Article

Pedagogical Factors That Affect Technology Integration at Two Universities of Technology in South Africa

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Abstract

This paper reports on a case study that was conducted at two South African universities of technology to explore the integration of technology in higher education institutions. Fourteen participants from these two institutions provided their perspectives about the pedagogical considerations that were important educational factors in the integration of technology in higher education institutions. The framework proposed by Tedre, Apiola, and Cronjé was used as a measuring tool to determine pedagogical elements that were essential in the adoption of technology. The aim of this research was to evaluate the effectiveness of the said framework as an analytical tool, and to contribute to its refinement. The central research question concerned the extent to which this framework was useful for a situational analysis at the relevant two South African universities. Although the universities' educational strategies and policies were found to be analogous, differences were identified in the manner of and approach to the implementation of educational technology. The pedagogical considerations for e-learning uptake in both universities were similar to a certain extent. The findings further showed that most of the educational factors that affected technology integration resonated with pedagogical issues experienced in other developing countries. It was concluded that students could determine the future of learning as they persistently engaged in potentially rhizomatic learning environments. This paper offers recommendations that address dramatic transformation in higher education institutions due to emerging technologies and radical changes that are experienced. The limitations of the study and suggestions for future research are also highlighted.

Keywords: pedagogical framework; technology integration; higher education;

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developing countries

Introduction

The application of information and communication technologies (ICTs) is changing the nature of the organisation and delivery of higher education worldwide (Spector 2015). As part of doing a needs analysis regarding the application of technology in higher education it is important for educational technology practitioners and developers to have a better understanding of how institutional faculties perceive and react to elements of e-learning (Koohang and Durante 2003). Zhu (2015) points out that a pedagogical framework should be employed and that this framework should be explicit in addressing the methods and techniques of best e-learning practices in higher education. A number of theories and models have been suggested for the adoption of technology (Rogers 2010; Venkatesh and Davis 2000), and some researchers have proposed critical success factors regarding the behaviour of technology users and their intention to use technology (Bhuasiri et al. 2012). In proposing a theoretical model for technology adoption, Wang and Qualls (2007) suggest some aspects to consider when rethinking challenging pedagogical issues such as training and support, limitations of devices, safety and security concerns, as well as cost. Notwithstanding the challenges, a growing number of South African universities are beginning to integrate various technology tools for a number of educational purposes, for example, to enhance teaching and to achieve efficient administration. This integration implies that the adoption of technology in universities may be a positive response to educational change (Blanchette and Kanuka 1999). Rogers (2010) points out that people are more likely to adopt an innovation if they realise the advantages of the new strategy relative to what they currently use.

As pointed out, a comprehensive framework is an essential yardstick to validate common issues influencing technology integration in a developing country context. A framework is also important to outline the complexities and dimensions of technology integration and possible adoption (Cao, Griffin, and Bai 2009). This paper reports on findings pertaining to the pedagogical issues that are necessary to consider when integrating educational technology, and the extent to which the framework developed by Tedre, Apiola, and Cronjé (2011) (hereafter also referred to as the Tedre framework) is useful in analysing the situation at two South African universities.

Problem Statement

The problem that drove this research was the lack of adequate solutions for facilitating the successful implementation of educational technology in higher education, in particular in open and distance learning (ODL). Educational technology can improve teaching and learning in higher education institutions in South Africa. Due to various factors, there is no one-size-fits-all solution for facilitating the successful implementation of educational technology. Tedre, Apiola, and Cronjé (2011) discuss a few educational, socioeconomic and technical considerations that educational

technology developers should consider. These considerations are contained in their proposed thematic pre-framework encompassing 100 attributes that are classified under 10 themes, which are based on the educational, socioeconomic and technical considerations for technology initiatives in developing countries. They conclude that since the context of each developing country differs greatly, there are no specific rough-and-ready solutions for such highly varying and complex sociotechnical systems as those frequently found in educational technology.

The current study was guided by the following two questions:

- How do the two South African universities of technology that are focused on in this study compare in terms of their technology uptake challenges and issues?

- To what extent are criteria in the Tedre framework useful in analysing the implementation of educational technology at the two relevant South African higher education institutions?

In order to answer the stated questions, a conceptual framework was used that was underpinned by 12 pre-framework variables in the Tedre framework as well as their 40 educational attributes. These variables refer to key pedagogical considerations for the integration of technology. The discussion in this paper is guided by the premise that it is useful to understand educational factors during technology integration. These factors relate to the 12 variables of the pedagogical framework defined in the Tedre framework. The research objective was to draw a comparison between the two relevant universities in terms of each pedagogical dimension of the Tedre framework. Furthermore, in order to contribute to the refinement of the framework, the research sought to evaluate the framework's effectiveness in analysing the educational situation during technology adoption at the two relevant universities of technology.

Literature Review

The literature survey done for this research was based on the initial Tedre framework, which proposes 100 attributes classified under 10 themes as important factors for technology initiatives in developing regions. The framework themes emanated from categories that were based on a broader spectrum of educational elements that needed to be considered by universities during technology adoption. As situations varied, the proposed elements addressed the educational, socioeconomic and technical contexts.

The research reported on in this paper was framed by educational (pedagogical) factors that technology practitioners might need to consider when they implemented and integrated e-learning in the context of a developing country. The research also considered how these educational elements compared between the two universities of technology, and to what extent these elements resonated with issues identified in the Tedre framework. One of the themes in the Tedre framework is named "pedagogical

framework," which consists of 12 educational factors to consider for technology integration.

Educational Factors That Influence a Pedagogical Framework

Some institutions have expanded and developed ICT-integrated programs and relevant policies; however, most of the institutions' strategic plans lack an explicit action plan to support successful ICT implementation (Muianga et al. 2013). Many universities rely on marketing specialists and product promoters to enable them to make a decision about and adopt viable educational technologies. It is important that educational technology practitioners and developers possess a better understanding of how higher education institutions perceive and react to elements of e-learning (Tedre, Apiola, and Cronjé 2011). A pedagogical framework should be explicit in addressing the e-learning methods, techniques and practices (Bates 2008) of a particular institution. Hence, the causal effect for each university is bound to be different because of its unique nature. The factors (elements) contributing towards technology integration may vary greatly between institutions, for example, between traditional universities and universities of technology. Based on the Tedre framework, this paper puts forward the following 12 elements as pedagogical issues that need to be considered in the process of technology adoption, especially in universities in typical developing environments.

Exposure to Technology

Bronack and Riedl (1998, 114) suggest that technology adoption is usually forced especially when the option of "doing nothing" is non-existent for an early adopter. Similarly there might be a forced choice between teaching techniques and methods when a faculty member is presented with an unfamiliar teaching setting and the option of "doing nothing" is absent. Many lecturers respond to pressure from technologically well-informed students to use technology to enhance teaching. The challenge might not be the exposure to technology but the implementation of suitable approaches and strategies that would result in the effective integration of the technology (Kahiigi 2012).

ICT Literacy

An inadequate infrastructure is likely to limit the students' and teachers' exposure to technology since many might have never used computers before. Some authors point out that a community with a technologically competent population often attracts new businesses and sustained investments (Önsel et al. 2008). Bates (2008) is of the view that, for both social and economic reasons, all students need computer and communications technology skills in order to survive in a knowledge-based society.

Value System

Value systems and individual behaviour can be treated as an integrated whole in an individual personality (Grunert and Jhul 1995). Different value systems emanating from

group work may affect a wide range of pedagogical elements since certain dynamics can carry over into virtual learning (Tedre, Apiola, and Cronjé 2011). Higher education institutions in South Africa are generally multicultural universities and have diverse student populations. It is, therefore, imperative for technology adoption in higher education institutions to consider the diversity of cultures and value systems.

Active and Passive Learning

Effective learning is characterised by active learning rather than passive learning, and by a student being in central control of the learning process. Instead of receiving information passively from technology, students engage actively when they use technology as a tool (Piccoli, Ahmad, and Ives 2001). This implies that students' active participation through engaging with peers, lecturers and learning content can validate some degree of learning, which may lead to students' satisfaction.

Grading Models

In South Africa, the importance of aligning assessment policies, teacher knowledge, and infrastructure in schools is emphasised (Department of Education 2003). This is a call by the government to improve the quality of education. Increasing numbers of higher education institutions are adopting grading models that provide a number of diversified assessment tools and methods (Cassady and Gridley 2005). Although many online assessment tool options exist, adequate tools to administer e-portfolio (online) assessments and grading remain very limited. Grading models that are not flexible can have an impact on the manner of teaching. The question that can be raised is to what extent open-source software such as Sakai, Moodle, and Desire2Learn can be viable e-assessment platform solutions in developing countries.

Open Courseware

The use of ICTs in education has led to the emergence of open educational resources that permit learning materials to be remixed, reused and redistributed. These resources enable open access to any course material and in diverse forms of media (Atkins, Brown, and Hammond 2007). While open courseware encourages local material development, imported materials may provide a framework for the design of local materials (Dougiamas and Taylor 2003). The tools used to produce educational resources should be generally available as open source in order to benefit many users. These production tools have been developed based on the need to handle learning materials in new formats and modes (Tlhoaele et al. 2014).

Parental Involvement

Educational technology adoption automatically calls for institutional change (Zhu 2015). Thus it is imperative for higher education institutions to involve all stakeholders, including parents, in the planning of such technology initiatives (Lwoga et al. 2015).

Due to socioeconomic constraints in most developing countries, a typical household survives on a below-average income. Many students rely on parents and relatives for financial support for their tertiary education. The endorsement by the parents and the community at large may create a sense of ownership, which has the potential to sustain technology projects.

Communication Patterns

Educational technology has not only changed the communication approaches in the classroom but has also influenced the way lecturers deliver their content material and the way students learn. Students normally learn better by sharing ideas in a group. The explicit and implicit differences in cultural diversities, especially in the "rainbow nation" that is South Africa, make it crucial to understand student-lecturer communication patterns. One of the most significant rationales for e-learning is that it affords communication both inside and outside the traditional classroom (Januszewski and Mulenda 2013). Without any restrictions on time and space, students continue to communicate instantaneously, anytime and anywhere (Harasim 1990; Leidner and Jarvenpaa 1995).

Class Size

Online teaching and learning requires an acceptable level of student-to-staff ratio. Individual attention in learning is an important educational factor (Garrison, Anderson, and Archer 2003). The size of the class should facilitate reasonable individual attention in order to meet students' expectations (Laurillard 2002). It is very difficult for lecturers to employ interactive teaching strategies when class sizes are large. In addition, adequate planning and preparation is important for effective lesson implementation.

Group Work

The adoption of technology is often regarded as an enabler for group assignments and collaborative learning. South Africa is highly diverse, and it is important to be sensitive towards group work traditions that are inherent to varied cultures. Vygotsky (1997) suggests that social interactions play a critical role in the process of active construction of learning and cognition. If not adequately planned, the group work may have a negative impact on teaching and learning.

Contact and Individual Teaching

Contact teaching and individual teaching are most practicable and effective in small class sizes as they provide appropriate levels of instruction to diverse groups of students. Garrison, Anderson, and Archer (2003) point out that, whether planning for face-to-face or blended teaching and learning, the pedagogical element should determine the decision whether to use contact and individual teaching. Although computers can individualise instruction for students, Tedre, Apiola, and Cronjé (2011) point out that

the need for individual contact teaching and effective support remains high in developing countries.

Pedagogical Models

The use of ICTs for teaching, learning and research at higher education institutions has undeniably brought far-reaching changes. These changes have affected teaching and learning, hence the development of various teaching models (Liu and Hwang 2010). New instructional materials and revised curricula also bring about new teaching approaches and strategies (Fullan 1993). Effective instructional models are developed through learning interventions over time and through gaining teaching experience (Bower 2008; Dalgarno and Lee 2010).

This research investigated the extent to which the readiness situation at two universities of technology in South Africa could be analysed effectively using the criteria of the 12 elements contained in the Tedre framework.

Research Perspective

Social informatics informed the underlying research perspective of this study. According to Sawyer (2008), the concept of social informatics refers to a problem-driven research domain that is characteristic of ICT. Complexities relate to socio-technical systems employed during technology adoption and require multifocal analysis and interpretation from a lens of multiple realities. Internal and external environmental changes could influence the intention to adopt educational technology in higher education institutions. The implementation of e-learning becomes a central process in the adoption of technology. During this process, numerous educational issues need to be considered, particularly in developing countries as they vary in many ways from industrialised countries (Tedre, Apiola, and Cronjé 2011).

The current empirical research set out to explore the situation at two South African universities of technology in order to determine the issues that affected technology integration. This study focused on the extracted constructs of pedagogically related considerations in an educational context.

Method and Design

Through the lens of the Tedre framework, this paper bases its discussion on how the two relevant universities compare and to what extent they resonate with situations in other developing countries. The paper reports on research findings regarding a "pedagogical framework" as the first of four main research components of educational considerations for technology integration. This component entails an understanding of how the two South African universities compare with each other and with institutions in other developing regions in terms of the educational considerations proposed in the Tedre framework. The central research question concerned the extent to which this

framework was useful for a situational analysis at the two relevant South African universities of technology. The subquestions concerned the framework's ability to distinguish between the situations at the two universities on the one hand and, on the other hand, to determine the overlaps or shortcomings of the model in describing these situations in context. In line with the work of Miles, Huberman, and Saldana (2013), this research used a conceptual framework that included the 12 issues that related to educational considerations as identified in the framework of Tedre, Apiola, and Cronjé (2011) (see Figure 1).

Figure 1: Issues for educational consideration during technology integration Source: Adapted from Tedre, Apiola, and Cronjé (2011)

The 12 factors depicted in the conceptual framework are educational issues that need to be considered for technology adoption particularly in a developing environment such as at the universities of technology in South Africa. These educational factors form the centre of the pedagogical framework and play a key role in an open distance-learning environment. Although the Tedre framework suggests three main aspects of technology adoption, namely educational, socio-economic and technical, the current research only focused on educational considerations in developing countries. The two non-traditional universities of technology that were studied (referred to as Case 1 and Case 2) have similar characteristics. They are situated in two coastal provinces, namely in KwaZulu-Natal and the Western Cape. These two universities offer technological career-directed educational programmes.

This study adopted a qualitative case study research methodology to study the two relevant universities. This methodology is suitable for studying smaller samples that have similar characteristics (Elliot, Fischer, and Rennie 1999; Yin 2013). Additionally, limited and basic quantitative secondary data was obtained through some of the methods to illustrate variables in order to provide descriptions of the frequencies of these

variables/attributes. Although this quantitative approach was limited, it yielded additional insights and added value to the interpretation of the qualitative data.

A sample of 14 participants was selected through purposive sampling. The participants, who all used the Blackboard Learning Management System (LMS), consisted of six lecturers and one senior manager from each university's e-learning unit. The maximum variation sample obtained based on demographic variables was considered as a strategy to cover a wide range of intended groups of participants across both universities' faculties. The ethical requirements of both universities were adhered to and the participants gave their consent.

Qualitative data was collected by means of less-structured interviews, observation, document analysis, field notes, training workshops, visual photographs, and questionnaires. The interviews were recorded on a voice recorder that ensured clear sound and playback. The questionnaire, which reflected aspects contained in Tedre's framework, was structured around four themes, namely, pedagogical framework, motivational aspects, content, and country's educational context.

Atlas.ti software was used to manage and facilitate data analysis, which enabled the researcher to distinguish between plausible categories and to understand the codes and themes that tied into the connected notions of the interpretive outcome. A Boolean operator was used to filter and analyse the descriptors in a printed format and to locate multiple codes, combinations and categories, and their connected relationships. The perceptions of the participants were interpreted according to the descriptions of their views and experiences, which included their sensory experiences (Merriam 2002).

Discussion of Findings

The findings are discussed relative to the three key research areas, which are: the similarities and differences in respect of the two universities; the extent to which the current findings resonate with findings relating to similar university situations in other African countries; and the determination of the shortcomings and overlaps of the Tedre framework.

To obtain the qualitative data required to compare technology integration at the two universities, the participants were asked to indicate the type of tools and methods they used to facilitate and enhance their course teaching. As indicated in Table 1, the participants mentioned a wide range of tools and techniques.

Table 1: Situational comparison between the two universities of technology

Case 1	*Case 2*
2:2 Twitter, YouTube videos, Respondus (6:6) 2:8 Blackboard, YouTube, emails (11:11) 2:24 Social media, Blackboard, Skype (24:24) 2:27 Early warning system (25:25) 2:37 Cellphones, Google apps, PowerPoint (35:35) 2:51 Videos (94:94) 2:60 Facebook (102:102) 2:83 Respondus assessment software (132:132) 2:85 ePortfolio (133:133) 2:119 Skype and Facebook (185:185) 2:120 Forums (185:185) 2:150 Blogging and watching YouTube (302:302) 2:155 Discussion board (305:305) 2:159 Story Board, QR codes, Prezi (314:314)	3:19 Blackboard, eJournals (42:42) 3:26 Using Moodle (52:52) 3:32 We use Wiki—a collaborative tool (59:59) 3:44 eJournals and videos (65:65) 3:52 Blackboard, discussion forums (70:70) 3:58 Blackboard, videos, blogging, PowerPoint (77:77) 3:64 Emails, dropbox (83:83) 3:66 Videos and podcasts (85:85) 3:77 Moodle, because it is open source (116:116)

Note: The numbers preceding and following the tools indicate the primary document and the paragraph line respectively.

It is important to note that the results revealed some commonalities between Case 1 and Case 2 especially with regard to participants' preferences and their exposure to new technology. Both universities had adopted Blackboard LMS tools. The analysis also indicated that the Blackboard LMS collaborative tools, such as emailing and discussion forums, were the common options. However, the analysis showed that students used YouTube to develop their own content for project tasks.

The document analysis revealed that e-learning policies of the universities (Case 1 and Case 2) compelled the university's e-learning support centre/unit to conduct regular training sessions. All the centres for e-learning were mandated to drive an effective e-learning adoption. Two training sessions were analysed for the purpose of this study. The objective of the training was to support the staff and train them on how to use Blackboard LMS tools. The feedback collected through post-training evaluation forms completed by the participants from Case 1 and Case 2 indicated a variety of affective aspects as reflected in Table 2 below.

Table 2: Motivational aspects of LMS training workshop participation

CASE-1	Variables	Strongly disagree	Disagree	Moderate	Agree	Strongly agree	N=23
1	I enjoyed the session				18	5	**23**
2	It was engaging			2	3	18	**23**
3	Tasks were relevant to my job				1	22	**23**
4	It was confusing	3	17	3			**23**
5	It was motivating				17	6	**23**
6	It was boring	4	19				**23**
7	The training was useful				16	7	**23**
CASE-2	**Variables**	**Strongly disagree**	**Disagree**	**Moderate**	**Agree**	**Strongly agree**	**N=15**
1	I enjoyed the session			2	5	8	**15**
2	It was engaging				16	7	**15**
3	Tasks were relevant to my job					15	**15**
4	It was confusing		12	2	1		**15**
5	It was motivating				13	2	**15**
6	It was boring		15				**15**
7	The training was useful			1	4	10	**15**

Table 2 shows that 38 academics in total had attended the workshop sessions offered in the universities under study. Whereas 23 academics from Case 1 participated in the Blackboard training workshop, 15 academics from Case 2 participated. The findings obtained ranged from academics enjoying the tasks to their asserting that the training was useful. The impact of the training workshops in respect of Case 1 and Case 2 is depicted in Figure 2 and Figure 3 respectively.

As indicated in Figure 2, about 70 per cent of the participating academics from Case 1 enjoyed the training because the tasks were relevant and the procedures were not confusing. Whereas 65 per cent of the participants found the tools useful, 70 per cent found that the training experience motivated them to adopt the technologies for teaching.

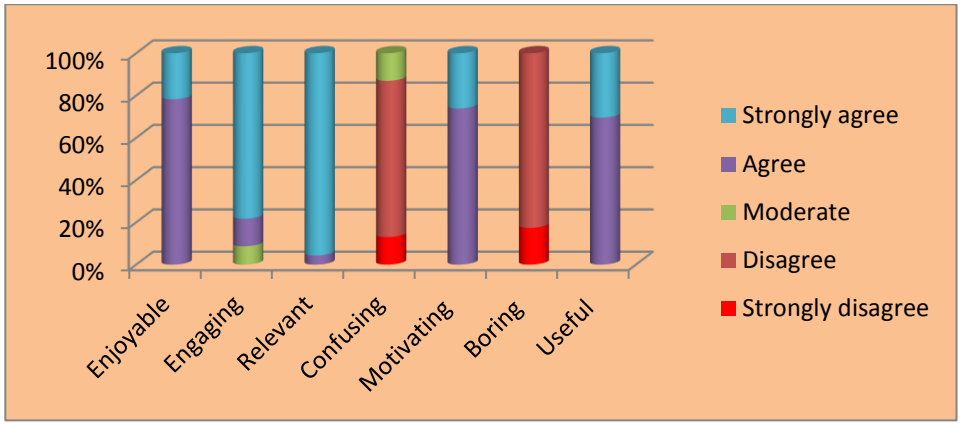

Figure 2: Graphic representation of motivational factors in Case 1

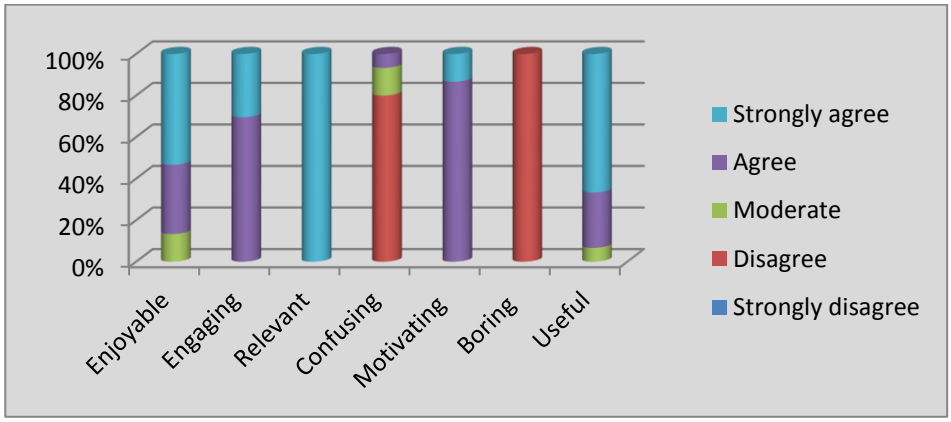

Figure 3: Graphic representation of motivational factors in Case 2

As indicated in Figure 3, more than 90 per cent of the participants found the training and tasks relevant. Of the participants, 80 per cent experienced the training as motivating, whereas 65 per cent of them found the activities relevant and useful for an online teaching environment. None of participants disagreed with the structure of the training workshop and the processes that were followed. Interestingly, the findings indicated that Case 1 participants used a wider variety of technology tools and techniques compared to Case 2 participants. By implication, participants' use of technology might benefit the technology exposure of students as they get to engage regularly with different tools. The document analysis revealed that exposure to technology was mandatory in accordance with the e-learning policy of the Cape Peninsula University of Technology (CPUT 2011), which states as follows:

> The use of additional technology and tools should be incorporated or enhanced in all the processes of teaching and learning, unless it poses a security threat to assessment procedures or institutional systems.

One of the lecturers from Case 1 provided evidence that e-learning policy was adhered to:

> We make sure we don't exclude anyone from learning. They use the technology they have available to complete tasks. You don't want students to be disadvantaged by not having access to software. (Respondent C1E)

With regard to *exposure to technology* being one of the important factors to be considered, it can be said that a policy implies adherence to guidelines and to what Mumtaz (2000) refers to as a distinguishing context-influenced framework that should be developed and used to guide the management of areas on which to concentrate. The findings were consistent with the notion in the Durban University of Technology's e-learning strategic planning and deployment report (DUT 2013) that inadequate infrastructure results in disparities. In this regard, Respondent C2A described her frustration:

> Let's just have a standard in which all the lecture venues, all the students, are exposed to a particular standard of technology …; in the same university, the same campus but other departments' teaching venues are more equipped than others.

ICT literacy for academics is very important for appropriate technology integration. One respondent in this study can be cited as an example of an academic who, simply because it was too "time consuming," was reluctant to become technologically literate with a view to developing existing courses. According to Rogers (2010), such "laggards" hamper technological integration.

In this study, those who participated expressed the belief that an African student had a very strong cultural foundation in terms of how certain things worked (Respondent C2A). Therefore, diversity in culture should be taken into consideration because *value systems* might play a role in group dynamics (Tedre, Apiola, and Cronjé 2011). For effective learning to take place, students should be *active* rather than *passive learners*. The findings revealed that there might be interdependence between active participation and authentic learning. Herrington, Reeves, and Oliver (2014) point out that a pedagogical approach that situates learning tasks in the context of future use is characteristic of authentic learning. In this study, the view was expressed that using audiovisual content enlivened class discussions and participation, and Respondent C1B reported as follows:

> My students are very active and creative with technology; they have created for themselves a Facebook page.

The above is an example of creating learning environments that afford the opportunity of active learning where students engage and share ideas. Concerning *grading models*, the findings revealed that a dire need existed for efficient online assessment alternatives. One respondent pointed out the following:

> I had 220 students last semester; the lecturers with bigger classes would be more easily persuaded to move to Blackboard because it is very efficient when it comes to marking and assessment grading. It keeps records and it doesn't make a mistake unless you made a mistake when you set up the test. (Respondent C2E)

Open courseware refers to university-created course lessons that are freely available on the Internet. For developing countries to benefit fully from the adoption of educational technology, most barriers are yet to be eliminated. Both universities were aware of open courseware and used many open-source materials such as the content in Khans Academy. Higher education learning has become increasingly expensive. The document analysis that was done revealed that both universities did consider *parental involvement* (i.e. the involvement of parents as stakeholders) in order for key project initiatives to succeed. *Communications patterns* should be unambiguous and should flow in a virtual learning environment. Without any restrictions on time and space, students and lecturers should be able to communicate synchronously or asynchronously to facilitate collaborative and cooperative learning. An analysis of the CPUT's e-learning policy (CPUT 2011) confirmed the finding in respect of Case 1 that the institutional mandate was that all courses offered must be online and must have at least one active communication tool selected from the LMS suite of communication tools.

It is almost impossible for lecturers with large *class sizes* to employ interactive teaching strategies and to gain insight into the challenges that individual students experience. Some respondents confirmed that "We don't do formal group work because of too large class sizes" (Respondent C2D). The findings of this study have revealed that an African student has a very strong cultural foundation in terms of how certain things work. Large class sizes are not a conducive environment for group and collaborative learning. It must be noted that collaborative learning is more effective in smaller manageable groups than in large, uncontrollable groups (Lin and Reigeluth 2016). There has always been a great need to balance *contact teaching* and *individual close contact teaching* and effective support. Although computers can individualise instructions for students (Tedre, Apiola, and Cronjé 2011), the process may seem far-fetched in developing countries where there are unfavourable situations such as big class sizes, a lack of quality student intake, and poor infrastructure. A number of barriers to effective e-learning have been determined, and it has been found that many challenging issues persist in hindering technology integration at universities.

Regarding describing a pedagogical model for technology integration, most participants in this research expressed the belief that a learning theory undoubtedly influenced their

teaching approaches. This implies that pedagogical issues tend to be systematically integrated and cannot be solved in isolation. The comprehensive network of varied associated pedagogical issues is displayed in Figure 4.

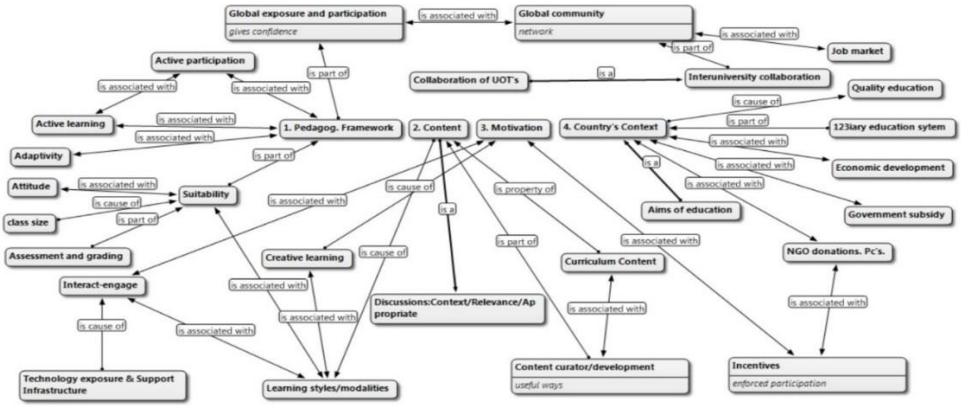

Figure 4: A network view of the implications related to pedagogical considerations

The findings further revealed that the participants were able to distinguish between the challenges they experienced and the key factors they considered to be important for the successful adoption of educational technologies. In addition, most participants appreciated the importance of the elements' interdependence and provisions during technology integration. Respondent C1C elaborated as follows:

> If you work from, or coming from the point of what is it that you want the students to learn, or how do you want them to engage with the material, and then the technology presents us with the whole range of other ways of achieving.

It is also important to present how these two universities compare in order to gauge the extent of the similarities.

Comparison between the Two Universities of Technology

The commonalities for consideration were in relation to institutional structure, institutional policies, and the approach to the implementation and rollout of Blackboard LMS tools.

A comparative summary of the e-learning adoption strategies at the two universities is presented in Table 3.

Table 3: A comparative summary of the e-learning adoption strategies at the two universities

Criteria	*Description*	*Case 1*	*Case 2*
Objectives	The goal and purpose of the policy documents	To align the use of technology in learning and teaching To add value to teaching and learning methods	To contribute to the university's strategic goals, mission and vision, and objectives To add value to teaching and learning methods
Campuses	Physical institutional campus buildings or sites	Seven campus sites	Eight campus sites
Faculties	Institutional faculties and sites	Informatics and Design Applied Sciences Education and Social Sciences Engineering Health and Wellness Sciences Business	Accounting and Informatics Applied Sciences Arts and Design Engineering and Built Environment Health Sciences Management Sciences
Mode of teaching and learning	Method and techniques for institutional programme course delivery	Blended teaching approach	Blended teaching approach
E-learning inception period	Adoption of the LMS and official introduction of educational technologies	Since 2005 Blackboard Learn 9.0	Since 2002 Blackboard Learn CE

As shown in Table 3, the main objective of technology integration at both universities is to add value to teaching and learning methods through blended learning. In regard to the inception of e-learning, the comparison in the table shows striking similarities in the universities' approach to the three pillars of implementation support structure. Importantly, the findings from the document analysis done for this study suggested that establishing an effective institution-wide model for support and training is "a prerequisite" for success in the adoption and growth of e-learning.

Limitations

The participation in this research by the purposeful sample of 14 participants obtained from the two universities of technology was voluntary. Therefore, the study might not

be fully representative of all the lecturers at these two universities and at other universities in South Africa. Although this study might not be fully generalisable, the transferable nature of this study aims to challenge readers to make connections between elements of the study and their own experiences in similar situations (Creswell and Miller 2000).

Discussion and Conclusion

Based on this study it is concluded that universities differ in many aspects. For example, although the educational strategies and policies of the two South African universities in this study are similar, there are differences in the manner they approach and implement these strategies and policies. Nevertheless, there are more commonalities than differences, therefore it is concluded that no significant differences exist between these two universities. The main imbalance between the two universities boils down to a situation of "having and not having" in terms of laboratory equipment and resources. It is therefore imperative to review the policies and the fund allocation framework of the Department of Higher Education and Training in order to address marginalised and underprivileged higher education institutions.

Evaluation Criteria Relating to the Tedre Framework

Two validation methods were created to determine the usefulness of the criteria of the framework of Tedre, Apiola, and Cronjé (2011) in analysing the situation at the two universities of technology. First, a criterion specified in the framework was **accepted** based on the following three situations:

a) Where the analysis findings contradicted the literature

b) Where a variable was silent or missing and there were no findings about a related attribute, and evidence of this was not found at either of the universities

c) Noncompliance (where a university policy was in place but not implemented)

Second, a criterion specified in the framework of Tedre, Apiola, and Cronjé (2011) was **rejected** based on the following three situations:

a) When the situation at both universities was the same and the Tedre framework did not help in differentiating between the two institutions

b) Where the specific practices at both universities and the practices described in the literature were found to be an exact match

c) Where the practices at either one of the two universities were found to be in line with the practices described in the literature

For example, in cases where the situations at the two universities were almost exactly the same, and the Tedre framework variables could not assist in differentiating between the two universities, the particular criteria were deemed not useful in analysing the situation; hence the relevant attributes were rejected and excluded. The opposite was also true: variables that were accepted were those that needed attention and were either related to policy non-compliance, or were missing or silent, or the findings relating to the attribute(s) contradicted the findings in the literature. The major implication of the exclusion of a framework variable was that it clearly validated the extent to which the current situation at the two relevant South African universities resonated with the situation at universities in other developing countries.

Pedagogical Framework

In the Tedre framework, which is a pedagogical framework, 12 variables are indicated. Four of these were accepted in this research and the rest were rejected on the basis that the situation at both universities was not unusual but that the attributes (as represented by the variables) resonated with the issues found in other African countries. In that respect, the Tedre framework could not assist in differentiating between the two universities.

In the next section, the researcher describes the pedagogical aspects that have an impact on technology adoption in a developing environment. The implications of the findings will assist in refining the Tedre framework as a practical analysis tool.

Technology Exposure and ICT Literacy

In validating the findings in the literature, two attributes relating to *technology exposure* and *ICT literacy* were confirmed in this study as considerations essential for technology integration as suggested in the Tedre framework. Ease of access to technology is one of the effective ways to expose faculty staff to the pedagogical use of ICT in their teaching (Yilidrim et al. 2014). By implication, lecturers' use of ICT will benefit students in that the students will experience their learning as meaningful and they will be exposed to technology. It was with concern that the researcher observed that one university appeared better equipped than the other and also that its faculty members seemed more comfortable speaking about technology use from different perspectives. The lecturers displayed a sound understanding of Mishra and Koehler's (2006) technological pedagogical content knowledge, and they also displayed confidence in utilising technology to present information. The researcher concurs with the prediction in the literature and the Tedre framework that students who are unable to navigate through a complex digital landscape will no longer be able to participate fully in the socioeconomic and cultural life around them (Organisation for Economic Co-operation and Development 2015).

Parental Involvement

The researcher concurs with Bhukuvhani, Zezekwa, and Sunzuma (2011) who emphasise the influence of parents as active stakeholders who encourage the use of technology for teaching and learning. In contrast, evident hands-on parental involvement was missing at both universities. Hence, the researcher agrees with the literature and the Tedre framework that in the context of this study, *parental involvement* is a viable consideration.

Contact and Individual Teaching

The challenge with the implementation of the above attribute is that big class sizes, coupled with the lack of access to computer laboratories and the poor infrastructure, make it impossible to balance individual close contact teaching and effective technical support. Although the findings from the document analysis indicated that attempts had been made to address this issue through support units at both universities, such units were evidently not implemented at either of these universities. In line with Atkins and Vasu (2000), the challenge can be ascribed directly to the lack of the capacity to adapt the pace and level of instruction to the needs of each individual student. On this score, the current research agrees with the literature and confirms this attribute identified in the Tedre framework as a pedagogical factor to be taken into consideration in technology integration.

Overlaps and Shortcomings of the Tedre Framework

In the literature review, the researcher confirmed that educational technology initiatives should consider important context-dependent issues in faculties (Kahiigi 2012) and follow a distinguishing context-influenced framework (Mumtaz 2000). In the literature review, the researcher confirmed that educational technology initiatives should consider important context-dependent issues in faculties (Kahiigi 2012) and follow a distinguishing context-influenced framework (Mumtaz 2000). In this regard, the attributes in the pedagogical framework of Tedre that were considered were, i) *Value system, ii) Grading models, iii) Open courseware, iv) Communication patterns, v) Class sizes, vi) Group work, vii) Active and passive learning*, and *viii) Pedagogical models.* As reported earlier, four of these were accepted and the others were rejected. The reason for the rejections was that the situation at both universities was the same and the Tedre framework could not assist to distinctively differentiate between the two universities. Although these considerations were not so relevant in the current research, the researcher believes that they might be of importance in other contexts.

Recommendations

This paper sought to offer a broad understanding of the common factors regarding pedagogical considerations for educational technology adoption in developing regions. The current situation is that lecturers are compelled to adapt by using technology tools

that enhance their teaching and the delivery of curriculum content, amongst other educational purposes. Many academics are reluctant to integrate technology due to a lack of recognising the importance of such integration. In addition, the investment incentives and government initiatives in e-learning alone cannot have any sustainable competitive advantage. A comprehensive ICT strategy by higher education institutions should provide clear guidelines on periodically monitored implementation. In this way, faculties may begin to realise the value added by technology integration in teaching and learning. Additionally, in order to address South Africa's vocational needs, amongst other things, it is important that the country's context be considered when developing educational policy.

Steadily improving infrastructure (as shown in this paper) demystifies the notion that technology integration provides access to learning if the students cannot access learning anywhere and anytime. This challenge persists because students have limited computer access as only a few computers are available to them.

Regular workshops should be provided for academic development in faculties in order to keep up to date with developing e-learning trends. For example, the incorporation of three-dimensional virtual worlds in the form of virtual reality should be considered to enhance learning and teaching where real scenarios are not feasible in developing countries. Probably, every household in South Africa owns and share at least one smart phone. Thus, augmented reality tools facilitated by mobile applications (apps) should be used to enhance learning as they are successful tools that greatly improve the engagement of students.

To conclude, further research is needed in respect of doing an in-depth analysis of technical and socioeconomic categories (such as those included in the Tedre framework) in order to contribute to a broad and deep systemic view of educational technology in developing countries.

References

Atkins, N. E., and E. S. Vasu. 2000. "Measuring Knowledge of Technology Usage and Stages of Concern about Computing: A Study of Middle School Teachers." *Journal of Technology and Teacher Education* 8 (4): 279–302.

Atkins, D. E., J. S. Brown, and A. L. Hammond. 2007. *A Review of the Open Educational Resources (OER) Movement: Achievements, Challenges, and New Opportunities*. San Francisco, CA: Creative Commons.

Bates, T. 2008. *Policy Issues and Challenges in Planning and Implementing E-Learning in Teacher Education*. Vancouver: Tony Bates. Accessed May 10, 2017. https://www.tonybates.ca/wp-content/uploads/2008/07/policy-issues1.pdf.

Blanchette, J., and H. Kanuka. 1999. “Applying Constructivist Learning Principles in the Virtual Classroom.” In *Proceedings of Ed-Media/Ed-Telecom 1999 World Conference on Educational Multimedia, Hypermedia and Telecommunications*, 434–39. Seattle, WA: Association for the Advancement of Computing in Education. Accessed February 15, 2017. https://www.learntechlib.org/p/17464/.

Bhuasiri, W., O. Xaymoungkhoun, H. Zo, J. J. Rho, and A. P. Ciganek. 2012. “Critical Success Factors for E-Learning in Developing Countries: A Comparative Analysis between ICT Experts and Faculty.” *Computers and Education* 58 (2): 843–55. https://doi.org/10.1016/j.compedu.2011.10.010.

Bhukuvhani, C., N. Zezekwa, and G. Sunzuma. 2011. “Students’ Preparedness to Integrate Information and Communication Technology Tools and Resources for the Learning of Organic Chemistry Concepts in the District of Masvingo, Zimbabwe.” *International Journal of Education and Development Using Information and Communication Technology* 7 (2): 27–37.

Bower, M. 2008. “Affordance Analysis—Matching Learning Tasks with Learning Technologies.” *Educational Media International* 45 (1): 3–15. https://doi.org/10.1080/09523980701847115.

Bronack, S. C., and R. E. Riedl. 1998. “Distributed Learning Environments: Pedagogy, Implementation, and the Early Adopter.” In *Proceedings of the 10th World Conference on Educational Multimedia and Hypermedia and the World Conference on Educational Telecommunications*, Freiburg, Germany, June 20–25, edited by I. Ottmann, and I. Tomek. Charlottesville, VA: AACE.

Bronack, S., R. Sanders, A. Cheney, R. Riedl, J. Tashner, and N. Matzen. 2008. “Presence Pedagogy: Teaching and Learning in a 3D Virtual Immersive World.” *International Journal of Teaching and Learning in Higher Education* 20 (1): 59–69.

Cao, Q., T. E. Griffin, and X. Bai. 2009. “The Importance of Synchronous Interaction for Student Satisfaction with Course Web Sites.” *Journal of Information Systems Education* 20 (3): 331.

Cassady, J. C., and B. E. Gridley. 2005. “The Effects of Online Formative and Summative Assessment on Test Anxiety and Performance.” *Journal of Technology, Learning and Assessment* 4 (1): 1–29.

CPUT (Cape Peninsula University of Technology). 2011. *E-learning Policy.* Cape Town: CPUT.

Creswell, J. W., and D. L. Miller. 2000. “Defining Validity in Qualitative Inquiry.” *Theory into Practice* 39 (3): 124–30. https://doi.org/10.1207/s15430421tip3903_2.

Dalgarno, B., and M. J. Lee. 2010. “What Are the Learning Affordances of 3-D Virtual Environments?” *British Journal of Educational Technology* 41 (1): 10–32. https://doi.org/10.1111/j.1467-8535.2009.01038.x.

Department of Education. 2003. “Draft White Paper on E-Education. Transforming Learning and Teaching through Information and Communication Technologies (ICTs).” *Government Gazette*, Vol. 470, No. 26734, August 26. Pretoria: Government Printer.

Dougiamas, M., and P. Taylor. 2003. “Moodle: Using Learning Communities to Create an Open Source Course Management System.” In *Proceedings of ED-MEDIA 2003—World Conference on Educational Multimedia, Hypermedia and Telecommunications*, edited by D. Lassner, and C. McNaught, 171–8. Honolulu, Hawaii: Association for the Advancement of Computing in Education. Accessed November 7, 2016. https://www.learntechlib.org/p/13739/.

DUT (Durban University of Technology). 2013. *E-Learning Strategic Planning and Deployment Report*. Durban: DUT.

Elliott, R., C. T. Fischer, and D. L. Rennie. 1999. “Evolving Guidelines for Publication of Qualitative Research Studies in Psychology and Related Fields.” *British Journal of Clinical Psychology* 38 (3): 215–29. https://doi.org/10.1348/014466599162782.

Fullan, M. G. 1993. *Change Forces: Probing the Depths of Educational Reform*. Bristol, PA: Falmer.

Garrison, D. R., T. Anderson, and W. Archer. 2003. “A Theory of Critical Inquiry in Online Distance Education.” In *Handbook of Distance Education*, edited by M. G. Moore, 113–27. New York, NY: Erlbaum.

Grunert, S. C., and H. J. Juhl. 1995. “Values, Environmental Attitudes, and Buying of Organic Foods.” *Journal of Economic Psychology* 16 (1): 39–62. https://doi.org/10.1016/0167-4870(94)00034-8.

Harasim, L. M. 1990. *Online Education: Perspectives on a New Environment*. Santa Barbara, CA: Greenwood.

Herrington J., T. C. Reeves, and R. Oliver. 2014. “Authentic Learning Environments.” In *Handbook of Research on Educational Communications and Technology*, edited by J. Spector, M. Merrill, J. Elen, and M. Bishop. New York, NY: Springer. https://doi.org/10.1007/978-1-4614-3185-5_32.

Januszewski, A., and M. Molenda, eds. 2013. *Educational Technology: A Definition with Commentary*. Oxford: Routledge.

Kahiigi, Kigozi E. 2012. “A Collaborative E-Learning Approach: Exploring a Peer Assignment Review Process at the University Level in Uganda.” Doctoral dissertation, Department of Computer and Systems Sciences, Stockholm University.

Koohang, A., and A. Durante. 2003. “Learners’ Perceptions toward the Web-Based Distance Learning Activities/Assignments Portion of an Undergraduate Hybrid Instructional Model.” *Journal of Information Technology Education: Research* 2 (1):105–13. https://doi.org/10.28945/316.

Laurillard, D. 2002. *Rethinking University Teaching: A Conversational Framework for the Effective Use of Learning Technologies*. London: Routledge. https://doi.org/10.4324/9780203304846.

Leidner, D. E., and S. L. Jarvenpaa. 1995. “The Use of Information Technology to Enhance Management School Education: A Theoretical View.” *MIS Quarterly* 19 (3): 265–91. https://doi.org/10.2307/249596.

Lin, C. Y., and C. M. Reigeluth. 2016. “Scaffolding Wiki-Supported Collaborative Learning for Small-Group Projects and Whole-Class Collaborative Knowledge Building.” *Journal of Computer Assisted Learning* 32 (6): 529–47. https://doi.org/10.1111/jcal.12140.

Liu, G. Z., and G-J. Hwang. 2010. “A Key Step to Understanding Paradigm Shifts in E-Learning: Towards Context-Aware Ubiquitous Learning.” *British Journal of Educational Technology* 41 (2): E1–E9. https://doi.org/10.1111/j.1467-8535.2009.00976.x.

Lwoga, N. B., W. Anderson, B. B. B. Mapunda, T. D. Andersson, and L. Mossberg. 2015. “Socio-Psychological Motives for Stakeholders’ Engagement in Conservation of Built Heritage Attractions in Tanzania.” In *Proceedings of the ATLAS Africa Conference*, 8–15. University of Dar es Salaam, Tanzania, June 3–5, 2015.

Merriam, S. B. 2002. *Qualitative Research in Practice: Examples for Discussion and Analysis*. San Francisco, CA: Jossey-Bass.

Miles, M. B., A. M. Huberman, and J. Saldana. 2013. *Qualitative Data Analysis: A Methods Sourcebook*. 3rd ed. Thousand Oaks, CA: Sage.

Mishra, P., and M. Koehler. 2006. “Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge.” *Teachers College Record* 108 (6): 1017–54. https://doi.org/10.1111/j.1467-9620.2006.00684.x.

Muianga, X., H. Hansson, A. Nilsson, A. Mondlane, I. Mutimucuio, and A. Guambe. 2013. “ICT in Education in Africa—Myth or Reality: A Case Study of Mozambican Higher Education Institutions.” *African Journal of Information Systems* 5 (3), Article 5. Accessed February 12, 2017. https://digitalcommons.kennesaw.edu/ajis/vol5/iss3/5.

Mumtaz, S. 2000. “Factors Affecting Teachers’ Use of Information and Communications Technology: A Review of the Literature.” *Journal of Information Technology for Teacher Education* 9 (3): 319-42. https://doi.org/10.1080/14759390000200096.

Organisation for Economic Co-operation and Development. 2015. “Students, Computers and Learning: Making the Connection.” Programme for International Student Assessment series. Paris: OECD. https://doi.org/10.1787/19963777.

Önsel, Ş., F. Ülengin, G. Ulusoy, E. Aktaş, Ö. Kabak, and Y. I. Topcu. 2008. “A New Perspective on the Competitiveness of Nations.” *Socio-Economic Planning Sciences* 42 (4): 221–46. https://doi.org/10.1016/j.seps.2007.11.001.

Piccoli, G., R. Ahmad, and B. Ives. 2001. “Web-based Virtual Learning Environments: A Research Framework and a Preliminary Assessment of Effectiveness in Basic IT Skills Training.” *MIS Quarterly* 25:401–26. https://doi.org/10.2307/3250989.

Rogers, E. M. 2010. *Diffusion of Innovations*. 5th ed. New York, NY: Simon and Schuster.

Sawyer, K. 2008. “The Future of Learning in the Age of Innovation.” Review paper for the Beyond Current Horizons programme. Berkshire: National Foundation for Educational Research/Future Lab.

Spector, J. M. 2015. *Foundations of Educational Technology: Integrative Approaches and Interdisciplinary Perspectives*. 2nd ed. Oxford: Routledge.

Tedre, M., M. Apiola, and J. Cronjé. 2011. “Towards a Systemic View of Educational Technology in Developing Regions.” In *Proceedings of the IEEE Africon Conference*, 1–8. Livingstone, Zambia, September 13–15. Washington, DC: IEEE. https://doi.org/10.1109/AFRCON.2011.6072012.

Tlhoaele, M., A. Hofman, A. Naidoo, and K. Winnips. 2013. “Using Clickers to Facilitate Engagement Activities in a Lecture Room for Improved Performance by Students.” *Innovations in Education and Teaching International* 51 (5): 497–509. https://doi.org/10.1080/14703297.2013.796725.

Venkatesh, V., and F. D. Davis. 2000. “A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies.” *Management Science* 46 (2): 186–203. https://doi.org/10.1287/mnsc.46.2.186.11926.

Vygotsky, L. S. 1997. *The Collected Works of LS Vygotsky: Problems of the Theory and History of Psychology*, vol. 3, edited by R. W. Rieber, and J. Wollock. New York, NY: Springer Science and Business Media.

Wang, Y., and W. Qualls. 2007. “Towards a Theoretical Model of Technology Adoption in Hospitality.” *International Journal of Hospitality Management* 26 (3): 560–73. https://doi.org/10.1016/j.ijhm.2006.03.008.

Yildirim, Z., C. M. Reigeluth, S. Kwon, Y. Kageto, and Z. Shao. 2014. “A Comparison of Learning Management Systems in a School District: Searching for the Ideal Personalized Integrated Educational System (PIES).” *Interactive Learning Environments* 22 (6): 721–36. https://doi.org/10.1080/10494820.2012.745423.

Yin, R. K. 2013. *Case Study Research: Design and Methods*. Thousand Oaks, CA: Sage.

Zhu, C. 2015. “Organisational Culture and Technology-Enhanced Innovation in Higher Education.” *Technology, Pedagogy and Education* 24 (1): 65–79. https://doi.org/10.1080/1475939X.2013.822414.