology on the practices and knowledge of a given discipline is critical to developing appropriate technological tools for educational purposes (Archambault & Crippen, 2009).

- **Technology pedagogical knowledge**

Due to their transformative nature, certain technologies can alter the teaching and learning process. Technology pedagogical knowledge (TPK), is concerned with understanding how technologies change the classroom practices. It also seeks to understand the pedagogical affordances and constraints of a range of technological tools in developing appropriate pedagogical designs and technologies. Understanding the impact of technology on the practices and knowledge of a given discipline is critical to developing appropriate technological tools for educational purposes (Niess et al., 2009).

- **Technology, pedagogy and content knowledge**

Technological pedagogical content knowledge (TPACK) consists of components namely pedagogy, content, technology and knowledge. It refers to the understanding that arises from the interaction among these components. It is the basis of effective teaching with technology.

3.3 Influence of individual differences on emerging technology-enabled innovative pedagogical practices: framework

Second-order barriers such as individual characteristics (e.g. age, gender, skills) and the inability of individuals to choose a life of value (in this case creating new pedagogical practices) can hinder the successful realization of innovative pedagogical practices. This coupled with difficulties in the high demands of innovative activities can discourage educators from being innovative and creative in their pedagogical practices. A factor that demotivates teachers from being innovative and creative is that teachers are often excluded in the decision-making processes in that they are not given a voice to inform pedagogical practices. This results in teachers lacking the motivation to be creative and innovative. In addition educational environments tend to be inflexible and discourage risk-taking this further discourages the integration of emerging technologies to create new pedagogical practices.

To support teacher innovative pedagogical practices, teachers can be included in the decisions through a diffusion of the decision-making of instruction, curricula and organizational structure to local level.

This in turn, allows new ideas and practices to be generated and diffused from the bottom-up. Furthermore policy and decision makers should create adequate conditions (e.g. institutional space and incentive structures) that will encourage risk-taking and the adoption of new pedagogical approaches. A lack of guidelines and strategic coordination of the integration of emerging technologies into schools means that innovative activities commonly fail and are not able to create positive outcomes (Shapiro, Haahr, Bayer, & Boekholt, 2007; Levin & Wadmany, 2008; Hannon, 2009).

The study seeks understand the micro-level factors affecting the use of emerging technologies for teaching and learning. Literature was reviewed to answer the key research question of how do teacher individual differences influence emerging technology-enabled innovative pedagogical practices? Figure 3, provides a framework for understanding the influence of individual differences on emerging technology-enabled innovative pedagogical practices. The study draws on the TPACK, theory-based design frameworks as well as concepts from individual differences frameworks.
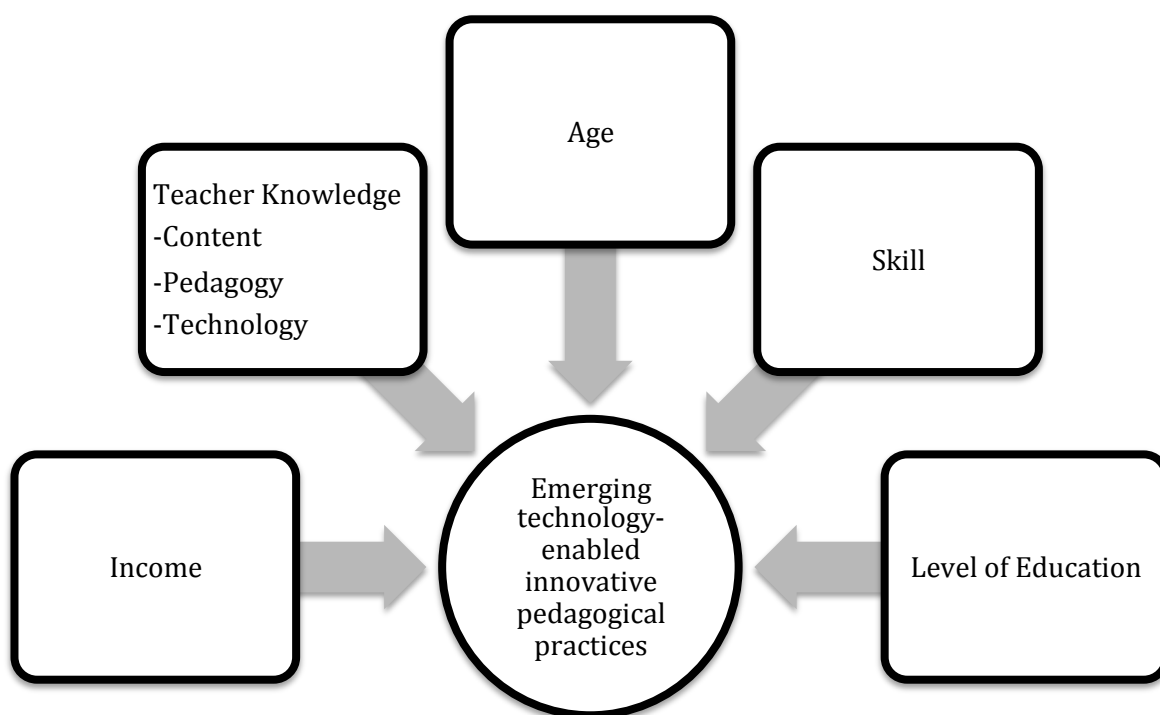

Figure 3: Framework for understanding the influence of individual differences on emerging technology-enabled innovative pedagogical practices.

Figure 3 provides a framework for understanding the influence of individual differences in emerging technology-enabled innovative pedagogical practices. According to Figure 3, individual differences such as; age, skill, income, level of education and technology knowledge influence the use of emerging technologies to create innovative pedagogical practices. Emerging technologies are considered as disruptive technologies that have the ability transform teaching and learning practices and enable innovative pedagogical practices. Due to its transformative nature clear guidelines are required on how to achieve innovative pedagogical practices with emerging technologies (Chai, Koh, & Tsai, 2013). The theory-based design framework consists of three interrelated components working together to create meaningful learning interactions. These interrelated components include:

- Pedagogical models (e.g. demonstrating teaching with emerging technologies within knowledge building communities),

- The instructional and learning strategies (i.e. focus on the practices of blogging podcasting and writing collaboratively) and

- Pedagogical tools (i.e. demonstrating affordances of technologies such as blogs, podcasts, wikis).

Along with the theory-based analytical framework that describe the three interrelated components that work together to create meaningful learning the TPACK and concepts of individual differences highlight the individual level factors that influence emerging technology-enabled innovative pedagogical practices.

- **Teacher knowledge**

Teacher knowledge namely content, pedagogy and technology, influences how teachers understand educational technologies and pedagogical content knowledge (PCK). There exist interactions between and among these bodies of knowledge, represented as PCK, technological content knowledge (TCK), technological pedagogical knowledge (TPK) and TPACK.

- **Individual differences**

Factors that influence the use of emerging technologies (ET) include: gender, income, age, level of education and skills (World Bank, 1998).
Due to its impact, social and cultural contexts such as gender play a role in ET use. For example, there exists a history of gender inequalities, with women lacking equal access to quality education, certain job areas as well as access to ETs. In essence, women are often marginalized with regards to gaining equal rights to social citizenship mostly because of the discrepancy in the responsibilities they have within the household context (Lister, 2008). Effects of these inequalities can also be seen in the access to ETs facilities with men mostly having more opportunities than women.
Similarly, level of income plays a role in the access to and use of ETs. For example schools in disadvantaged communities lack ETs due to financial limitations. Here although ET aids much efficiency to the teaching and learning processes especially in instances whereby a lack of skilled teachers exists, a lack of finances means that subjects will have little to no computer facilitated aspects. Education and skills level also influence the adoption and use of ETs. Teachers that are given specialized training on how to use complex educational software are more likely to integrate ET into their teaching and learning processes. Since the idea of integration of emerging technologies is a fairly new concept older teachers may not be motivated to keep informed about new technologies that are emerging as opposed to their younger counterparts who are more computer savvy. Therefore, age is also a factor in ET usage. Due to its disadvantaged state, adoption and use of ETs in the teaching and learning process is generally slow in the rural areas. This is a result of a lack of infrastructure, telecommunication, classrooms and etc. Therefore social contexts play a role in the usage of ETs.

4   Conclusion

This study is a literature review of how individual differences influence the use of emerging technologies in innovative pedagogical practices. Selection of the articles is based on teaching and learning technologies. The articles are selected to aid in understanding how individual teacher differences influence the integration of emerging technologies into schools' curricular. A limitation in the study is that since the topic is multidisciplinary field one cannot generalize the findings to a more specialized field such as education. To address this limitation literature was reviewed from databases that were relevant to the field of study. 100 articles were reviewed and out of these, 37 were chosen based on their relevance to the study. After reviewing the literature on the status of the integration of emerging technologies in the teaching and learning process it was found that there is a need to address the discrepancies in the integration of emerging technologies into teaching and learning processes. Existing frameworks that address the integration of emerging technologies into the teaching and

learning do not factor the individual differences of teaching in using emerging technologies to improve teaching and learning practices. The study adds to a body of knowledge by proposing a framework for understanding the influence of individual differences on emerging technology-enabled innovative pedagogical practices, which draws on the Technological pedagogical content knowledge (TPACK), theory-based design framework and concepts from individual differences.

For future research a case studies will provide a good basis to validate the framework (Figure 3). One can also implement the framework (Figure 3) in schools within disadvantaged and advantaged communities in South Africa so as to identify how economic factors influence the successful integration of emerging technologies into schools' curricula.

5   Reference

Abbitt, J. T. (2011). Measuring technological pedagogical content knowledge in preservice teacher education: A review of current methods and instruments. *Journal of Research on Technology in Education, 43*(4), 281-300.

Archambault, L., & Crippen, K. (2009). Examining TPACK among K-12 online distance educators in the united states. *Contemporary Issues in Technology and Teacher Education, 9*(1), 71-88.

Bates, A. T., & Sangra, A. (2011). *Managing technology in higher education: Strategies for transforming teaching and learning* Jossey-Bass.

Bocconi, S., Kampylis, P., & Punie, Y. (2013). Framing ICT‐enabled innovation for learning: The case of one‐to‐one learning initiatives in europe. *European Journal of Education, 48*(1), 113-130.

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education & Development using Information & Communication Technology, 8*(1)

Chai, C. S., Koh, J. H. L., & Tsai, C. (2013). A review of technological pedagogical content knowledge. *Educational Technology & Society, 16*(2), 31-51.

Collis, B., & Wende, M. (2002). Models of technology and change in higher education: An international comparative survey on the current and future use of ICT in higher education.

Dabbagh, N. (2005). Pedagogical models for E-learning: A theory-based design framework. *International Journal of Technology in Teaching and Learning, 1*(1), 25-44.

Dede, C. (1996). The evolution of distance education: Emerging technologies and distributed learning. *American Journal of Distance Education, 10*(2), 4-36.

Doering, A., & Veletsianos, G. (2008). Hybrid online education: Identifying integration models using adventure learning. *Journal of Research on Technology in Education, 41*(1)

Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education, 57*(3), 1953-1960.

Hall, I., & Higgins, S. (2005). Primary school students' perceptions of interactive whiteboards. *Journal of Computer Assisted Learning, 21*(2), 102-117.

Hannon, J. (2009). Breaking down online teaching: Innovation and resistance. *Australasian Journal of Educational Technology, 25*(1), 14-29.

Harris, J. B., & Hofer, M. J. (2011). Technological pedagogical content knowledge (TPACK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research on Technology in Education, 43*(3), 211-229.

Inan, F. A., & Lowther, D. L. (2010). Factors affecting technology integration in K-12 classrooms: A path model. *Educational Technology Research and Development, 58*(2), 137-154.

Kampylis, P., Bocconi, S., & Punie, Y. (2012). Towards a mapping framework of ICT-enabled innovation for learning. *European Commission Joint Research Centre Institute for Prospective Technological Studies (Http://Ftp.Jrc.Es/EURdoc/JRC72277.Pdf),*

Kennewell, S., & Beauchamp, G. (2007). The features of interactive whiteboards and their influence on learning. *Learning, Media and Technology, 32*(3), 227-241.

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

Koranteng, K. (2012). *Access and use of Information and Communication Technology for Teaching and Learning Amongst Schools in Under Resourced Communities in the Western Cape, South Africa,*

Levin, T., & Wadmany, R. (2008). Teachers' views on factors affecting effective integration of information technology in the classroom: Developmental scenery. *Journal of Technology and Teacher Education, 16*(2), 233-263.

Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature, ,* 688-726.

Lister, R. (2008). Inclusive citizenship, gender and poverty: Some implications for education for citizenship. *Citizenship Teaching and Learning, 4*(1), 3-19.

Mateus, A. D., Iwu, C. G., & Allen-Ile, C. (2014). Skills shortage in south africa: Perspectives from high school educators. *Anthropologist, 18*(2), 491-504.

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

Mlitwa, N. W., & Koranteng, K. (2013). Integration of ICT onto curricula in the western cape schools: The activity theory perspective. *The Journal of Community Informatics, 9*(4)

Ng'ambi, D., Gachago, D., Ivala, E., Bozalek, V., & Watters, K. (2012). Emerging technologies in south african higher education institutions: Towards a teaching and learning practice framework. *Proceedings of the 7th International Conference on E-Learning,* 354-362.

Ng'ambi, D., & Bozalek, V. (2013). Editorial: Emerging technologies and changing learning/teaching practices. *British Journal of Educational Technology, 44*(4), 531-535.

Niess, M. L., Ronau, R. N., Shafer, K. G., Driskell, S. O., Harper, S. R., Johnston, C., . . . Kersaint, G. (2009). Mathematics teacher TPACK standards and development model. *Contemporary Issues in Technology and Teacher Education, 9*(1), 4-24.

Nonyane, J., & Mlitwa, N. (2008). ICT access and use in rural schools in south africa: A case study in mpumalanga province. *Section 1: IS, ICT & E-Commerce, E-Health, E-Learning, 1*, 94-104.

Owston, R. (2007). Contextual factors that sustain innovative pedagogical practice using technology: An international study. *Journal of Educational Change, 8*(1), 61-77.

Raymond, A. M. (1997). Inconsistency between a beginning elementary school teacher's mathematics beliefs and teaching practice. *Journal for Research in Mathematics Education, ,* 550-576.

Redecker, C., Ala-Mutka, K., & Punie, Y. (2010). Learning 2.0-the impact of social media on learning in europe. *Policy Brief.JRC Scientific and Technical Report.EUR JRC56958 EN, Available from: Http://Bit.Ly/Cljlpq [Accessed 6 Th February 2011],*

Sahin, I. (2011). Development of survey of technological pedagogical and content knowledge (TPACK). *Turkish Online Journal of Educational Technology-TOJET, 10*(1), 97-105.

Shapiro, H., Haahr, J. H., Bayer, I., & Boekholt, P. (2007). Background paper on innovation and education. *Prepared for the European Commission, DG Education and Culture, Tech.Rep,*

Surry, D. W., & Land, S. M. (2000). Strategies for motivating higher education faculty to use technology. *Innovations in Education and Teaching International, 37*(2), 145-153.

Veletsianos, G. (2013). Open practices and identity: Evidence from researchers and educators' social media participation. *British Journal of Educational Technology, 44*(4), 639-651. doi:10.1111/bjet.12052

Walsham, G. (1995). Interpretive case studies in IS research: Nature and method. *European Journal of Information Systems, 4*(2), 74-81.

Yelland, N. (2006). *Shift to the future: Rethinking learning with new technologies in education* Routledge.

Zemsky, R., & Massy, W. F. (2004). Thwarted innovation. *What Happened to E-Learning and Why, A Final Report for the Weather Station Project of the Learning Alliance at the University of Pennsylvania in Cooperation with the Thomson Corporation, Pennsylvania,*