Transforming teaching with emerging technologies: Implications for higher education institutions

V. Bozalek

University of the Western Cape, Cape Town, South Africa.
E-mail: vbozalek@uwc.ac.za

D. Ng'ambi

University of Cape Town, Cape Town, South Africa.
E-mail: Dick.Ngambi@uct.ac.za

D. Gachago

Cape Peninsular University of Technology, Cape Town, South Africa.
E-mail: gachagod@cput.ac.za

Abstract

A gulf is widening between the technologies used by students, those used by educators and those provided by institutions. However, knowledge about the impact of so-called emerging technologies on learning or the readiness of higher education institutions (HEIs) to engage with such technologies in the South African context is relatively thin. This article uses Rogers' (2003) diffusion of innovations model as a conceptual framework to examine the diffusion, adoption and appropriation of emerging technologies in South African HEIs. We report on a survey which examined how emerging technologies are used in innovative pedagogical practices to transform teaching and learning across South African HEIs. The article concludes that, in order to foster a greater uptake or more institution-wide diffusion of use of emerging technologies, institutional opinion leaders need to purposefully create an enabling environment by giving recognition to and communicating with change agents, and developing policies that will encourage institutional-wide engagement with emerging technologies.

Keywords: emerging technologies, higher education institutions, teaching and learning, higher education policy, enhancement, diffusion of innovations

INTRODUCTION

South African higher education is currently facing challenges posed by a diverse student population with varied levels of preparedness, multilingualism, large classes,

and massification of education, and is further under pressure to increase throughput against a backdrop of limited resources (Jaffer, Ng'ambi and Czerniewicz 2007; Scott, Yeld and Hendry 2007). At the same time curricula have to be aligned to meet the constant changes in employers' expectations in a 21st century workplace, which calls for improved preparedness of students with what has been termed 21st century skills (Becta 2008; Johnson et al. 2011) and digital citizenship (Johnson and Adam 2011).

Responding to these challenges, while maintaining quality of throughput, requires a rethink of curriculum and delivery. Higher education institutions (HEIs) have been responding to this with a number of different strategies, such as extended curriculum programmes, re-curricularisation and multilingual policies (Boughey 2002; Garraway 2009; McKenna 2004). The integration of technology into the curriculum has been seen as another way of responding to these challenges, often applied as an overly-optimistic remedy resulting in large institutional infrastructure projects, such as the implementation of resource intensive institutional Learning Management Systems (LMS) in all HEIs in South Africa (Ivala 2011; Snowball and Mostert 2010; Snyder and Prinsloo 2007).

The results and uptake of these technologies have been varied (Chigona and Dagado 2011). One of the main critiques of the implementation of these technologies is that they have fallen short of delivering on the promise of transforming existing teaching and learning practices (Kirkup and Kirkwood 2005; Margaryan and Littlejohn 2011). However, international research points to the fact that there are new, cost-effective technologies – that have been attributed with a disruptive nature, but which students are using competently and creatively – with the potential to positively transform existing teaching and learning practices (Johnson et al. 2011; Meyer 2010). Examples of such technologies are social network sites (e.g. Facebook), or micro-blogging applications (e.g. Twittter).

This article argues that these technologies could have a significant positive impact on teaching and learning practices, particularly in contexts characterised by diversity, as they offer opportunities for more personalised learning and teaching experiences. The use of emerging technologies in higher education, for example, provides opportunities for students to practise writing, with the added benefit of developing an appreciation for the audience they are writing for (Helvie-Mason 2011; Jones 2011). Furthermore, the ease of use that emerging technologies such as Twitter and Facebook afford, makes these methods of engagement an accessible option for both students and staff (Wankel 2011). Social media can offer opportunities for collaboration, co-creation, learning and interaction, thus contributing to improved teaching and learning (Dede 2009; Greenhow, Robelia and Hughes 2009; Helvie-Mason 2011; Jones 2011; Pang 2009; Wankel 2011). Of particular importance in the context of the current study is that they can increase students' access to social learning networks (Ng'ambi and Rambe 2008); bridge informal and formal learning (Rambe and Ng'ambi 2011); and support students with difficulties in learning in a language different from their mother tongue (Ng'ambi 2008).

These innovative practices are currently happening on a small-scale basis; are mostly initiated by individual lecturers or students; and are not widespread. To improve diffusion on a wider scale, we contend that institutions need to actively engage with these technologies. Our thesis is that appropriate recognition of individual innovators, and encouraging the sharing and dissemination of experiences with peers would open up dialogue amongst these practitioners in the institution; increase uptake by a wider community; lead to changes in policies and norms; and create a culture of innovative practices of teaching/learning with emerging technologies.

The research questions guiding the current study, therefore, were:
1. What role can emerging technologies play in addressing the challenges facing HEIs in South Africa?
2. Is it important for HEIs to engage with these technologies?
3. What are the implications for HEIs regarding the adoption of emerging technologies for enhancing teaching and learning?

In the next section we review relevant literature, and provide a conceptual framework to guide the study.

LITERATURE REVIEW

The use of emerging technologies is on the rise in the higher education sector worldwide. More and more lecturers, sometimes prompted by their students, are using technologies, such as Facebook, which their students use in their social lives, for informal and formal learning. What are emerging technologies? One of the most cited definitions of emerging technologies is found in the yearly Horizon reports and defines emerging technologies as those technologies which are 'likely to have a large impact on teaching, learning, or creative inquiry on college and university campuses within the next five years' (Johnson et al. 2011, 3). Emerging technologies allow an individualised, flexible and differentiated focus on learning needs and pedagogy (Bates and Sangrà 2011) and provide a more learner-controlled rather than teacher-controlled 'one-size-fits-all' approach (Johnson and Adams 2011). Social media provide opportunities for collaboration, co-creation, learning and interaction, thus contributing to improved teaching and learning. These affordances have also been noted in other studies (Dede 2009; Greenhow, Robelia and Hughes 2009; Helvie-Mason 2011; Jones, 2011; Pang 2009; Wankel 2011).

Current Horizon reports, such as the Technology Outlook for UK Tertiary Education 2011–2016, the NMC Horizon Report 2011, Global Edition, and the 2010 NMC Horizon Report, Australian-New Zealand Edition, serve as useful dashboard indicators of technologies most likely to enter mainstream education in the next five years (see Figure 1).

Short List Topics Across Three NMC Horizon Projects

Technology Outlook for UK Tertiary Education 2011-2016	NMC Horizon Report 2011 Global Edition	2010 NMC Horizon Report Australia-New Zealand Edition
Time-to-Adoption Horizon: One Year or Less		
Cloud Computing	Cloud Computing	Cloud Computing
Mobiles	Collaborative Environments	Electronic Books
Open Content	Electronic Books	Mobiles
Tablet Computing	Mobiles	Social Networking
Time-to-Adoption Horizon: Two to Three Years		
Game-Based Learning	Augmented Reality	Augmented Reality
Learning Analytics	Game-Based Learning	Game-Based Learning
New Scholarship	Open Content	Open Content
Semantic Applications	Visual Data Analysis	Virtual Worlds
Time-to-Adoption Horizon: Four to Five Years		
Augmented Reality	Brain-Computer Interfaces	Gesture-Based Computing
Collective Intelligence	Gesture-Based Computing	Semantic Web
Smart Objects	Learning Analytics	Telepresence
Telepresence	Semantic Applications	Visual Data Analysis

Figure 1: Emerging Technologies Short List of the New Media Consortium Horizon Projects (Johnson and Adams 2011, 1)

CHATACTERISTICS OF EMERGING TECHNOLOGIES

Veletsianos (2010, 13–17) defines emerging technologies as 'tools, technologies, innovations, and advancements utilized in diverse educational settings to serve varied education-related purposes', and continues to list the following characteristics of emerging technologies: (1) they may or may not be new technologies; (2) they change rapidly so are always in a state of coming into being; (3) they go through cycles of hyped expectations; (4) they are in a continuous state of being understood and researched; and (5) they have potential for transforming social practices. The adoption of emerging technologies to enhance teaching and learning is thus dependent upon institutional resources being allocated to fund, evaluate and reward innovative pedagogical practices (Bates and Sangrà 2011).

Thus, the article is premised on the fact that HEIs cannot afford to ignore the dashboard as students are already using emerging technologies, yet the pedagogical value of emerging technologies in HEI remains unexploited. Thus, the goal of the study was to investigate how HEIs are engaging with emerging technologies to achieve their core business of teaching, research and scholarly engagement. The article is focused on the use of emerging technologies for teaching and learning.

CONCEPTUAL FRAMEWORK

In order for such pedagogical changes to have an institution-wide effect, the diffusion of emerging technologies to teaching and learning practices needs to be understood. The diffusion of innovations theory espoused by Rogers (2003, 11) provides a useful framework to unravel the role of decision makers and institutional planners in enhancing technological changes to education practices. Rogers defines diffusion as the process by which (1) an innovation, (2) is communicated through certain

channels, (3) over time, (4) among the members of a social system. Crucial to Rogers› model is the way innovation is communicated through creating and sharing innovative ideas amongst peers to achieve a common understanding and diffusing of good practice over time. Time refers to the time of adoption of an innovation by individual members of the institution, which depends on a number of personal characteristics of these members. Rogers differentiates between five categories of adopters, namely: (1) innovators; (2) early adopters; (3) early majority; (4) late majority; and (5) laggards. These categories are a continuum for managing change process in the institution and how to appropriate support. Although these essentialised categories may not be regarded as useful in the current context of inclusiveness, we did not adopt them to label lecturers, but to make sense of the quantitative data collected.

The fourth element of Rogers› (2003, 23) theory is the social system, which is defined as ‹a set of interrelated units that are engaged in joint problem solving to accomplish a common goal›. This social system is where the diffusion takes place and in the current study these are the individual HEIs in South Africa. Norms, which define expected behaviours in a social system, can be either enablers or barriers in diffusing innovation. Similarly, there are few innovators that can work as opinion leaders (on a higher level) and change agents (on a lower, more technical level) involved that can either enable or hinder the diffusion of innovation. Rogers (ibid., 26) contends that ‹the most innovative member of a system is very often perceived as a deviant from the social system and is accorded a status of low credibility by the average members of the system›. Accepting Rogers› assertion, the front runners of emerging technologies in HEIs may feel marginalised, unsupported, and unacknowledged, and this may stifle creativity and demotivate academics. Figure 2 illustrates how these elements in an HEI›s social system would interact to create such an environment.
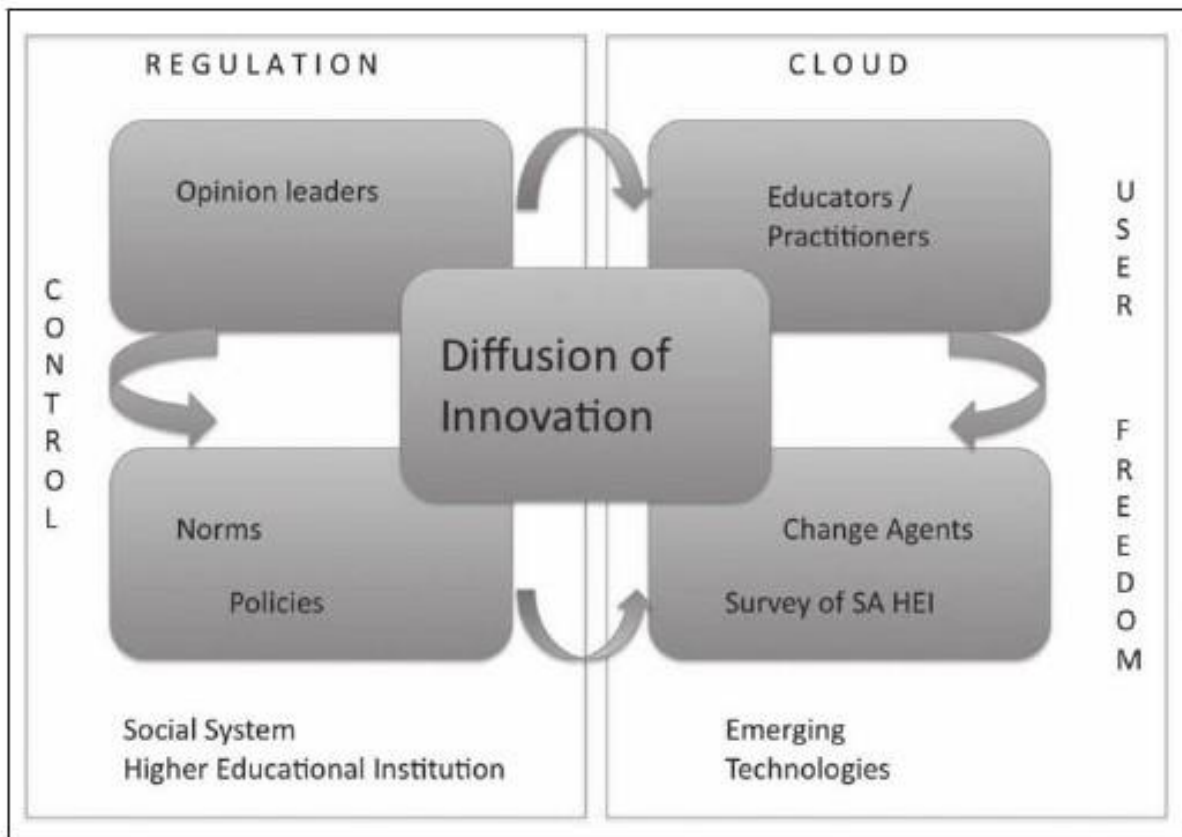
Figure 2: Framework for diffusion of Emerging Technologies in HEIs

METHODOLOGY

The data that were collated and used for the findings and are reported on in the article came from a larger study funded by the National Research Fund (NRF) which used mixed methods research (Creswell 2003; Johnson and Onwuegbuzie 2004) to investigate emerging technologies and their use in South African HEIs to improve teaching and learning in the sector. The data were drawn from a survey which was conducted between August and September 2011 to establish the use of emerging technologies by academics and support staff across South African HEIs.

Members of the research team identified possible respondents, including lecturers who were known to be using emerging technologies in their teaching and support staff involved in supporting these technologies in teaching and learning at HEIs. Directors of Teaching and Learning and senior academics at all South African HEIs were also targeted. The sample was broadened using snowball sampling.

The survey was designed to establish the ways in which emerging technologies were being used and whether such uses had any transformative effect on pedagogical practices. Questions explored usage of technologies; innovative practices with technologies; the reasons for use; the effects on teaching and learning; and the constraints and support from the institution. Quantitative data were analysed using frequencies and means. Open-ended comments were coded by two independent

researchers to establish emerging themes. The relationship between the literature review, the South African HEI survey, and implications for teaching and learning practices is illustrated in Figure 3.
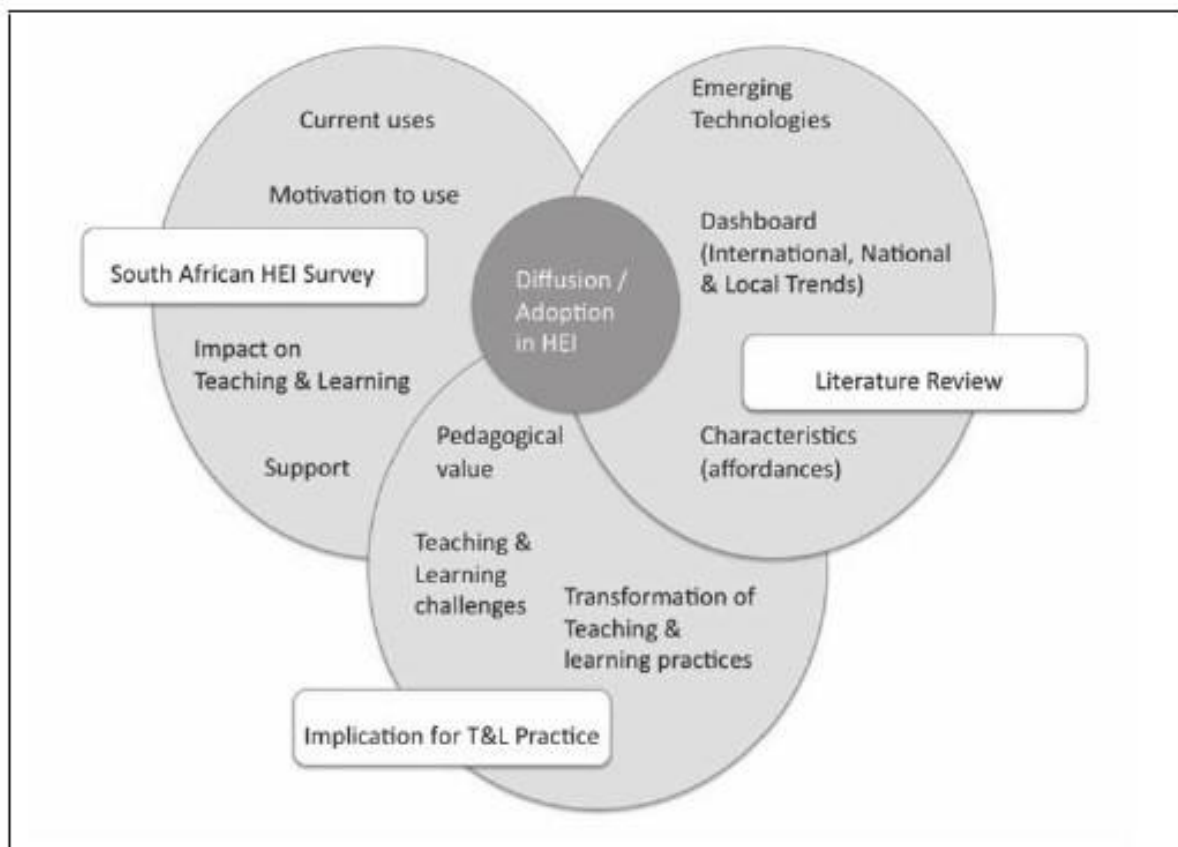

Figure 3: Inter-play between literature review, HEI survey, and the implications for teaching and learning Practices

The research project received ethical clearance from the university where the principal researcher was based.

FINDINGS

Demographic profile of respondents

The survey was submitted by 242 respondents, of whom 149 completed all three parts of the survey (62%). The majority of respondents (57%) were drawn from the four universities in the Western Cape. Table 1 shows the distribution of respondents by institution.

Table 1: Respondents by institutional affiliation

Institutional affiliation	Female	Male	(blank)	Count	Percentage
University of Stellenbosch	27	21		48	20%
University of Cape Town	24	9		33	14%
Cape Peninsula University of Technology	14	16		30	12%
University of the Western Cape	15	12		27	11%
University of Fort Hare	5	8	2	15	6%
Durban University of Technology	9	4		13	5%
Rhodes University	11	2		13	5%
Nelson Mandela Metropolitan University	6	5		11	5%
University of Johannesburg	4	5		9	4%
University of Limpopo	5	2		7	3%
University of the Free State	6			6	2%
Walter Sisulu University of Technology and Science	1	5		6	2%
Central University of Technology	1	2	1	4	2%
Mangosuthu University of Technology		4		4	2%
Vaal University of Technology	1	3		4	2%
North-West University	3			3	1%
University of South Africa	3			3	1%
Other (e.g. overseas)		2		2	1%
Tshwane University of Technology	1			1	0%
University of Pretoria		1		1	0%
University of the Witwatersrand		1		1	0%
University of Venda for Science and Technology		1		1	0%
Total	136	103	3	242	100%

CHARACTER

In terms of teaching experience, the results showed a fairly equal spread amongst respondents, with a slight inclination towards respondents with less than five years' experience (34%) (see Table 2).

Table 2: Number of years of teaching experience at higher education level of respondents

Number of years teaching experience at HEI	Female	Male	(blank)	Count	Percentage
1 - 5 years	45	28	1	74	31%
6 - 10 years	38	20		58	24%
11 - 20 years	31	34	1	66	27%
More than 20 years	16	16		32	13%
(blank)			5	5	2%
Total	134	101	7	242	100%

The majority of respondents were appointed on a lecturer level (33%) or senior lecturer level (20%). However, it is important to note that a significant number of respondents were non-academic (21%).

Table 3: Respondents by level of appointment

Level of appointment	Female	Male	(blank)	Count	Percentage
Associate Professor	11	9		20	8%
Junior lecturer	14	9	1	24	10%
Lecturer	54	25	1	80	33%
Non-Academic	29	20	1	50	21%
Professor	3	14		17	7%
Senior lecturer	25	24		49	20%
(blank)			2	2	1%
Total	136	101	5	242	100%

Respondents' use of emerging technologies

In the second part of the survey, respondents were asked about their engagement with specific emerging technologies (list populated through findings from the literature review and anecdotal evidence).

Rogers' (2003) five categories of adopters mentioned above are a continuum for managing change process in the institution and how to appropriate support. Applying Roger's diffusion of innovations curve helps to make sense of these percentages.
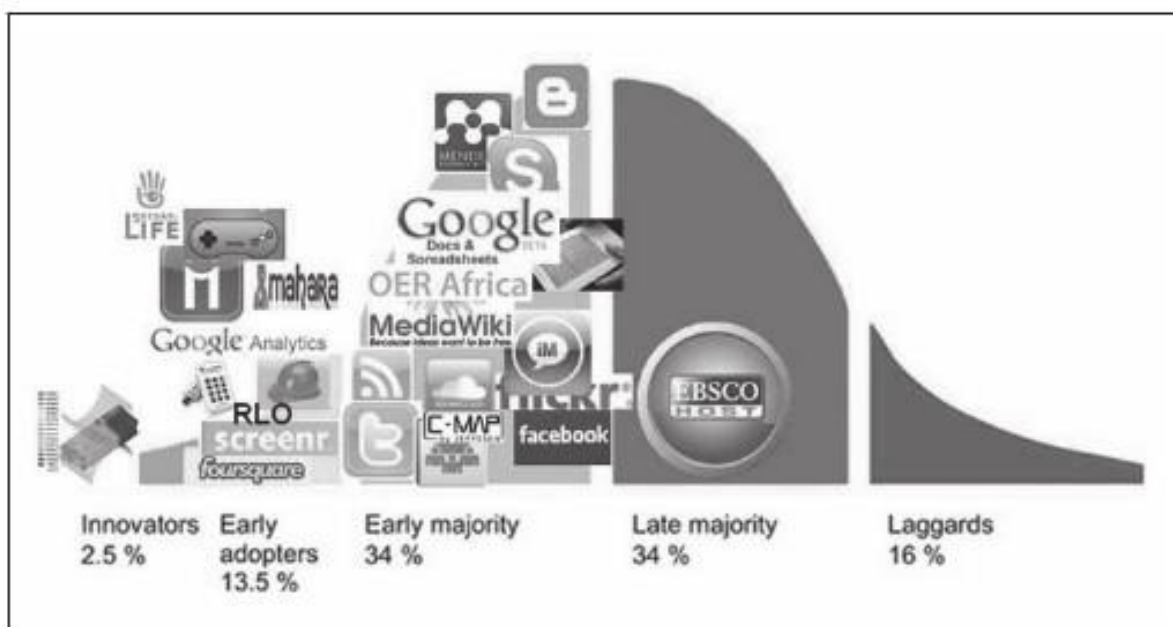
Figure 4: Adapted diffusion of innovation curve (Rogers 2003)

Figure 4 shows the following results:
• Only one of the tools or applications on the list is used regularly by a **late majority** of respondents (more than 50%: research databases).
• Quite a number of tools are however used by an **early majority** (16.5%–50% of users). These include social media, social networking, instant messaging, e-books, web based documents, blogging, bibliographic management (such as Zotero or Mendeley), Internet telephony, Open Educational Resources (OER) repositories, wikis, podcasting, RSS feeds, concept and mind mapping, multimedia production, web conferencing, micro blogging and lecture capturing.
• **Early adopters** (3%–16% of users) are starting to engage regularly with e-portfolios, learning analytics, remote instrumentation, tablet computers, reusable learning objects, screencasting, context aware environments, adaptive systems, game-based learning, social bookmarking, personal response systems, virtual worlds, augmented reality and argumentation visualisation.
• **Innovators** (less than 3% of users) have discovered modelling and simulation tools.

It is important to take note that the respondents of this survey were specifically targeted by their reputation as technology adopters and might as such not be representative of the whole academic staff population. It is also interesting to see that the technologies least used are bandwidth intensive ones, such as virtual worlds, augmented reality and argumentation visualisation.

Respondents' motivation to use emerging technologies

One of the questions in the survey asked respondents about their reasons for using emerging technologies. An analysis of the data revealed that the main motivator to engage with emerging technologies was a lecturer's personal interest and passion for technology (28%), followed by availability of the technology at the institution (23%). Only 2 per cent of lecturers felt that monetary incentives were the reason for their engagement. This is an important finding for institutions planning their engagement with these early adopters of technology. Only a few lecturers reported that their engagement with emerging technologies was prompted by their students (5%) and this does not correspond to the findings in the literature (Johnson et al. 2011). In the open-ended comments (under 'other'), the majority of comments referred to student learning: such as improving students interacting and learning from one another in a non-threatening way, exploring ways of increasing participation online or increasing student engagement in class. Table 4 summarises these findings.

Table 4: What prompted you to explore the use of this specific technology/ies? (175 Responses)

Motivation to use technologies	Count	Percent
Personal interest: I am passionate about technology	100	28%
It is available at my institution	81	23%
Institutional workshop / demonstration	36	10%
My institution requires this of me	29	8%
My colleagues had positive results using this technology	29	8%
My students demanded this	17	5%
I experienced it as a student in my studies	13	4%
Other: To improve learning	12	3%
I saw this at a conference	11	3%
I read about it in a paper	11	3%
Incentive (funding, policy)	6	2%
Other (various)	6	2%
Total	351	100%

Impact on respondents' teaching and learning

In one of the open-ended questions, respondents were asked about the impact of the use of emerging technologies on their teaching and learning. As indicated in Table 5, a small percentage of respondents mentioned a direct tangible impact as a result of using a range of the previously identified emerging technologies. However, a major finding of this study was the large number of respondents who identified a direct intangible impact. Respondents most often mentioned general improvement in interaction between students and lecturers including an improvement in feedback, engagement and a positive learning experience. One of the respondents' comments

depicted these findings as follows: 'Made things more relaxed – multiple ways of doing things – asynchronicity is crucial.'

Research on teaching and learning in higher education has shown that prompt feedback and frequent interaction between lecturers and students are core principles of good teaching and learning (Chickering and Gamson 1987; Gibbs 2006; Hounsell 2007; Junco, Heiberger and Loken 2011; Stevens and Levi 2005).

Table 5: Impact on teaching and learning

	Count	Percentage
Direct tangible impact on student learning		
Better attendance	2	2%
Better grades	6	7%
Direct intangible impact on student learning		
Better interaction/communication/feedback (incl. shy students and off campus students)	25	30%
Pos. feedback from students / enjoyment / interesting / increasing of student engagement	22	27%
Better organisation of content and course / improved access to content	6	7%
integration theory/practice	5	6%
Improved technology skills (students and staff)	7	9%
Diverse learning experience/learning styles	2	2%
Independent learning	4	5%
Indirect impact		
Research /publications for lecturer	1	1%
Cutting cost (of communication)	2	2%
Total	82	

Support

Respondents were predominantly positive about the support they received from the institution when using emerging technologies. In total, 64 comments were analysed according to perceived support and 47 (73%) of the comments were positive.

An analysis of the source of the support yielded the following:
• 19 respondents mentioned that they had received positive support from their respective units that support the use of technology in teaching and learning; 12 respondents mentioned receiving help from supportive colleagues; eight respondents received support from management (e.g. HODs or Deans); and five respondents mentioned monetary incentives, in the form of research grants, for example. Other respondents (three or less) referred to IT units, friends or the wider civil society.
• Only 11 responses were negative (17%) and focused on limited infrastructure (six comments). Four comments talked about passive or active resistance

from the institution, as the following quote shows: 'none [support], more like passive resistance'.

- Six respondents (9%) showed mixed feelings about support and mentioned some supportive elements in their institutions, but also non-supportive elements.

Again, these are interesting findings for institutions trying to strategise their support for lecturers engaged with emerging technologies and foreground the growing importance of integrating staff development units which support teaching and learning practices and those that support the use of technology.

Constraints

As indicated in Table 6, the main constraints mentioned by respondents centred on issues to do with institutional infrastructure (54%) and in particular inadequate access to the Internet and lack of equipment, such as computers or data projectors. The next area of constraint (25% of comments) concerned lecturers themselves, such as colleagues' attitudes and their resistance to change. Lack of time and challenges of managing one's time also featured in this group. Challenges focusing on students made up 22 per cent of the responses and referred mainly to students' lack of skills or motivation (especially when activities are not graded).

Table 6: Constraints when engaging with emerging technologies

Constraints	Count	Percentage
Institutional constraints		
inadequate access to the Internet	20	21%
using own equipment	5	5%
lack of equipment (computers)	15	15%
institutional systems	9	9%
lack of funding	3	3%
Total institutional constraints	52	54%
Lecturer's constraints		
lack of time/ time management	8	8%
lack of support for students / large classes	2	2%
difficulties in evaluating technology	1	1%
lack of colleagues' support due to fear of change, resistance	10	10%
time management, expectation of immediate feedback	1	1%
lecturer's skills and attitude	2	2%
Total lecturers' constraints	24	25%

Constraints	Count	Percentage
Students' constraints		
lack of skills in students	7	7%
lack of student motivation (especially if no marks allocated), mixed take up	7	7%
cost transferred to students	1	1%
students' access off campus	5	5%
plagiarism	1	1%
Total students' constraints	21	22%
Total	97	100%

DISCUSSION AND INSTITUTIONAL IMPLICATIONS

In view of the above analysis, we revisit the research questions that guided the study and reflect on the extent to which the questions have been addressed.

1. What role can emerging technologies play in addressing the challenges facing HEIs in South Africa?

The study shows that using emerging technologies is addressing the challenges of student-student, student-teacher interactions, communication in and out of class, and provision of feedback to students. It has also shown that students enjoy learning with the emerging technologies thereby enhancing student engagement.

2. Is it important for HEIs to engage with these technologies?

The engagement of institutions with emerging technologies is not an option. Students and some academics are already using the technologies to enhance their teaching and learning. However, the lack of support, incentives and a supportive infrastructure environment limits the possible widespread adoption of the technologies into the mainstream of South African higher education.

3. What are the implications for HEIs regarding the adoption of emerging technologies for enhancing teaching and learning?

The implications that adopting emerging technologies will have for South African HEIs are considered from the perspective of the following four groupings: opinion leaders, norms and policies, educators or practitioners and change agents (Rogers 2003).

Opinion leaders:
HEI managers need to take advantage of the increasingly diverse range of options provided by emerging technologies. Unless opinion leaders in HEIs acknowledge this trend and apply their minds as to how to incorporate these technologies into

14

academic programmes, they may well find their institutions being by-passed by students. This will be the case particularly as more choices become available through the possibilities of flexible learning which make it possible to study at international institutions while staying at home.

The conviction of senior HEI management is critical for the promotion of emerging technologies for transforming teaching and learning. In order for them to be convinced it may be necessary to offer them some education regarding the affordances of emerging technologies. Rather than unilaterally setting goals, opinion leaders need to adopt a collaborative approach to strategic planning and policy development together with a wide range of change agents, students and educators.

Norms and policies:

The norms of restricted use of personal technologies such as mobile devices, including tablets, which are both affordable and ubiquitous for students in the South African context, ought to change. These devices create new ways of interacting with educational resources and are likely to impact on the use of large computer laboratories and tiered lecture halls thereby impacting on cost/benefit analyses for institutions (Bates and Sangrà 2011).

Emerging technologies provide a way of responding rapidly to diverse and changing needs in that they have the potential to provide lecturers with a constant picture of where their learners are and to be more learner-created and directed. Furthermore, they could provide up-to-date information on current and changing trends in a discipline.

Educators/Practitioners:

Although there is an acknowledgement that emerging technologies are important and useful for higher educators and students across the curriculum, there has been little focus on professional development or informal training to use these technologies. The need to support both learners and academics with digital literacy skills is a crucial priority.

The use of emerging technologies will not only require a proficiency in how to use them but also an engagement with new pedagogical paradigms and approaches (Johnson and Adams 2011; Veletsianos 2010). Learning with emerging technologies is becoming increasingly collaborative enabling ecological spaces for searching, connecting, collecting and creating (Littlejohn 2011).

Change agents:

Research has shown that the impact that innovators may have on institutional culture regarding teaching and learning will remain limited unless opinion leaders support and engage with them and use their experience to change policies and practices (D'Andrea and Gosling 2005). Resources for more widespread implementation and professional development will be needed to expand pockets of good practice, with opinion leaders ensuring that change agents lead the way (Bertolo 2008).

CONCLUSION

The study set out to explore the potential of emerging technologies of positively disrupting current teaching and learning practices. The findings of the study indicate that emerging technologies do indeed have an enhancing effect on pedagogical practice, particularly with regard to prompt feedback, collaboration and interaction between educators and students. However, institutional constraints are shown to influence academics' willingness and ability to adopt emerging technologies in their practice, which has also been the case in other international contexts (Johnson and Adams 2011). In order to harness the potential that emerging technologies have for improving teaching and learning practices, HEIs would have to consciously develop governance structures and strategic plans for infusing the use of these technologies into institutional life. This would require improved communication between opinion leaders and change agents so that practices could be extended from small pockets of innovation to other educators and students in the institution. It is also important to provide recognition to innovative users of emerging technologies in order to move from innovation to embedded practice (Knight 2011).

Future research could focus more specifically on those HEIs which are not well represented in this sample in South Africa. In the next phase of our educational technologies in higher education project, we intend to focus on collecting more in-depth qualitative data regarding the institutional constraints and opportunities from the eight HEIs and the one non-governmental organisation (NGO) involved in this project, as well as case studies on innovative pedagogical practices using emerging technologies in these institutions.

REFERENCES

Bates, A. W. and A. Sangra. 2011. Managing technology in higher education: Strategies for transforming teaching and learning. San Francisco, CA: Jossey-Bass.

Becta. 2008. Emerging technologies for learning. Vol. 3. Available at: http://freeonlinebook. net/Others/5032/Emerging-Technologies-for-Learning-Volume-3-2008-FULL-REPORT (accessed 21 October 2011).

Bertolo, E. 2008. Web 2.0: Unlearned lessons from previous virtual learning environments. Bioscience Education ejournal 11 (June). Available at: www.bioscience.heacademy.ac.uk/journal/vol11/beej-11-7.pdf (accessed 22 April 2013).

Boughey, C. 2002. 'Naming' students' problems: An analysis of language-related discourses at a South African university. Teaching in Higher Education 7(3): 295–307.

Chickering, A. W. and Z. F. Gamson. 1987. Seven principles for good practice in undergraduate education. The American Association for Higher Education Bulletin. Availableat:http://www.aahea.org/bulletins/articles/sevenprinciples1987.htm (accessed 23 October 2011).

Chigona, D. and R. Dagado. 2011. Adoption and use of e-learning at tertiary level in South Africa: A qualitative analysis. Global Learn Conference, 28 March – 1 April, Melbourne.

Creswell, J. W. 2003. Research design: Qualitative, quantitative, and mixed approaches. Thousand Oaks, CA: Sage.

D'Andrea, V-M. and D. Gosling. 2005. Improving teaching and learning: A whole institution approach. Maidenhead: SRHE and Open University Press.

Dede, C. 2009. Comments on Greenhow, Robelia and Hughes: Technologies that facilitate generating knowledge and possibly wisdom. Educational Researcher 38(4): 260–263.

Garraway, J. 2009. Success of foundation (extended programmes) in engineering and sciences at CPUT. In Success stories in foundation/extended programmes, 50–52. HELTASA. Available at: http://associated.sun.ac.za/heltasa/documents/Final Book.pdf (accessed 23 October 2011).

Gibbs, G. 2006. How assessment frames student learning. In Innovative assessment in higher education, eds. C. Bryan and K. Clegg, 23–36. London and New York: Routledge.

Greenhow, C., B. Robelia and J. Hughes. 2009. Web 2.0 and classroom research: What path should we take now? Educational Researcher 38(4): 246–259.

Helvie-Mason, H. 2001. Facebook, 'friending', and faculty-student communication. In Teaching arts and science with new social media, ed. C. Wankel, 61–90. Bingley: Emerald Group.

Hounsell, D. 2007. Towards more sustainable feedback to students. In Rethinking assessment in higher education, eds. D. Boud and N. Falchikov, 101–113. London and New York: Routledge.

Ivala, E. 2011. Implementing eLearning at a university of technology in South Africa: A qualitative study. In Proceedings of the 6th International Conference on e-Learning. Okanagan, Canada: University of British Columbia Okanagan.

Jaffer, S., D. Ng'ambi and L. Czerniewicz. 2007. The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges. International Journal of Education and Development Using ICT 3(4).

Johnson, L. and S. Adams. 2011. Technology outlook for UK tertiary education 2011–2016: An NMC Horizon Report regional analysis. Austin, TX: The New Media Consortium.

Johnson, L., R. Smith, H. Willis, A. Levine and K. Haywood. 2011. The Horizon Report 2011 Edition. Austin, TX: The New Media Consortium. Available at: http://net.educause.edu/ir/library/pdf/HR2011.pdf (accessed 23 October 2011).

Johnson, R. B. and A. J. Onwuegbuzie. 2004. Mixed methods research: A research paradigm whose time has come. Educational Researcher 33(7): 14–26.

Jones, A. 2011. How Twitter saved my literature class: A case study with discussion. In

Teaching arts and science with new social media, ed. C. Wankel, 91–106. Bingley: Emerald Group.

Junco, R., G. Heiberger and E. Loken. 2011. The effect of Twitter on college student engagement and grades. Journal of Computer Assisted Learning 27(2): 119–132.

Kirkup, G. and A. Kirkwood. 2005. Information and communications technologies (ICT) in higher education teaching – a tale of gradualism rather than revolution. Learning, Media and Technology 30(2): 185–199.

Knight. S. 2011. Emerging practice in a digital age. JISC Innovation Group, Bristol University. Available at: www.jisc.ac.uk/digiemerge (accessed 21 October 2011).

Littlejohn, A. 2011. Collective learning. Presentation to Change 11 Massive Open Online Course, 5 October.

Margaryan, A. and A. Littlejohn. 2011. Are digital natives a myth or reality?: Students' use of technologies for learning. Computers & Education 56(2): 429–440.

McKenna, S. 2004. The intersection between academic literacies and student identities. South African Journal of Higher Education 18(3): 269–280.

Meyer, K. E. 2010. The role of disruptive technology in the future of higher education. EDUCAUSE Quartely 33(1). Available at: http://www.educause. edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolum/ TheRoleofDisruptiveTechnologyi/199378 (accessed 22 October 2011).

Ng'ambi, D. 2008. Podcasts for expansive learning: A case of reflective student stories. South African Computer Journal 42: 9–13.

Ng'ambi, D. and P. Rambe. 2008. Barriers to students' use of electronic resources during lectures. South African Computer Journal 42: 47–53.

Pang, L. 2009. Applying cloud computing and other Web 2.0 technologies to online and traditional classroom learning. Paper delivered at Learning Conference, 1 July, Barcelona.

Rambe, P. and D. Ng'ambi. 2011. Towards an information sharing pedagogy: A case of using Facebook in a large first year class. Informing Science: The International Journal of an Emerging Transdiscipline 14. Available at: http://www.inform.nu/Articles/Vol14/ ISJv14p061-089Rambe579.pdf (accessed 23 October 2011).

Rogers, E. M. 2003. Diffusion of innovations. 5th ed. New York: Free Press.

Scott, I. R., N. Yeld and J. Hendry. 2007. A case for improving teaching and learning in South African higher education. Higher Education Monitor 6: iii–v. Availableat:http://www.che.ac.za/documents/d000155/HE_Monitor_6_ITLS_ Oct2007.pdf (accessed 23 October 2011).

Snyder, I. and M. Prinsloo. 2007. Young people's engagement with digital literacies in marginal contexts in a globalised world. Language and Education 21(3): 171–179.

Stevens, D. and A. Levi. 2005. Introduction to rubrics: An assessment tool to save grading time, convey effective feedback and promote student learning. Sterling, VA: Stylus.

Snowball, J. and M. Mostert. 2010. Introducing a learning management system in a large first year class: Impact on lecturers and students. South African Journal for Higher Education 24(5): 818–831.

Veletsianos, G. 2010. A definition of emerging technologies for education. In Emerging technologies in distance education, ed. G. Velestianos, 1–22. Edmonton: AU Press.

Wankel, C. 2011. New dimensions of communicating with students: Introduction to teaching arts and science with new social media. In Teaching arts and science with new social media, ed. C. Wankel, 3–14. Bingley: Emerald Group.