*International Journal of Education and Development using Information and Communication Technology* (*IJEDICT),* 2010, Vol. 6, Issue 1, pp. 5-13

# Defining innovation: Using soft systems methodology to approach the complexity of innovation in educational technology

**Glenda Cox**
**University of Cape Town, South Africa**

## ABSTRACT

This paper explores what educational technologists in one South African Institution consider innovation to be. Ten educational technologists in various faculties across the university were interviewed and asked to define and answer questions about innovation. Their answers were coded and the results of the overlaps in coding have been assimilated into a definition. Soft systems methodology (SSM) was used as a method to make visible the complex nature of innovation in educational technology in one setting. The initial definition formed the 'situation definition' in SSM terms. The method proved useful in producing a picture (based on rich pictures drawn by each person) and a root definition (based on CATWOE, a mnemonic that enables the interviewer to ask each participant to identify processes and role players). Participants discussed changes in processes, structures and attitudes at the institution.

## THE CONTEXT

The work of the Centre for Educational Technology (CET) at the University of Cape Town (UCT) has shown that there are pockets of innovation occurring across the institution-these need to be identified, showcased, acknowledged and assessed. As a staff developer it is essential to be aware of these innovations but in the rapidly changing landscape where technology is ubiquitous it is more difficult than a few years back to track these developments. It is important because the role of CET is to promote the effective use of educational technology and if we are not aware of innovative use we cannot share examples and help staff to find the best solution to their teaching challenges.

In 2003, when our unit launched our first staff development project at our institution, the idea of using online learning environments (OLE) was still a relatively new concept as it was in many other institutions around the world. Now in 2009 we have one centrally supported OLE (as opposed to three or more) and to date have approximately 4100 course sites. We aspire to have all academics who would benefit from using technology in their courses, and their students actively participating online and we are still trying to achieve this goal. Including an OLE in a course is no longer innovative for much of the university although there are still departments who are not teaching online. Our emphasis has begun to shift, and it is not so much about convincing people of the benefits of using technology but rather how it is used to enhance teaching and learning.

## THE PROBLEM

Why is it important to study innovation? An understanding of the nature of innovation will enable educational technologists (ET's) to identify and showcase it in order to share ideas, and inspire colleagues with the goal of enhancing student learning. Indeed, it has been noted that learning technology community need to be more expert at "selling' the benefits of innovative use of technology in practice" "given the need achieve large-scale uptake of successful innovations

within our organizations (Porter 2005). In the case of CET, the findings of this research will provide a strong basis for the organization to make the case for support for innovation in educational technology in the form of resources, processes and recognition. .Studies have shown that the full potential of educational technology innovations are not achieved without senior management and organizational support ( Laurillard 1994, Phillips 2005).

The first step in this process is to find some kind of consensus as to how ET's define innovation. Phillips (2005) in his study of factors affecting the uptake of educational technology in higher education concludes that " care is needed to define precisely what is meant in discussions about educational technology" ( p. 547). Ten practitioners (including educational technologists and others working in the field of computer science) from various faculties of the university were interviewed to find out: What counts as innovation in the current educational technology landscape?

In the literature, innovation is defined in generic terms, for example, one definition is as follows: "…the real essence of innovation is fresh thinking that leads to value creation…".Vijay Vaitheeswaran (2007). But there appears to be no definition that applies specifically to educational technology. Rowan and Bigum (no date) discuss the common criteria for measuring innovation and from their point of view the most crucial measure for innovation is "…will it improve the educational experiences of a diverse student group…" Both these examples are useful but they are not specific enough and so in this paper we define innovation in terms of educational technology.

This research has been planned in five phases, the first phase being to interview educational technologists. The second is to interview academics identified by the educational technologists as innovators, the third to get feedback from students on these courses, the fourth to interview administrators (For example in the planning and innovation offices) and the fifth is to set up a way of monitoring and tracking and sharing innovative ideas across campus. Thus we have identified different stakeholders that can be categorized at different levels: Students-clients, academics at the chalk face, educational technologists supporting academics (middle management), and Administrators who represent the institutional view.

The work reported here represents the first phase: the analysis of part of the transcriptions of 10 open question interviews using standard interview techniques and testing Peter Checkland's Soft Systems methodology (SSM) as a way of approaching the complex views surrounding innovation in Educational Technology. SSM is designed to be a starting point in a process of debate and negotiation around the situation that is being analysed.

This research highlights the problems and contentions around innovation, and as educational technologists, (and in the authors case a staff developer) we need to resolve these issues and form purposeful activity (to use SSM terminology) to overcome these obstacles.

## EDUCATIONAL TECHNOLOGY TODAY

Salmon (2005) describes educational technology (ET) as having gone through two stages: the first was when 'learning technologies' were used as a new way of doing something familiar - some aspects of teaching moves online but essentially no underlying assumptions about

pedagogical approach are changed. For example a learning management system is introduced and this in itself is considered an innovation. The second phase is when technology is used in new ways not previously possible in the classroom and learning technology combines with traditional approaches to "meet new objectives and purposes of teaching and learning." : This second phase is in progress at many universities at present, including our own but it is complex and involves change at the individual practice level and possibly also at the institutional level if exciting innovations are identified as possibilities for many faculties.

Salmon (ibid) stresses the lack of institutional learning about the thousands of isolated examples of innovation because in the UK experience (as is our own) where there is little or no reward, recognition and support for systematic change or experimentation.

The result is a basic use of OLE's to post notices and store lecture notes. Many lecturers do not move beyond this point without specific help and do not see the pedagogical ability of educational technology (Cox 2008, Deacon & Jaffer 2008). "Learning technologies are not transparent" and cannot in themselves achieve learning benefits - to do that you need support and pedagogical input (Salmon ibid).

The areas that Salmon (ibid) suggest should be researched now include the identification and promotion of "excellent sustainable, transferable practice and models of change related to human intervention and sustainability:"

**PARTICIPANTS**

Interviews were conducted with 10 key individuals in the educational technology field. Five were members of the Centre for Educational Technology at the University of Cape Town. The others included academics from Computer Science, Information systems and technology support staff from Humanities and Health Sciences. These individuals were chosen because of ~~to give~~ a range of experiences across the institution. It seemed from our experience running staff development workshops across faculties that ideas of innovation would vary.

The majority of these participants are middle management and many are change agents. Here is a list of how some of them encourage innovation:

1) A head of department who has used personal funding as an incentive for his students to implement innovation using technology;
2) A computer scientist who inspires students through his own testing of innovation and supports them in their attempts to attain funding to innovate
3) Humanities faculty IT manager who led the way in using blogs in her teaching
4) Educational Technologist who has worked with colleagues to raise external funds to research and promote Open Education Resources.

The initial Interviews also included questions around the theme of innovation in ET and each person was asked to give examples of academics who are using technology in innovative ways in their teaching, how they would assess the effectiveness of an innovation, and if they had any ideas on how to monitor or track innovation across the institution (these aspects are not covered here).

**METHOD**

All seven stages of the of Soft systems methodology were used. Soft systems methodology has been developed over the last 40 years (Checkland 1990, 2006a & b). It was developed at Lancaster University as part of an action research programme. It emerged when Checkland and other researchers started out using Hard systems methodology and found it was inadequate for dealing with 'messy' human problems where the social realities and different perspectives of participants were complex. The first two stages involve defining the situation and this is completed in two ways (See Figure 1). Each interviewee is asked to define innovation and draw a 'rich picture' of the innovation and its complexities at their institution. A 'rich picture' "...is a good way to show relationships; in fact it is a better medium for that purpose than linear prose" (Checkland 2006b). The third stage is to develop a root definition based on the rich pictures and Peter Checkland's "CATWOE" mnemonic: C: Customer (also Beneficiary from Bergvall-Kareborn et al. 2004); A: Actor; T: Transformation process; W: worldview; O: owner and E: environmental constraints. One of the criticisms of SSM is that it is too simple upfront (Houghton & Ledington 2002). The method often used upfront is a focus group. To counter this, individual interviews were done first to get different perspectives.

Group discussions where used from Stage four onwards. Two 2-hourly focus groups were held. Stage four included building conceptual models of systems described in root definitions (See Table 1). Stages five and six involved having all the individuals interviewed in one room to compare models to the real world (Stage 5), and Stage 6 suggest systemic changes which would result in action ( Stage 7) to improve the situation.

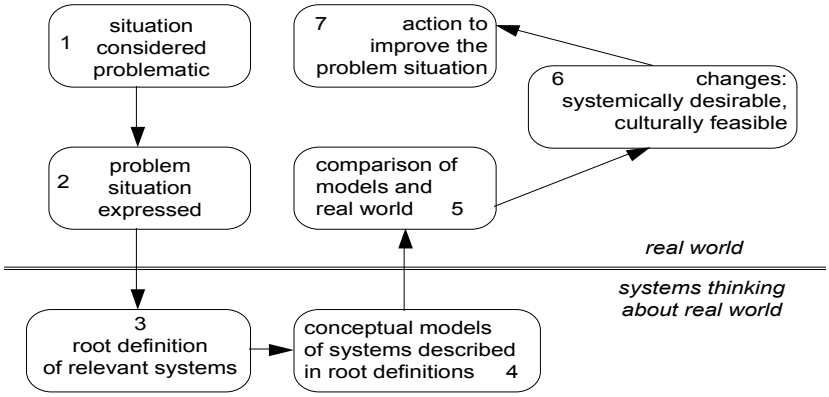


***Figure 1**: Adapted from Checkland, P. 1981. Systems thinking, systems practice.*

**RESULTS**

In the interviews, the educational technologist were asked to define innovation. There was no time to prepare a simplified definition but rather they were asked to reflect on terms and key words they felt should form a definition. The transcriptions of the answers to this question were read repeatedly by the author and key phrases and words identified. This text was uploaded into NVivo qualitative software and the phrases and words were coded across all the answers to look for repetition and patterns. Here is a list of the results: new (6), change (4), solving problems (4),

context (4), useful (4) improve student understanding of content (3), using an existing tool (2), adds value (2), innovation of processes (2), clever (1),low cost (1), mutually beneficial (1), creative (1), cutting edge (1), effective (1), efficient (1), qualitative and quantitative change (1), smart (1) and sustainable (1).

If we consider the most repeated phrases and words as a definition it would look something like this:

> "Innovation can be defined as a new and useful way of solving existing educational problems, for example, improving student understanding of content. The innovation does not have to be a new tool, it could be in the changing of the way an existing tool is used. Importantly any innovation needs to be understood in terms of its context, for example, what is new in a third world university may not be new in a first world one"

All interviewees were asked to draw a diagram of how they viewed innovation in the institution. They were asked to draw them with no preparation as a "rich picture" and an example of this was given to them. I have used the various aspects highlighted by the interviewees in these pictures and combined them into a picture of innovation at our institution (Figure 2).

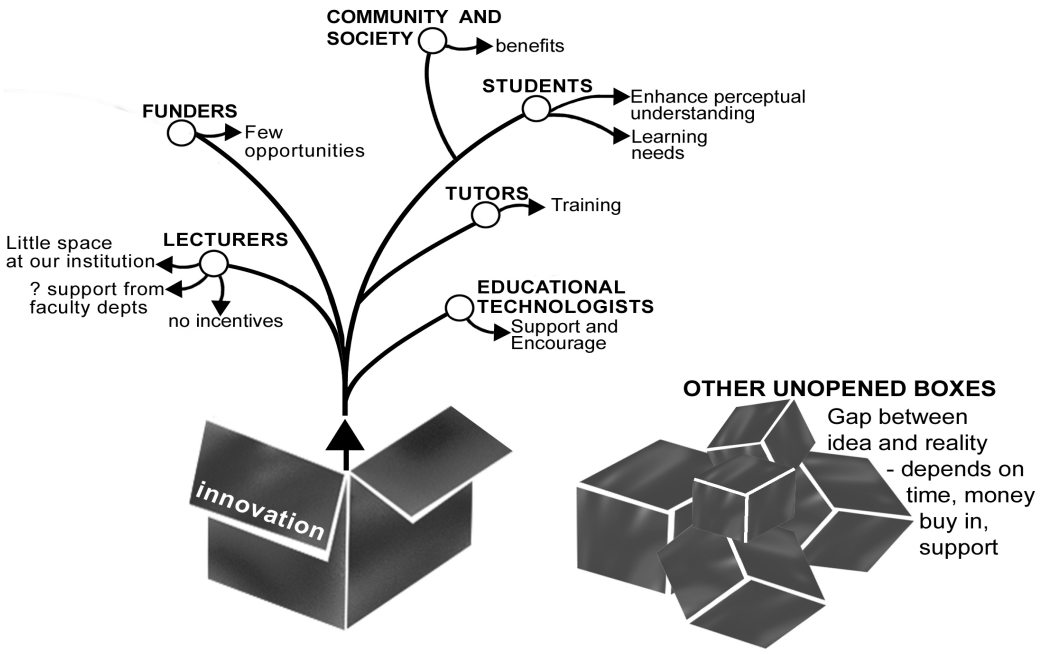


***Figure 2**: Innovation in the institution*

Participants gave similar answers for the different aspects of CATWOE. Almost all of them said that the "*Customer*" was the student and the lecturer, although 4 said the student only. The "*Actors*" were identified as being the lecturers, who were also referred to as change agents and people with original thought. Two talked about the developers or educational technologists working with the lecturers. Most stated that teaching and learning would be "*transformed*" through innovation. "*Worldviews*" varied as expected some examples are; improve throughput and most spoke about enabling deeper learning. The "*owner*" was also clearly a complicated

issue where variation occurred some said the lecturers and /or the developers but others felt that ownership could lie with management of the institution. All agreed on the " *constraints*": time, money, lack of reward, insufficient infrastructure, a lack of buy in by colleagues and limited funding opportunities (see Table 1)

***Table 1****: Sample of results of 'CATWOE" analysis illustrating three worldviews chosen for models.*

| CATWOE | Participant A | Participant B | Participant C |
|---|---|---|---|
| **Customer (beneficiary, victim)** | student | students and lecturer and employer | student |
| **Actor** | academics and students | facilitators-educational technologists | teachers, academics, developers, those who paid for it and those who make sure it works |
| **Transformation process** | innovation should improve student learning and also teaching | transform lecturer and student understanding of knowledge- gives the opportunity to look at the same information in different eyes | an innovative idea using something technological to meet an educational need |
| **Worldview** | improve through put | innovation should enable deeper learning | innovations must enhance the teaching and/or learning experience |
| **Owner** | academic but can also be developer | university- department, those who currently own the content | neutral objective person often higher up in bureaucracy |
| **Environmental constraints** | time, money, RFJ | time and money, lack of incentives | primary constraints:<br>1) time,<br>2) buy in from lecturers and 3) money<br>secondary constraints: computer labs, bandwidth |

Three models were chosen from the root definitions. These were chosen by the author and represent three very different 'worldviews', that innovation must result in improved through put (Participant A in Table) and it must enhance teaching and learning (Participant B) and it must be aligned with educational needs(Participant C) .

Participants were divided into three groups and they were required to 1) fill in a detailed matrix and 2) debate how the model they had been given differed from the real world situation and 3) how that model would behave if it were placed in the real world. The models stimulated debate and strong worldviews emerged. The aim of this exercise according to Checkland (2006b) is "to

find a version of the real situation and ways to improve it which different people with different views can nevertheless work with…".

The final stage of this research can only be realized when all the stakeholders have been interviewed. However the suggestions made by the participants positioned around three elements ( according to SSM); changes to structures, changes to processes and procedures and changes to attitudes highlight key aspects about the challenges outlined earlier that our insititution (and others) face around learning about the innovation that exists (Checkland 2006a).

Table 2: Stage 7 changes proposed by individuals in the Educational technology field

| **structure** | **attitudinal** | **process** |
|---|---|---|
| flexibility in bureaucracy | less democratic/less committees | time structures |
| institutional support/incentives | understand nature of innovators | clarity of process with positive and negative incentives |
| parallel structured resources | help innovators to help others | |
| one person accountable for innovation across the institution | | |

The table includes a summary of the key changes that emerged from the second focus group. These changes involve some interesting contradictions as they are the result of different views, as Checkland (2006b) says, this final stage should involve accommodation and not consensus. Thus there is a need for flexibility in structure as well as structure in process. It seems there is a need for both clarity and simplification.

**DISCUSSION**

We know that there are tensions between setting and formalizing systems across an institution while still allowing flexibility so that academics feel they are not forced into a particular route (Czerniewicz and Brown 2009). This centralized –decentralised tension between the the organisational need for standardization and the individual academic's need for maximum flexibility has been well documented (see for example Agre, 2000 ) The results of Stage 7 of Checkland's SSM highlight these tensions.

Despite a number of constraints identified in both the picture and the root definition there are many examples of innovation at our institution. Institutional reward systems are not going to change in the near future. In the meantime it is our role, as educational technologists and staff developers, to find a way of tracking and encouraging those who are starting innovations as well as those who have been innovating for some time. Cummings et al (2005) explain the importance of middle managers in what he calls the 'middle out approach' to change management as opposed to top down or bottom up approaches. At Murdoch University in Australia (Cummings et al. 2005: p. 15) it was the middle management champions who identified "…the problem or the need for change…" at this institution and they developed solutions and initiated change.

As the study of innovation at our institution is expanded it will become clearer whether in fact we have a true 'middle out approach' as defined with characteristics outlined by Cummings et al. (ibid). At this point it appears we do have a 'middle out approach'. We have no clear senior management leadership; and innovation using technology is not centrally funded, nor is there sufficient infrastructure. Cummings et a. caution that for the 'middle out approach' to work change needs to be adopted by the whole university and 'this requires an administration open to evidence-based proposals and willing to take on and to fund partially implemented changes' (p.16)

## CONCLUSION

All outcomes (definition of innovation, rich picture, root definitions and proposed changes) are valuable and have given the author a much clearer idea of how educational technologists view innovation. The next step is to interview the other stakeholders. The definition is informative but will be more powerful when the author gets feedback from others in the field. The picture provides a practical visual to open areas of interest and concern. It was predicted that individuals would have different worldviews and this will be explored in further research. What is particularly revealing was the varied views on who the owner of an innovation should be. This feeds into the lack of institutional support and positioning of teaching innovation in the structure of the University. This is a key finding that will be explored in more detail.

## REFERENCES

Agre, P. E. 2000. "Infrastructure and Institutional change in the networked university". *Information, Communication and Society,* vol.3, no.4, pp.494-507.

Cox, G. 2008. "Enablers and barriers, intentions and use: Faculty take-up of an online learning environment", *Proceedings of 3rd international conference on e-Learning*, Cape Town 26-27 June.

Bergvall-Kareborn, B., Mirijamdotter, A. & Basden, A. 2004. "Basic Principles of SSM Modeling: An examination of CATWOE from a soft perspective". *Systemic Practice and Action Research*, 17(2), 55-73. http://www.springerlink.com/content/h714910425033h52/?p=202e1b4f67ba43eaa8ea215accb0a7bb&pi=1

Checkland, P. 1981. *Systems thinking, Systems practice*. Chichester: Wiley &Sons

Checkland, P. & Scholes, J. 1990. *Soft systems methodology in action*. Chichester: Wiley & Sons.

Checkland, P. & Winter, M. 2006a. "Process and content: two ways of using SSM". *Journal of the Operational Research Society*, vol.57, no.12. http://www.palgrave-journals.com/jors/journal/v57/n12/full/2602118a.html

Checkland, P. & Poulter, J. 2006b. *Learning for Action*. Chichester: Wiley & Sons.

Cummings, R.,Phillips, R., Tilbrook, R & Lowe, K. 2005. "Middle- out approaches to reform of University teaching and learning: Champions striding between the 'top-down' and the 'bottom-

up' approaches", *International Review of Research in Open and Distance Learning,* vol.6, no.1, pp.1-15.

Czerniewicz, L & Brown, C. 2009. "A study of the relationship between institutional policy, organizational culture and e-learning use in four South African universities". *Computers and Education,* vol.53, pp.121-131.

Deacon, A. & Jaffer, S. 2008. "Collaborative learning designs for postgraduate writing interventions". *Proceedings of 3rd international conference on e-Learning*, Cape Town 26-27 June

Houghton, L. & Ledington, P.W.J. 2002. "The evolution of confusion: Soft Systems Methodology and social theory revisited". *Australian Journal of information Systems*, vol. 9, no.2, pp.75-83. http://dl.acs.org.au/index.php/ajis/issue/view/11

Laurillard, D. 1994. "How can learning technologies improve learning?" *Law Technology Journal*, vol.3, no.2, [Online]. Retrieved from http://www.law.warwick.ac.uk/ltj/3-2j.html

Phillips, R. 2005. Pedagogical, institutional and human factors influencing the widespread adoption of educational technology in higher education. In *Balance, Fidelity, Mobility: maintaining the momentum? Proceedings of ASCILITE,* Perth 2005, pp.541-549

Porter, S. 2005. "Issues in the relationship between technology and practice". *ALT-J, Research in Learning Technology*, vol.13, no.3, pp.231-240.

Rowan, L & Bigum, C (no date). "Innovation Chains: Possibilities and constraints for critical perspectives on computers, difference and quality innovation". Discussion Paper, Faculty of Education, Deakin University.

Salmon, G. 2005. "Flying not flapping: a strategic framework for e-learning and pedagogical innovation in higher education institutions". *Research in Learning Technology*, vol.13, no.3, pp. 201-218. http://dx.doi.org/10.1080/09687760500376439

Vaitheeswaran. V. 2007 'Special Report: Innovation', *The Economist*. http://www.economist.com/specialreports/displaystory.cfm?story_id=9934754

Contact details: Glenda Cox, Center for Educational Technology, University of Cape Town, South Africa. Glenda.cox@uct.ac.za

---