

Strategy for the use of ICT in learning and teaching at Stellenbosch University

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1 Executive Summary

Stellenbosch University recognises the potential value of ICTs (information and communication technologies) to transform education from the traditional methodologies and approaches to a more contemporary, open, responsive and flexible learning system. In this way, ICTs are used to improve the flexibility (*anytime* access) and mobility (*anywhere* access) of formal and non-formal programmes. The judicious utilisation of ICTs can therefore play an important role in improving the learning experience of the residential student's on-campus experience as part of a blend of face-to-face and technology-enhanced learning opportunities, as well as broadening access to higher education by offering lifelong learning opportunities to the non-residential learn-and-earn student market. In addition, opportunities arise to contribute to the "public good" by enhancing collaboration amongst academics and with other higher education institutions and organisations to expand the footprint of Stellenbosch University nationally and internationally.

A Task Group, with the Vice-Rector: Learning and Teaching as chairperson, was convened to formulate a vision and strategy for the effective and efficient utilisation of ICTs in teaching and learning. The following vision was formulated:

Stellenbosch University has a 21st Century ICT-enhanced learning and teaching environment that uses ICTs effectively and efficiently to extend the reach and richness of its academic offering.

This vision can only be achieved if the academic project, and not the technology *per se*, drives the initiatives. In order to formulate a strategy, the task group considered national and international higher education trends as rationale for technology-enhanced teaching and learning. The current SU utilisation of ICTs in teaching and learning was considered both on the institutional level (technology infrastructure, residential and non-residential utilisation) as well as on the faculty level (how lecturers already engage in technology-enhanced teaching and learning practice, the perceived value and impact, as well as the challenges they face and the innovative solutions found).

It is clear from both the institutional view and the lecturers' feedback that in some areas Stellenbosch University is already aligned with national and international best practice and that pockets of excellence with regard to technology-enhanced learning and teaching already exist within faculties. However, to make a quantum leap in terms of the overall institutional use of ICTs, a comprehensive and well-funded strategy is needed to build on the good practice within faculties and to address the challenges experienced in a cost-effective and sustainable manner. The strategy includes the following dimensions:

- *Teaching and learning initiatives* that include redesign of selected academic programmes/modules, assessment for and of learning, interactivity during the lecture, e-learning content and copyright, as well as ICT applications in short courses.
- *Empowering the students* to utilise ICTs in their learning activities.
- *Support for lecturers*, including workshops, discussion forums and incentives.
- *Enabling technologies* that include technology devices available to students and lecturers, technology in the lecture halls, connectivity both on and off campus, as well as security issues.

It is of the utmost importance that the University adopts a research-based and evaluative approach to the rollout of the ICT learning and teaching strategy, to ensure that the vision is reached in a cost-effective and sustainable way.

In summary, various examples of the effective use of ICTs were found in faculties and there is clear excitement to extend the reach and richness of the academic offering through the use of ICTs. This indicates that the timing for a comprehensive strategy is now more appropriate than ever before. To implement the strategy, a steered but supported approach for the redesign of a selection of programmes in each of the faculties will be most appropriate, making an investment in the enabling technology platform and providing appropriate Internet-enabled devices for both students and lecturers.

2 Vision for ICT-enhanced learning and teaching at SU

Stellenbosch University has a 21st Century ICT-enhanced learning and teaching environment that uses ICTs effectively and efficiently to extend the reach and richness of its academic offering.

This vision is based on the premise that Stellenbosch University recognises the potential value of ICTs (information and communication technologies) to transform education from the traditional methodologies and approaches to a more contemporary, open, responsive and flexible learning system. In this way, ICTs are used to improve the flexibility (*anytime* access) and mobility (*anywhere* access) of formal and non-formal programmes. The judicious utilisation of ICTs can therefore play an important role in improving the learning experience of the residential student's on-campus experience as part of a blend of face-to-face and technology-enhanced learning opportunities, as well as broadening access to higher education by offering lifelong learning opportunities to the non-residential learn-and-earn student market. In addition, opportunities arise to contribute to the "public good" by enhancing collaboration amongst academics and with other higher education institutions and organisations to expand the footprint of Stellenbosch University nationally and internationally.

This vision can only be achieved if:

- The academic project and not the technology *per se* drives the initiatives.
- There is a context-specific (re)design and customisation of programmes / individual modules to integrate the effective use of technologies. Technology applications should not simply be used to replicate or serve as add-ons to existing learning and teaching practices.
- In the redesign of the programme an optimal, context-specific blend is found between face-to-face and technology-enhanced learning and teaching methodologies to thereby capitalise on the affordances of both.
- Lecturers are supported to acquire the necessary digital literacy skills (technology and pedagogy) to facilitate learning in the digital knowledge society.
- SU students are supported to acquire the information literacy and critical awareness so that they can productively engage with the digital and knowledge society within the teaching and learning context.
- All students and staff have access to an advanced stable learning and teaching technology platform.
- The University facilitates the availability of connectivity, Internet-enabled devices, software and electronic education resources for all staff and students, on and off campus.
- The University adopts a research-based and evaluative approach to its rollout of ICTs in its learning and teaching strategy, to ensure meaningful and cost-effective uses.

3 Context statement

The future vision for the use of ICT (information and communications technology) in learning and teaching (L&T) was developed by examining international, national and local (SU) trends. Part of the context statement entails the central importance of pedagogy and how it can be enriched by ICT.

3.1 International and National Higher Education context

Within the international higher education context there is broad agreement that it is virtually impossible to address the growing international (and specifically African) need for higher education opportunities only through brick and mortar solutions. Some of the drivers and the related challenges for traditional residential universities are:

a) The need for lifelong “anywhere anytime” flexible learning opportunities to address the specific needs of the knowledge economy and 21st century employment market. This also causes a shift from a homogenous (18-24 years of age) student cohort to a more diverse group of students in terms of learning needs, age, preparedness for university education and computer literacy.

b) The high cost of residential higher education, with a greater demand for advanced studies and increased competition from non-formal educational providers, necessitates more innovative, open and borderless learning opportunities.

c) The use of information and communication technologies provides the opportunity to transform traditional methodologies and approaches into flexible learning systems that could potentially:

- Address the needs of a more heterogeneous student cohort,
- Widen access to universities to make higher education less exclusive,
- Enable a paradigm shift in terms of pedagogical frameworks to not only use ICT as add-on or electronic replication of existing practice,
- Require continuous lecturer support, and
- Impact on the type of physical learning environments within higher education institutions.

National policy documents (e.g. the Green Paper for Post-School Education and Training in South Africa, January 2012, the Draft Policy Framework *for the Provision of Distance Education in South African Universities*, May 2012 en die National Development Plan, August 2012) also confirm these international trends and focus within the South African context on the specific challenges where ICT could potentially address national education challenges:

- Increasing the low higher education participation rate and decreasing the high attrition rate,
- The provision of lifelong learning opportunities and in-service training to the so-called “*learn-and-earn*” students,
- The professional development of teachers, and
- The articulation between school and university

There is also a more specific aspect of the broader Higher Education context, namely how ICT is actually applied in national and international contexts.

3.2 National and international trends in the use of ICT in L&T

The vision for the use of ICT at SU is confirmed as well as challenged by developments at other universities – both nationally and internationally.

At the *national* level, many universities are busy with similar projects to those at SU¹:

- At all the universities from which feedback was received, central learning management systems (LMS) form the basis of the ICT offering. They renew the upgrading of existing systems and promote the better use of ICT in L&T. This includes the integration of student record systems (UP), quality assurance mechanisms (CPUT), improved e-assessment (UP and UWC) and training (CPUT).
- There are movements at the level of lecture recording and podcasting, with various systems in the pilot phase. UCT, for example, is busy with a large-scale project to be able to support the recording of lectures in most of their large lecture halls.
- Mobile learning is an important subtopic and systems to use cell phones and tablet-friendly ICT for L&T are being implemented with great success (UP).
- Wi-Fi in classrooms (UP) and the creation of special technology-enhanced classrooms (CPUT) are important initiatives.
- There also is a vision for the use of emerging technologies (largely Web 2.0² and social networks) for L&T (Wits and UWC).

At the *international* level, it can be reported in relation to English Higher Education,³ for example, that:

- All the universities still regard their learning management system as being central to the integration of ICT into teaching and learning (the systems vary from Blackboard to Moodle).
- There are world-class examples (Coventry's Art and Media Department) of the use of Web 2.0, social networks and emerging technologies for L&T.
- There is established use of e-Portfolios (particularly Bradford) such as PebblePad at some of the universities. e-Portfolios offer students an opportunity to build up proof of their learning development in an electronic format.
- The recording of lectures has been implemented at some universities (Newcastle, with Panopto) and many of the universities are planning, or are already prepared, to record lectures (Coventry, Worcester and Middlesex).
- Wi-Fi has full-strength coverage (except at Newcastle and Bradford) in most classrooms and is available campus wide (particularly in the many informal self-learning spaces that can be found everywhere on campuses and in purpose-made buildings).
- There is a particularly strong focus on the furnishing of seminar and tutorial-size learning spaces as well as purpose-made classrooms for technology-enhanced active learning or group-based learning. All the universities had examples of well-equipped spaces with computers (or computer connection points), Wi-Fi, screens on tables or against walls, with the aim of teaching more interactively according to active learning principles.
- There is a strong focus on the digital literacy of students and lecturers in the L&T strategy of all the universities. E-learning is regarded as an integral part of L&T (Newcastle and

¹ This information was obtained from a quick calibration request sent to the most important universities. There were five responses (CUT, CPUT, UP, UWC and Wits) that are accounted for here.

² Web 2.0 refers to the more recent types of websites where the user not only retrieves information in one direction, but also can send information interactively through bi-directional communication.

³ The information was obtained during a visit by SU to seven English universities in October-November 2012 in order to investigate classrooms and other learning spaces. The universities that were visited are: Newcastle, Bradford, Sheffield, Coventry, Worcester, Middlesex and Exeter.

Worcester) and ICTs as “simply” more instruments with which to support a lecturer’s teaching model.

The broad international and national perspective confirms that ICT definitely will play a cardinal role in the future of universities’ L&T offering. This includes: (a) the better facilitation of L&T; (b) easier access to the L&T offering by new students; and (c) that the initial input costs in terms of ICT will be justified by the long-term growth in non-residential student numbers, and the deepening of the offering to residential students.

All of these aspects are also under discussion at SU and will now be discussed in the local context.

3.3 Stellenbosch University context

The current focus on hope at SU, the formulation of Vision 2030, the revision of the University’s list of overarching graduate attributes, as well as its renewal of its Strategy for Teaching and Learning, make this an opportune time to generate a holistic and systemic approach, and to bring together the pedagogic, curricular, technological as well as infrastructural components in order to strengthen opportunities for teaching and learning.

There is an opportunity to enhance the University’s delivery model with the judicious use of ICT. This, however, requires careful planning and a clear strategy that is supported by all. The model could involve a more cost-effective teaching platform and the extension of the University’s offerings to a more diverse and geographically spread out population.

There is an opportunity to generate a positive image of the University as a role player on the regional as well as international stage via the greater use of ICTs for formal courses, as well as informal offerings. This includes not-for-profit community interaction.

SU was a forerunner with regard to its e-campus initiative at the beginning of the century, and now runs the risk of falling behind if it does not re-invest in hardware, the capacitation of its teaching corps to use ICTs for teaching and learning, and the meaningful redesign of its curricula and delivery methods.

There is also the risk that the University has stagnated with the use of mainly one enterprise Learning Management Support system, which, while useful, does not provide for the range and creativity available in the current era. SU runs the risk of irrelevance if it does not keep up with its students, or rather lead them by example, since the majority of students are using ICTs and social media in their daily lives.

3.4 Appropriate pedagogical integration of ICT into learning and teaching

This strategy recognises that without learning and teaching driving change, ICTs will not be institutionally relevant and effective. It is when we start at the integration of ICT into the pedagogy of learning and teaching that ICT makes institutional sense. The rationale for using ICT often comes from a global context of pervasive technology use, but this fact alone does not provide a strong enough case. What is needed is a description and vision of how ICT can be integrated into the *pedagogy* of learning and teaching.

Network technologies do enable us to retrieve vast amounts of information at rapid speeds. However, the ability to retrieve information, or the mere exchange of information, does not imply that learning has occurred. Learning assumes a critical engagement with information: the ability to analyse information, the ability to separate out the garbage from the good, the ability to recognise that all information is partial (and in what sense it is), the ability to use information in solving problems, and so on. With the vast amount of information available through network technologies, effective e-learning assumes that lecturers and instructional designers are highly skilled persons – skilled technically/technologically and pedagogically.

The epistemological labour required from lecturers in pedagogical contexts where network technologies are used will not be less demanding than what is required in traditional face-to-face

pedagogical settings (at least not initially). Lecturers would have to scaffold students in navigating vast amounts of information so as to enable them to develop the requisite knowledge and skills required within disciplines, achieve the outcomes of programmes or the graduate attributes defined by the institution. Yet, at the same time, lecturers need abilities to also encourage play, to stimulate students' curiosity, and to value the unplanned, unintended and serendipitous moments that are so important in learning. The knowledge and repertoire of skills are of course required of competent lecturers in all contexts. However, network technologies open up new ways of mediating learning, new ways of scaffolding students' learning, new ways of playing, and so on.

It is important to understand that technologies are not simply tools that we can employ to achieve particular ends as if they are objective/neutral entities. Technologies form part of mechanic assemblages in societies that serve to either control or democratise societies. At the micro-level of institution or classroom, pedagogical assemblages incorporating network technologies can therefore serve to control students (colonise desire) or serve to stimulate creativity and innovation so that the assemblages function to liberate and transform society. All education/pedagogical assemblages are multiplicities that integrate architectures (traditional or network technologies) and body parts (of students and lecturers) with brain chemistry and everything in between. It is our intention at SU that pedagogical assemblages of which network technologies form part will invigorate vectors/lines that open up new ways of learning, being and becoming.

This is a rationale that resonates with the idea that we use ICT to deepen learning and widen access by means of enabling technology infrastructure.

Apart from the pedagogy, it is also important that we look at how the development of ICT and the future plans for the shape and size of SU combine in the future. To this end one has to look at modelling growth.

3.5 Models to consider for growth in technology-enhanced learning and teaching

In order to examine the growth of technology-enhanced L&T at SU by means of modelling, a possible meaningful approach is firstly to identify a few desirable future scenarios on the basis of the University's strategy, national needs, etc. For example, Scenario 1: use ICT to serve more non-residential students; Scenario 2: use ICT to improve the teaching and learning experience of residential students; Scenario 3: use ICT for more effective assessment, and so forth. It would also be possible to sketch sub-scenarios for a specific main scenario.

As soon as the different scenarios have been characterised (e.g. in terms of target market, technology(ies), degree of difficulty, pedagogical model, expected impacts/benefits, etc.), weighting criteria (e.g. size of target market, expected income, expected expenditure, implementation time, current expertise, etc.) can be used to evaluate the respective scenarios in terms of viability and attractiveness. In this process, modelling can be used to explain the quantitative aspects of the evaluation of each of the scenarios (e.g. models for student projections, income and cost estimates can be used to estimate the expected income and expenditure of each scenario). After the evaluation of each scenario, informed decisions can be taken on the underlying priorities and desirability of the respective scenarios.

The three scenarios of the size and shape of SU by 2030 on how ICT can play a role in each of the scenarios (of which scenario b) possibly is the preferred scenario) must be used in this modelling, viz.:

- a) A fixed-size niche university (30 000 students)
- b) A two-mode medium-sized university (35 000 students)
- c) A large, broad-spectrum university (50 000 and more students)

For scenario (b), for example, ICT could be used fruitfully to technologically mediate the L&T of non-residential students for the periods when they are at work in their career environments. Their face-

to-face contact times with lecturers will then take place in block courses on the Stellenbosch campus in the December/January and June/July vacations when the residential students are in recess.

Before we can move on to what SU can do strategically further on (this is discussed in Section 5), this report will first deal with the survey that was done on the use of ICTs for L&T at SU.

4 Current utilisation of ICTs at SU

This section looks at how ICTs are used at SU from various perspectives – from the institutional to the faculties and the students. The expectations of what ICT can contribute further, as well as the challenges relating to the use of ICTs, then serve as basis for the strategic actions that are proposed later in Section 5.

4.1 Utilisation in the institutional context

Institutionally, the current use of ICTs is described in terms of applications for residential and non-residential students, the Library and the International and Postgraduate Office. A perspective on the current use of technology for L&T support at SU is also necessary.

4.1.1 Residential use

Up until three years ago, e-learning at SU was equivalent to the learning management system (LMS), called Webstudies. The options for e-learning have broadened in the meantime, although the LMS remains (at least for the next two to five years) an important part of the e-learning ecosystem. The migration of all modules from the old systems (WebCT Vista and Moodle 1.9) to the new systems (Blackboard 9.1 and Moodle 2.3 in 2013 and possibly only Moodle 2.3 in 2014⁴) creates the opportunity for a new focus to be placed on the meaningful use of the LMS for the enrichment of L&T.

The co-operative learning instruments in the new systems (such as wikis and blogs⁵), as well as the seamless integration with social network technologies (such as YouTube, Flickr and Slideshare⁶) add new value to the creation of learning opportunities that involve students in their learning.

The production of podcasts (the electronic recording and publishing of lectures and other learning opportunities on the web), the use of emerging technologies (such as Google applications and other “new” or emerging web services), as well as a focus on the offline availability of content and thinking from the perspective of mobile learning strategies (e.g. the accessibility of systems for cell phone applications and the use of tablets to promote interactivity in the class) are among the most important current ICT projects to enrich L&T.

The use of cell phones and tablets in the classroom (connected to Internet via Wi-Fi or cell phone data networks), ensuring that classrooms are brought up to standard with the relevant technology (among others to accommodate diversity such as of disability and language preference), and the fitting of multipurpose, high-quality technology-enhanced active learning e-classrooms, are among the critical projects in which ICT can make a large impact in order to improve the student experience.

⁴ Moodle 2.3 is recommended in a concurrent document, “Teaching management system follow-up evaluation and recommendation”, as the one, central LMS for SU as of 2014. The document has not yet received final approval.

⁵ Wikis are web pages that can be developed jointly by groups, and blogs are web pages that mediate considered reflections and opinions as well as comments.

⁶ These systems enable the easy dissemination of video (YouTube), photo (Flickr) and presentation material (Slideshare) over the Internet.

Although residential students comprise the largest part of the student corps, the current (and in the future potentially even bigger) focus on non-residential students is also of cardinal importance in the consideration of the use of ICTs at SU.

4.1.2 Non-residential use

A key aspect of the Stellenbosch University vision is to offer greater access to prospective students – particularly those who wish to combine a professional career with further study, the so-called learn-and-earn students. In order to support these students effectively, a unique technology platform was developed that consists of a combination of satellite,⁷ mobile, web and videoconferencing technology.⁸

The space segment that currently is purchased from Intelsat is sufficient for two channels and the studio is large enough to be divided into two, with two control rooms. It therefore would be possible to broadcast on two channels per satellite in the future. Experimentation is also under way with streaming of the signal from the studio via the Internet.

With the aid of streaming, additional target markets can be reached beyond the Africa footprint of the satellite. Using a hybrid approach (simultaneous satellite and Internet broadcasts), the University would gain a competitive advantage in the future in that both rural communities without access to broadband Internet and urban areas with broadband Internet could be reached.

The existing applications of the technology platform (some in partnerships) include: (a) Postgraduate programmes in Economic and Management Sciences, Health Sciences and Education, and undergraduate programmes in Military Science; (b) In-service training in communities and communication in companies; and (c) Additional support to high school learners and teachers in key subjects.

Further applications of the technology platform in the future could include: (a) Further extension of postgraduate support; (b) Focused workshops/short courses for learn-and-earn students; (c) Selected open access modules where there is specific expertise within the University (showcase could be MOOCs⁹ - see section 5.1.5 below for more information); (d) Co-operation with and support to other universities; and (e) Further co-operation with organisations to deliver programmes in the rest of Africa.

Both residential and non-residential L&T with support from ICT can only take place successfully if the technology infrastructure is there and always reliable.

4.1.3 Technology infrastructure

The current ICT infrastructure, which is utilised well and is extremely important for the SU model of L&T, entails: (a) Desktop computers in the CUAs¹⁰ – currently approximately 3 000 computers; (b) Laptop computers and tablets (Internet-enabled devices) for classroom and home use: currently approximately 15 000 own units registered by students; (c) Student network access on campus and at home (Wi-Fi and/or 3G): currently insufficient Wi-Fi and 3G access on campus; (d) Satellite broadcast facilities for non-residential students: see section 4.1.2 for more information; (e) Video

⁷ Space segment on Intelsat 17 with an Africa footprint is purchased directly from IntelSat and the signal distribution is done by Telemedia. There currently are 300 learning centres across the country (19 SU, 53 Medi-Clinic, 147 WCED, 69 NCED, three Free State Education Department, seven Development Bank of Southern Africa, two Edureach). All that is required to receive a signal from a learning centre is an antenna, decoder, and a TV or data projector and sound system (depending on the size of the venue).

⁸ The University has a fully equipped studio and control room, mobile camera unit, video conferencing unit and web and cell phone technology for real-time communication.

⁹ Massive Open Online Course

¹⁰ CUAs = computer-user areas

streaming facilities: currently in experimental phase, and the key to further expansion; (f) Electronic class notes and textbooks: a large number of departments already disseminate their notes in this way, but e-textbooks are still the exception, with potential for cost savings as far as printing costs are concerned (see section 5.1.4); and (g) Learning management systems and aids: capacity sufficient for on-campus access. Students' ability to gain off-campus access from where they live is problematic.

In order to not only enrich the L&T model, but also to transform it systematically, it is necessary to gradually upgrade the current technical platforms and then position them as enablers on which information and communication systems can be developed to meet the needs of a 21st century university. All information systems and knowledge sources are linked to the network and are either directly or indirectly dependent on a rapid and stable network, which currently is not always the case at SU.

ICT systems and technology have increasingly greater value if they are focused on renewal and transformation, and aligned in an integrated manner. This alignment of subsystems is incorporated into the strategic proposals in Section 5.

4.1.4 Library and International and Postgraduate Office

The Library uses technology to support access to scientific information for students and lecturers in support of L&T. Information therefore is accessible from any place, at any time and via a wide variety of user devices. In this way, ICT is used as the foundation for all the services offered by the Library to ensure that the Library remains "open" 24 hours a day, seven days a week. The Library also offers information literacy awareness and training to students.

The Library furthermore provides access to 135 online databases, more than 10 000 e-books and more than 100 000 electronic journals. In this regard there is co-operation at the local and national level to negotiate access to online databases, journals and e-books. Open access to online educational resources is a further priority, and access to the University's research and knowledge is shared with the rest of the world via SUNScholar. There currently are 50 265 items in SUNScholar (11 226 full text), comprising mainly research articles and theses.

A further new development is the purchase of e-books, which the Library makes available via devices such as tablets. This development is in line with the purchase policy for printed textbooks. In this regard the Library believes that the selection and purchase of online textbooks and learning material should be driven by the lecturers. The Library makes its expertise and advice available for the negotiation of licences, setting up of access and deciding on a purchase model.

The International Office already has a very successful portal for postgraduate students through which a variety of support mechanisms are being offered to these students. Among the challenges that could possibly be addressed further in the ICT strategy are:

- The extension of the campus-based services to off-campus students.
- The move towards more on-line offering of services.
- An integrated postgraduate calendar that draws in postgraduate study news and events in an intelligent manner and presents it to postgraduate students.

4.2 Utilisation in the faculty context

Besides for the institutional macro-context, the faculties' micro-context is also of critical importance. The members of the Task Team held focus group interviews with groups in each faculty that gave rise to important insights into the use of and challenges relating to ICT.

4.2.1 ICT learning and teaching currently being used in faculties

Learning management systems (LMS) are commonly used (although the depth of quality used varies considerably between environments). There already is broad buy-in into the LMS concept, but

different environments use different systems (Webstudies, Blackboard and Moodle). There also (generally) is positive feedback on the use of Moodle (particularly a functionality that automatically submits assignments to Turnitin to check for plagiarism). Excellent support for the service is a primary need of all users (particularly after-hours enquiries and help – possibly a 24-hour helpdesk).

There are examples of environments that are already using the broader functionalities of e-learning systems and emerging technologies (e.g. cell phone-based response systems (clickers) and/or Twitter). Then there are others who fruitfully use an integrated learning stack, e.g. use SharePoint to manage content and use Moodle/Blackboard for learning and interaction.

Course content in e-format, as well as the creation and submission of assignments in e-format (e.g. Turnitin) are supported and are experienced positively.

Regarding e-assessment: current formative and summative utilisation includes quizzes (usually in multiple choice format, with the student getting immediate feedback), assignments (lecturer provides paperless feedback), Turnitin (specifically indicates originality of work), discussion forums (peer learning and assessment), rubrics (to improve reliability of assessment and provide complete feedback to students), Scorm material (Sharable Content Object Reference Model – refers to the standard that is used to be able to use material in different systems and contexts and usually includes assessment), and cell phone-based response systems (clickers) to test the understanding of concepts using real-time formative feedback in the classroom.

4.2.2 Value and impact of ICT used in learning and teaching

There was a spectrum of opinions on the role of ICT in learning and teaching. On the one hand there were those who are convinced that the classroom and ICT are inseparably connected, while others feel that ICT only plays a supporting and enriching role. More importantly for some is that ICT should not change the corporate identity (“The Matie brand”) of SU. The SU trade mark experience of generous contact between the student and the lecturer is of critical importance and may not be lost as a result of the technological mediation of L&T.

Class time could be used more authentically for interaction (and the achievement of high-level knowledge integration through discussion) if podcasts are used to convey the more content-related knowledge. The use of clickers to improve the students’ involvement in class sessions appears promising (for example to determine on the basis of immediate feedback in the class whether most of the students understand critical concepts). This also includes the focus on being able to serve *large classes* better through e-assessment and more effective administration.

According to the majority of faculty members, a more comprehensive application of ICT in L&T will greatly strengthen SU’s esteem as a technologically advanced institution.

4.2.3 Challenges and innovative solutions in the context of the faculty

General challenges mentioned by faculty members include: (a) The overloading of champions of the use of ICT because there is not large-scale buy-in among the academics. Here it appears that bigger departments are less easily convinced (in contrast to smaller environments, where changes can be introduced more easily); (b) Uncertainty about how to introduce ICT into L&T (including the problematic nature of the use of Open Educational sources that are plagiarised, or how to use social network technology productively in the L&T context); (c) Insufficient and unreliable connectivity in the lecture halls.

Challenges facing the further implementation and extension of ICT with regard to *e-assessment* include the following: (a) Compliance with all criteria for good assessment practice and particularly security aspects; (b) Student readiness with regard to technology; (c) Competence and perceptions of staff regarding ICT-based assessment; (d) Integration of pedagogy, technology, curriculum content; (e) The development as well as integration of e-assessment design, programme outcomes and student needs.

From a faculty perspective the following need to be in place before lecturers will attempt to innovate using ICT on a large scale: (a) Technology platforms need to work excellently; (b) High-quality connectivity is of critical importance; as well as (c) Standardised classrooms with the necessary presentation technology need to be available.

4.3 Utilisation from a student perspective

Focus group discussions were also held with students. In general, the students believe that they use ICT more than the lecturers. The students also believe that the use of tablets with academic applications, for example, has started to increase drastically among them over the past year or so.

Central systems such as Webstudies are generally used with varying success (from merely storing documents to very interactively). The CUAs as well as the Library's Learning Commons play an important role in the academic lives of the students. Where there are challenges relating to issues such as the central printer service (*Safecom*), for example, the students feel very strongly that only reliable and supported systems should be implemented at SU.

The costs related to obtaining access to SU's data sources via 3G are very expensive, hence the refrains among students (along with lecturers): "Create a favourable and supported ICT platform for us and we will react positively to it" and "Start with proper Wi-Fi coverage on the campus and in the classrooms".

As far as classes are concerned, the students will react positively to lecturers who make an effort to integrate ICT. According to the students, the lecturers will realise quickly that it is meaningful to use technology, thereby making classes relevant and interesting and ensuring class attendance. One of the biggest plus points of the use of ICT in the classroom is that richer and more meaningful notes can be taken (for example with a tablet with an application that synchronises the taking of notes with the recording of the class). However, there also are skills issues, since students do not always know when to stop taking notes and just listen (or to refrain from being connected to social networks).

The students' answers to *Which three things would you change to promote the learning experience at SU?* are very insightful and include: (a) Proper campus-wide Wi-Fi coverage at a good speed; (b) Uncapped use with a fixed cost Internet model; (c) A user-friendly application to support being a student at Maties; (d) Including a tablet computer with the registration package (a student could select not to take it), with Maties applications that help students; (e) More network drive space for students; (f) Better integration of the use of ICT between lecturers and students; (g) Access to the Internet and network from where you live; and (h) Positive messages from lecturers about ICT use.

5 ICT expansion strategies and focuses for SU Vision 2030

On the basis of the SU future vision, the context statement and current use of ICT at SU, strategic proposals for expansion and investment are now made. A significant investment in staff time and funding will be necessary initially to move SU forward rapidly. This will include reconsideration of L&T initiatives in general, a focus on the skills of students and lecturers, as well as the creation of a favourable and supportive technological environment.

The ICT in L&T Task Team purposefully wrote the following sections of the plan in a less philosophical and more action-oriented manner in order to offer a multitude of options that could be implemented systematically. Precisely how each one plays out and which actions are meaningful will have to be decided in consultation with the faculties, because the ability to carry them out often depends on the context and the teaching programme.

5.1 Learning and teaching initiatives

The proposed strategies and focuses start with the L&T initiatives in order to establish the principle that it is this aspect that is the driver of change, and not first of all the technology. ICT offers many

possibilities, but does not replace the more important requirements for *L&T renewal* at SU, which includes adaptations in pedagogical approach (starting at the programme level), assessment, interactivity in the class, as well as the role and content of short courses and open access to SU expertise.

5.1.1 Reconsideration on programme level (programmes/modules)

In order to ensure the sustainability and continuity of the integration of ICT into L&T it is necessary to start with a reconsideration of the use of ICT in targeted programmes in faculties. The faculties will decide which programmes are best suited to the integration of ICT into the respective modules. It is essential that a systemic process is followed at programme level, and that the expansion of ICT is not simply done on an uncoordinated, “per-module” basis. A phased approach will probably be used so that ICT is rolled out systematically from the first year to the senior years of the programme. There could also be a piecemeal deepening of the use of ICT on the basis of the content of the module, such as increased inclusion of e-content (e-textbooks, podcasts, vodcasts, simulations, interactive tablet/computer applications, etc.), more forms of e-assessment and greater interactivity during lectures. In the annual ICT expansion evaluation some form of scorecard should be used to determine to which extent the respective ICT elements have been taken into use.

This approach has specific benefits from a teaching programme perspective:

- It is not necessary to rely only on the early adopters to do the development work, as it is done in team context at the programme level. In this way more lecturers are exposed to the use of ICT in L&T.
- Training and support can be tailor made for the particular academic programme. The team of lecturers who present the programme can then design the work sessions specifically for the needs of the programme.
- The phased approach implies that, if one starts in Year 1, the continuous feedback on the effectiveness of the use of ICT can be used in the planning of the subsequent years.
- The scorecard with regard to the extent of integration of the various ICT elements is an important instrument to measure progress in the use of ICT in a specific faculty.

Although this strategy has clear benefits, continuous support should also be given to the early adopters / champions who are already integrating ICT into modules that might not be part of the targeted programmes. The point of departure is that most modules should show basic ICT integration, but that there might be a few modules (particularly at the beginning) that are targeted for development towards ICT excellence to serve as examples and pilot projects for the meaningful use of ICT.

From a module perspective, the following frameworks and steps can be used for the design of technology-enhanced modules:

- Lecturers decide which aspects of the module are only content and which are the higher cognitive learning aspects of the module.
- With regard to aspects relating to content: Lecturers decide which components are complex enough to rather present in a lecture contact session and which elements the students will be able to master through self-study (e.g. from hard copy sources, other module hand-outs, e-books, content on module websites, content of other Internet sources, MOOCs, etc.).
- With regard to the higher cognitive aspects of the module: The lecturer decides which learning material will be made available in addition to that which he/she presents in the class, e.g. Internet sources.
- The lecturers uses online assessment exercises that student have to complete before the contact session to address basic knowledge on the subject. The lecturer should have a measure to verify which students have in fact completed the online (formative) assessment.

- If specific software applications are required for a module and formative assessment is meaningful, these should be made available and the security issues need to be addressed.

Because assessment is such an important subdivision of the L&T strategy, it is discussed in greater detail in the next section.

5.1.2 Assessment for and of learning

ICT can be used for effective assessment if it complies with all the criteria for assessment, if the staff are willing and competent, if the infrastructure and resources are available, if the benefits are clear and if it serves the teaching and learning strategy of SU. The benefits of ICT for assessment lie particularly in (1) assessment *for* learning (e.g. formative learning opportunities in which the student learns through assessment, such as a quiz or rubric feedback, for example) and (2) the assessment *of* learning (summative assessment). The results of the assessment for and of learning opportunities will also inform other L&T initiatives, e.g. curriculum design and student support (mentors, tutors, tutorials). Further benefits include the optimisation of staff time, increased fit between teaching and assessment modes, and increased student involvement and responsibility for learning.

The following actions are proposed:

- Future utilisation could include the further use of ICT in peer assessment; formative and summative assessment and feedback; utilisation of rubric instruments to give feedback to large numbers of students, simulations, self-assessment, management information systems for the monitoring of student progress and the use of visual media for assessment.
- The assessment policy's guidelines for e-assessment should also be investigated and adjusted again in order to be able to undertake successful and secure assessment (formative, but particularly summative).
- The matter of security during opportunities for e-assessment (formative and summative) needs to be given specific attention (see section 5.4.4).

Besides the enrichment of programmes and modules through renewal of the curriculum and particularly of assessment, ICT can also be used fruitfully to promote interactivity in the class.

5.1.3 Interactivity in the class

In order to improve the depth of the L&T offering to residential students, it is necessary to focus on the promotion of interactivity in the class. Interactivity is also of cardinal importance for non-residential students who get together to learn in virtual classrooms. ICT can assist in this process.

There are already lecturers who make use of very effective cell phone-based response systems (clickers) to encourage interactivity, for example. Others use tablets for wireless presentation, as well as other cell phone applications (such as Twitter) to get students involved during learning opportunities. During the satellite broadcasts of lectures, the sms system is used to promote interaction between the lecturers in the studio and students in the respective learning centres.

To encourage these uses and further interactivity during lectures (residential and non-residential), the following are proposed:

- Focus on the further development of special applications (*apps*) for tablets and cell phones for classroom interactivity.
- Optimise venue layout and equipment for the promotion of interactivity (particularly Wi-Fi access – see sections 5.4.2 and 5.4.3).
- Make the necessary technology available to lecturers and students to be able to use it meaningfully in L&T (see section 5.4.1).
- Training of lecturers in the effective integration of technology in the classroom in order to improve interactivity.

A further essential aspect for the renewal and enrichment of modules and programmes is the creation and use of appropriate and more e-learning content.

5.1.4 e-Learning content and copyright

There already is widespread use of a variety of e-learning content at SU. To promote the further use thereof, the following actions are planned:

- Formulate and communicate a clear rationale for the use of e-content that includes a clear definition of what e-content is, what the different types of e-content describe, the possible benefits as well as the potential stumbling blocks of their use.
- Identify at least two pilot projects per faculty within the programme context in which experimentation is undertaken with different types of e-content.
- Participate in the ASAUDIT e-textbook pilot project along with PASA (Publishers Association of South Africa) to make more learning content available to students electronically.
- Investigate the possibility that the Library negotiate with publishers to buy one copy of an e-textbook with a licence through which students then have access to it.
- Investigate a joint platform (content management system) for the storage and distribution of e-text material (e.g. in ePub format) with a facility that automatically converts existing documents (Word, PowerPoint, Excel) into e-Pub format.
- Develop special applications to download class notes and e-textbooks to a laptop computer and/or tablet.
- Investigate a communal secure platform on which podcasts/vodcasts can be made available for distribution on campus and off campus.
- Investigate the possibility of making infrastructure available in some lecture halls so that lecturers can record lectures, archive them and make them available to students.
- Formulate policy/principled standpoints with regard to the recording of lectures by students and other student-generated content.
- Plan a policy/strategy to give students and lecturers affordable access to academic electronic sources, for example on Coursera and other open educational resources platforms.
- Formulate and communicate clear copyright guidelines to lecturers

5.1.5 Short courses and open access to SU expertise

Short courses are not only important for the learn-and-earn market, but can also be used successfully to share knowledge between universities, to be a showcase for the unique research expertise at the University, as well as to provide additional support in critical skills to students as preparation for as well as during their studies. In this regard the following actions are planned:

- Investigate how ICTs can be utilised to enhance short course offerings as professional development courses in a more cost-effective way for a broader target group outside the University, while promoting lifelong adult learning
- Create a seamless process to share advanced modules (3rd year and honours/master's) between universities based on the expertise available in academic departments
- Target disciplines or research expertise that is unique within the University and showcase parts of the courses as OERs¹¹ and/or as MOOCs.¹²

¹¹ Open Educational Resources

¹² Massive Open Online Course

- To promote access with success, consider different levels of preparatory courses in core subjects (maths, computer science, computer skills, economics, writing) for school learners to complete before they enrol at University
- Use the *graduate attributes* as guideline to compile a list of short courses on generic skills, e.g. writing skills, coping with different scenarios (e.g. encountered in motivations for re-admission), survival short courses (e.g. finances, balancing various commitments) that can be made available to all levels of students.

Building on the idea of short courses, SU has the further opportunity to showcase and give targeted open access to some of its expertise. This can be in the form of MOOCs, for example. With the wealth of information available through the Internet, there is a growing need for turning information into knowledge through the “World’s best courses, online, for free” (see Coursera initiated by Stanford University and Princeton via www.coursera.org), which are available “for anyone, anywhere, anytime” (see edX of Harvard University, MIT and University of California, Berkeley via www.edx.org).

The advantages of ICT for open access to the SU knowledge base are that:

- students may study in their own time, at their own pace, at their chosen level of understanding/learning using their most suitable study method
- there are no physical space restrictions on the number of students enrolled for the course
- students enrolled for the course may interact and possibly collaborate with students from all over the world enrolled for the course
- students are exposed to the best lecturers in the world for a particular course
- students/lecturers may enrich an existing face-to-face course at various levels

Further challenges for the implementation and expansion of ICT for open access to the SU knowledge base are:

- identification of courses that draw on the distinct/unique expertise at SU
- quality control, allocation of credits, assessment
- facilitating meaningful real-time interaction between the lecturer and the students
- enhancing learning/understanding from the identification of key concepts to the development of deep and enduring understanding.

In line with the idea that SU’s priority is deepening the quality of campus-based programmes and widening access to non-residential programmes on a 100% subsidy model, the suggestion is to experiment with one or two MOOC-type courses, and not that it should in any way become a mainstream offering.

5.2 Empowerment of students for the use of ICT in learning and teaching

The assumption cannot be made that all students necessarily are technologically literate. It further needs to be borne in mind that, although students use technology for social interaction and recreation, this does not necessarily mean that they can also use technology successfully in learning and teaching. Special attention therefore needs to be paid to:

- A strategy to ensure that all students are in fact technology literate.
- A strategy to formulate the elements that are essential for the successful use of ICT in L&T (e.g. the use of electronic resources, the formatting and display of academic discussion in a discussion forum as part of a module).

Further support to students will include the updating of systems to keep track of student progress, feedback on students’ requests for advice and consideration of how all the existing support services can be provided to off-campus students as well.

5.3 Support to lecturers for the effective integration of ICT into learning and teaching

The effective integration of ICT into learning and teaching depends to a large extent on the lecturer's vision, skills and buy-in into the process. This strategic division therefore puts the focus on the critically important aspect of support to lecturers through the entire process. A few proposals are made.

5.3.1 Workshops, discussion forums and support

Regarding workshops, the following four models¹³ are proposed:

- Tailor-made workshops aimed at the integration of ICT into a specific programme.
- Presentations, demonstrations and "hands-on" sessions to discuss the latest trends with regard to the integration of ICT into L&T.
- e-Learning short courses over a longer period of time and at the end of which the participants receive a certificate.
- e-Learning partnerships¹⁴ in which participants receive time and funding for a year or two to develop and research a specific idea.

The sharing of good practice and examples within departments and faculties remains an integral part of the strategy in terms of which a lecturer sees a colleague in action in relation to the use of ICT for L&T. In this regard, discussion forums within the context of a discipline on the variety of appropriate uses of ICT are very important. A number of champions were identified during the visits to the faculties who will be able to share their experiences within faculties during the initial rounds.

In the execution of all these actions it will be important to not only focus on the use of face-to-face workshops, but also to use ICT to facilitate the workshops and discussion forums.

Support in the form of additional funds, as well as human resources, is important to ensure specifically that the strategy with regard to the integration of ICT at programme level is successful. Investment in the initial development of targeted technology-mediated modules is important because the human and financial resources are not necessarily in place in departments to support these types of initiatives. In the process, clear guidelines for and discipline-specific examples of well-designed curricula that integrate ICT should be developed to facilitate the further integration of ICTs.

The Centre for Teaching and Learning will provide support for advice and training with regard to the integration of ICT into the curriculum. It is proposed that at least one person is appointed, and in the larger faculties even more than one person, to assist lecturers in the process of ICT renewal on a practical level.

5.3.2 Incentives

While the early adopters are prepared to experiment with the use of ICT without any incentives as a result of their intrinsic motivation and conviction of the potential value of ICT to enrich the learning experience of the students, the reality is that incentives will have to be provided for the majority of lecturers. The following actions are planned in this regard:

- Integrate the development of ICT skills as part of the work agreement and development plan of lecturers.

¹³ The first three models are already being presented by the Centre for Teaching and Learning and now need to be broadened further. The partnership idea has to be developed from scratch.

¹⁴ Fellowships in line with the current learning and teaching partnerships of the Centre for Teaching and Learning for which lecturers can apply. These partnerships can be aimed specifically at the integration of ICT. There are examples overseas from which we can get advice.

- Acknowledge successes in the annual performance appraisal process with an incentive in terms of best practice, scholarship, curriculum design and leadership.
- Promote the scholarship of and research on the use of ICT in L&T as a discipline by focusing on the underlying aspects of ICT approaches in order to find a match between the theory and the practice, as well as research-based feedback and the sharing of good practice at the SOTL conference and HELTASA, for example.
- Integrate questions on the effective use of ICT as part of student feedback at programme level.
- Annual competition in which students can nominate the best implementers (lecturers) of ICT who are shortlisted to find three winners, who will receive prizes.

Among the most important considerations for lecturers are time and incentives. Lecturers need to be granted space within their busy schedules to develop ICT-supported modules and programmes.

All the planning and actions will stand or fall largely on the basis of the robustness of the ICT infrastructure, as well as the necessary support. Specific strategies and action plans in the sphere of technology will now be scrutinised.

5.4 Technology perspective

In order to enable all the L&T initiatives and the focus on the empowerment of students and lecturers, a favourable and supportive infrastructure is of cardinal importance.

5.4.1 Technology in the hands of the student and the lecturer

From the interviews with lecturers and students it became evident that it is essential to put the correct technology in the hands of the student and lecturer so that they can function effectively within the ICT environment. Students increasingly have their own laptop computers, smartphones and tablets, but provision needs to be made for students who do not personally have the technology.

In this regard the following actions are proposed:

- Marketing and communication of recommended personal ICT device for optimal functioning on the SU campus.
- Financing of technology in the student's hands.
- The facilitation of laptop purchases.
- The facilitation of tablet purchases.
- The design of a business model for safe lock-up facilities with recharge power points on campus for the students' electronic equipment.

In the interviews with the faculties it became clear that students often have access to newer technology than the lecturers. To ensure that lecturers have the appropriate technology, the following actions are planned:

- Special offers to encourage lecturers to obtain the necessary ICT equipment
- Training courses to become familiar with the equipment

5.4.2 Learning spaces

The equipping of lecture halls is of cardinal importance if lecturers wish to use technology during lectures and thereby promote interactivity (see section 5.1.3). It is also necessary to take a look at the broader understanding of learning spaces (i.e. not just the technology aspects) and to incorporate these into L&T strategic planning. In this regard the following actions are proposed:

- Optimise the large lecture halls and also those with the highest frequency of use according to modern standards for ICT-supported L&T.

- Develop a roll-out strategy for the optimisation of all learning spaces, including the compilation of standards for podcast recordings.
- Develop classroom environments to make provision for a reality in which students and lecturers will use their own technology and can expect it to work.
- Determine a strategy to make live streaming possible from a select group of classrooms.
- Undertake a pilot project with web conference technology such as Lync to offer interpreting services to students. The benefit of this type of technology is that the lecture can be recorded at the same time for later streaming.
- Create special spaces, as part of the ICT renewal process of one or two programmes, where ICT is integrated into the learning space completely. This should permit the concept behind the Den Bosch experimental classroom to ripple outwards by tailor-making it for a specific programme's newly integrated ICT approach.

5.4.3 Connectivity on and off campus

Connectivity, both on and off campus, remains an essential prerequisite for the effective use of ICT in L&T. The lack of sufficient 3G / Wi-Fi connectivity in lecture halls was also highlighted during the faculty visits as one of the biggest stumbling blocks in relation to the use of ICT. In this regard the following actions are planned:

- Install Wi-Fi in (a) some open spaces of academic buildings on the Stellenbosch and Tygerberg campuses; (b) the support service buildings; (c) some preferential classrooms; and (d) residences.
- Negotiate cost-effective access to the learning management system and e-sources for students via the 3G network of all cell phone providers and a continuous reduction in Internet costs. This includes improved 3G coverage on campus.
- Make broadcasts from the Telematic Services studio available via both satellite and the Internet.

5.4.4 Security

As ICT is increasingly integrated within the L&T processes, it will be essential to pay close attention to the challenges related to the electronic security of the technology platform within which all information systems are managed. A task team is already busy finalising a policy framework for all information systems, specifically also addressing the electronic security risks associated with ICT for L&T.

In this way, for example, a policy on the protection of information on end-user equipment and media has already been compiled and the technical and user implications of its implementation are currently being analysed before it is put into operation. This will help manage the risk should mobile technology be lost or stolen.

Cheating in ICT-enabled learning and teaching (e.g. with regard to e-assessment as well as plagiarism) is always a possibility and a threat if there are security shortcomings and the student then manages to exploit these to his/her benefit.

Various actions are currently being undertaken to ensure electronic security and prevent cheating:

- Identity and access management for all information systems, and specifically also learning management systems, is already happening effectively, but needs to be improved to make provision for new technology and new methods of work. AT SU, the security upgrade is currently taking place within the Identity and Access Management (IAM) project.
- Special security controls and the configuration of computers in the CUAs is already being done during e-assessment sessions, thereby decreasing the risk that cheating can take place.
- Turnitin is also used as an Internet-based service to test the originality of a document against Internet sources and databases. Not only is Turnitin used to identify cheating, but the results

can be used by the student to identify similarities to existing sources, and formative assessment can also be used to help teach students how to avoid plagiarism and improve their writing.

Various actions are provided to improve security. A few of these actions are:

- Technical setup of the computer and/or tablet that typically limits the functionality of the device at the time of e-assessment. Various products have been developed over the past few years to improve this security and these can also be used to manage the security associated with mobile technology. The endpoint apparatus is managed remotely and testing is done continuously to ensure that the configuration of the computer/tablet is not being fiddled with. However, all technology must be registered centrally so that it can be managed according to a predetermined profile. Only computers that are registered may be used during examinations. The effectiveness of this method will still need to be tested fully.
- Revision of existing policy and procedures (e.g. assessment policy) and further intensification to prevent students from bringing additional electronic devices, such as smartphones, to the examination venue for the purpose of cheating. This naturally is an existing risk during traditional examinations, but now is becoming more difficult to control as the use of ICT increases.
- An investigation of biometric identification that offers increased security in that students have to be identified electronically for access to systems. This could contribute to increased security, but is not necessarily useful for off-campus students.

The security challenges relating to ICT in L&T will probably never be addressed in full, particularly when e-assessment has to be done off campus. However, the value of continuous assessment and real-time feedback to students generally outweigh the challenges regarding the management of e-assessment and cheating.

6 Implementation of the strategy

6.1 Prioritisation of actions

It is proposed that a working group be compiled under the leadership of the Vice-Rector (Learning and Teaching) to examine, in co-operation with the faculties, which programmes are most suitable for the integration of ICT. In this regard it would be possible to build specifically on the examples of good practice that already exist in some faculties, as well as new initiatives. Concurrently, the working group will also have to prioritise, in terms of impact and costs, which actions should be launched first to systematically extend the success of ICT utilisation at the programme level. A realistic balance will have to be found between the available funds and the time and project scope to achieve the vision as set out, and to keep it aligned with the institutional objectives.

6.2 Describing and evaluating the impact of ICT-enhance learning and teaching

As the implementation rolls out, it will be essential to continuously measure the progress and impact of ICT incorporation in L&T. When describing and evaluating the impact of ICT-enhanced teaching and learning at SU, two related levels will be identified. For each level, the aspects on which there will be an impact will be identified. The impact on each of these aspects will be addressed with the development of indicators, research questions, and data collection instruments (e.g. questionnaires, interviews, observations, reflective reports).

One has to make a distinction between monitoring activities that are more business as usual and on-going, and more evaluation and research-based activities that are less regular and more targeted. We want to know whether the good things are happening, but also want to become aware of new challenges and difficulties that are encountered as we proceed.

6.2.1 Indicators on programme level

At the programme level (interfaculty, interdepartmental), six aspects can be identified with indicators/outcomes:

Impact on the **curriculum** in terms of

- Declarative knowledge (what concepts, structures, properties and how, where appropriate, learning thereof can be facilitated with ICT)
- Procedural knowledge (what processes, algorithms, etc. and how, where appropriate, learning thereof can be facilitated with ICT)
- Levels of learning (knowledge, comprehension, application, analysis, synthesis, evaluation) that can be enhanced by ICT
- Connections, where possible, with the outside world
- Availability as a short course for broader target group

Impact on **pedagogy** in terms of

- learner-centred
- co-operative and collaborative
- active learning
- access to and identification of valuable information
- balance between face-to-face instruction and discovery learning

Impact on **assessment** in terms of

- Feedback – in-class and out-of-class, on-line or traditional
- Reflection and an opportunity for improvement
- Guidance through a discussion forum

Impact on the **learning environment** in terms of

- building knowledge
- authentic assessment and active learning - explore real-world problems
- engaging students by motivating and challenging
- increasing productivity of students
- providing scaffolding to support higher-level learning
- increasing learning independence
- promoting collaborative and co-operative group work
- tailoring learning to student
- overcoming physical disabilities

Impact on **lecturers** in terms of

- role of lecturers (range: lecturer as focus of learning to lecturer as facilitator of co-operative learning)
- ICT literacy measured in terms of
 - o perception along x-axis with dislike, comfortable, enthusiastic
 - o knowledge and skills along y-axis with expert, adequate, inadequate (acquired from ICT short courses)
- workload and productivity (= educational outcomes / cost)

Impact on **students** in terms of

- role of students (range: students as passive learners to students as active, independent, responsible learners)

- ICT literacy measured in terms of
 - perception along x-axis with dislike, comfortable, enthusiastic
 - knowledge and skills along y-axis with expert, adequate, inadequate (acquired from ICT short courses)
- support to employ full range of learning/thinking skills within authentic contexts (knowledge, comprehension, application, analysis, synthesis, evaluation/interpretation)
- effective learning, realising full potential
- success in achieving goals and in developing a range of learning/ thinking skills

6.2.2 Indicators on institutional level

At the institutional level, four aspects can be identified with indicators/ outcomes:

A **vision** (comprehensive, long-term) for ICT-enhanced teaching and learning

- At institutional level
- At programme level
- At faculty level
- At departmental level

ICT infrastructure aligned with educational goals and standards

- access to on-line resources (what and how)
- access to appropriate ICT (hardware, software)
- networking for learning communities
- connectivity
- venues (lecture rooms, seminar rooms, Library) facilitating ICT for teaching and learning

In-service and pre-service **training**

- on-going technical support during implementation
- short courses on appropriate pedagogy, developing skills, broadening knowledge, moving to a positive attitude

Management **support**

- time for lecturers to plan and learn effective integration of ICT into teaching and learning
- policies and practices (integrating into teaching and learning policy, assessment policy, incentives as part of performance evaluation and reward system, copyright of material, equity of access and experience)
- learning management system
- supporting lecturers in their administrative tasks – integrated student study record management system

6.2.3 Measuring the impact of ICT-enhanced learning and teaching

At the programme level, the impact of ICT on teaching and learning should not be measured in isolation, but rather as enhancing teaching and learning.

Lecturers may start with a few indicators, adding more in subsequent years.

For each indicator, the key data/feedback that could be obtained from the lecturer and from the students includes:

- in what way (descriptive)
- to what extent (qualitative)
- how often (qualitative)

The collection of this data could be done through a questionnaire, interviews, observations and reflective reports.

Experts in the student feedback office and/or CTL could interpret this data and provide a report (similar to what is done currently for student feedback).

6.2.4 Measuring the impact on infrastructure

It should also be fairly easy to measure the progress made in terms of ICT infrastructure in the learning environments. For example, in the table below, ICT1, ICT2, etc. can be a series of technological features that the SU divisions for Facilities Management or IT are able to provide. Within a planned ICT enhancement strategy for SU's L&T venues, SU will be able to track progress and know which venues can be used for more advanced ICT usages.

	ICT 1	ICT 2	ICT 3	ICT 4	...	
Venue 1	✓					
Venue 2	✓					
Venue 3 . . .		✓				

Columns labelled with available ICT from basic to most advanced

Rows labelled with venues, as they are equipped with ICTs

For each indicator use ✓ for implemented, use 0 for inappropriate, and use ? for work in progress.

7 Comments in conclusion

In a recent publication, “An avalanche is coming – Higher education and the revolution ahead”,¹⁵ the authors make a convincing case for the fact that worldwide, higher education is at the point of changing radically. They use the metaphor of an avalanche and come to the logical conclusion that one thing that one does not do when an avalanche is approaching is to stand still! They quote David Puttnam, who said the following in a talk at the Massachusetts Institute of Technology in June 2012:

[I]t’s ... tragic because, by my reading, should we fail to radically change our approach to education, the same cohort we’re attempting to “protect” could find that their entire future is scuttled by our timidity.

This strategic report is a significant step in the greater process to renew Stellenbosch University so that the statement above does not become true in our context. The following steps will be to enter into agreements with the faculties, compile specific project plans, to budget for extra human resources (support service and academic) and infrastructure, and to carry out projects with disciplined measurement of progress.

¹⁵ Barber, M, Donnelly, K, & Rizvi, S 2013. *An avalanche is coming: Higher education and the revolution ahead*. London: Institute for Public Policy Research.