VICTORIA UNIVERSITY OF WELLINGTON
Te Whare Wānanga o te Ūpoko o te Ika a Māui

NZ E-Learning Capability Determination

Determination of New Zealand Tertiary Institution E-Learning Capability: An Application of an E-Learning Maturity Model

Literature Review

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Project Objective

Developing, through the practical application of international research and standards, a set of e-learning process standards and a capability determination model that are then applied to inform New Zealand TEOs of ways of effectively improving their capability to deliver and support e-learning.

Project Background

The project was founded on an attempt to develop tools for the management of e-learning which were informed by the success of process maturity approaches in software engineering (Paulk *et al.* 1993a; El Emam *et al.* 1998; SPICE 1995). This work has resulted in a model described as a "e-Learning Maturity Model" or eMM (Marshall and Mitchell 2002; 2003; 2004) which combines the SPICE framework with a set of practices derived from the educational literature.

Organisational Management of E-Learning

E-Learning has come to dominate the strategic thinking of both institutions and Governments over the past decade. This has been driven by the perception that increased use of technology will improve the quality and flexibility of learning (Bush 1945; Ryan *et al.* 2000; Bates 2001; Cuban 2001; DfES 2003; Oppenheimer 2003) combined with a changing focus on learners rather than teachers and institutions (Oblinger and Maruyama 1996; Buckley 2002; Laurillard 2002).

Despite this emphasis on e-learning, it is clear that models for successful deployment and ongoing success have not yet been identified (Phipps 1999; Ryan 2002; Zemsky and Massy 2004). Even with the large amounts of money being spent, it is not clear that any improvement in student learning outcomes has been identified (Conole *et al.* 2000; Taylor 2001; GAO 2003). The situation has been further complicated by the belief that e-learning was going to inevitably result in structural changes to the education sector (Katz 1999; Cunningham *et al.* 2000; Ryan 2002; Zemsky and Massy 2004) in line with other technology-induced panics (Cuban 2001; Oppenheimer 2003).

Part of the explanation of the lack of clear success in e-learning is likely to be the complexity of the problem of deploying the new approaches (Kenny 2001; Radloff 2001) as the projects usually involve multiple disciplines and different types of expertise (Inglis *et al.* 1999), mixed in an environment with significant tension between technology, pedagogy and organisational concerns (Reid 1999; Laurillard 2002).

The need to ensure that the organisational aspects of e-learning are supported as well as the pedagogical and technological is now being recognised (Ryan *et al.* 2000; Bates 2001) and

this includes an understanding of the wider, systems, context that e-learning is situated within (Laurillard 1997; Ison 1999; Laurillard 1999; Peters 1999) and the need for strategic direction and collaboration (Hanna 1998; Reid 1999). As well as pedagogy, there is now an understanding of the need to consider resource utilization (Karelis 1999), sustainability (Strauss 2002; Young 2002), scalability and reusability (Bain 1999, IEEE 2002; Boyle 2003) and management concerns (Laurillard 1997; Reid 1999).

Process Capability Maturity

The eMM derives its underlying theoretical foundation from the insights learnt in the field of software engineering. Software engineers identified that ad-hoc processes were weakening the ability of software organisations to deliver effective and high quality software (Paulk *et al.* 1993a). This resulted in the development of the Capability Maturity Model or CMM (Paulk *et al*. 1993a; 1993b). This model provides both a roadmap for improvement of process capability and a means of benchmarking organisations for both comparative and planning purposes. An important characteristic of the CMM is that it does not depend on the technical details of the process inputs and outputs, but rather focuses on the ability of the organisation and individuals to be effective (Humphrey 1994). This independence has seen the CMM extended to support human resource activities (Curtis *et al.* 2001).

The CMM has been found effective in supporting the transfer of good practice between projects (Herbsleb *et al.* 1994; Lawlis *et al.* 1995) and in answering the questions (SECAT 1998):

- Is the organisation successful at learning from past mistakes?
- Is it clear that the organisation is spending limited resources effectively?
- Does everyone agree which problems within the organisation are the highest priorities?
- Does the organisation have a clear picture of how it will improve its processes?

Consideration of the CMM approach lead to the initial ideas behind the current research (Marshall and Mitchell 2002), however this has been superceded by later work (Marshall and Mitchell 2003; 2004) that builds on the related SPICE (Software Process Improvement and Capability Determination) framework (SPICE 1995).

SPICE differs from the CMM in that it organizes the capability determination around five areas derived from research and validation trials conducted in the 1990s (El Emam *et al.* 1998). These five areas are listed in table 1. Modification of these in the eMM (Marshall and Mitchell 2004) has resulted in a similar set focused on e-learning (table 2). Capability in each of these areas is assessed over a number of practices at six levels (table 3), resulting in a tabulation of strengths and weaknesses in SPICE that reflect the diversity of drivers of effective practice. This view of capability, richer than that provided by the CMM, helps benchmark performance and guide decision making (Marshall and Mitchell 2004).

Process category	Brief description
Customer-Supplier	Processes that directly impact the customer
Engineering	Processes that specify, implement, or maintain a system and software product
Project	Processes that establish the project, and co-ordinate and manage its resources
Support	Processes that enable and support the performance of the other processes on the project
Organization	Processes that establish the business goals of the organization and develop process, product, and resource assets which will help the organization achieve its business goals

Table 1: SPICE version 1 process categories

Process category	Brief description
Learning	Processes that directly impact on pedagogical aspects of e-Learning
Development	Processes surrounding the creation and maintenance of e-Learning resources
Co-ordination	Processes surrounding the oversight and management of e-Learning
Evaluation	Processes surrounding the evaluation and quality control of e-Learning through its entire lifecycle.
Organisation	Processes associated with institutional planning and management

Table 2: eMM Process Categories

e-Learning Maturity Model: Levels	
Level	**Focus**
5: Optimising	*Continual improvement in all aspects of the e-Learning process*
4: Managed	*Ensuring the quality of both the e-learning resources and student learning outcomes*
3: Defined	*Defined process for development and support of e-Learning*
2: Planned	*Clear and measurable objectives for e-learning projects*
1: Initial	*Ad-hoc processes*
0: Not performed	*Not done at all*

Table 3: Levels of process capability

A risk of models such as the eMM, SPICE and CMM is that organisations become focused on achieving high levels in the model as a goal in itself and the approach is not without its detractors (Bach 1994), although these have been countered (Curtis 1994; Paulk 1996; 1999).

Effective E-Learning Practices and Standards

One of the reasons why uncertainty remains over the effectiveness of e-learning and its impact on student learning outcomes (Conole *et al.* 2000, Taylor 2001) is that the body of research supporting e-learning is weak and subject to methodological flaws (Phipps 1999; Mitchel 2000; Conole *et al* 2004). Despite this weakness, substantial amounts of money has been invested (GAO 2003) and a large amount of work is being undertaken to define standards for more (table 4). Examination of successful projects has suggested that some formality of project management is necessary for success (Alexander and McKenzie 1998; Kenny 2002) but the proliferation of standards without a stronger understanding of what drives successful e-learning has been subject to criticism (Boyle 2003; Olivier and Liber 2003; Blandin 2004; Friesen 2004).

For a document to be a standard, a recognised national or international standards body must issue it (ISO/IEC 1996). In comparison e-learning is dominated by guidelines and heuristics (table 5). These include the influential seven principles (Chickering and Ehrmann 1996; Graham 2001) and the Quality On the Line benchmarks (IHEP 2000; Hagner 2001). These guidelines have the benefit of being informed by expert opinion and experience, but at the cost of lacking empirical support (Phipps 1999; Mitchel 2000; Conole *et al.* 2004) and they have a focus on inputs rather than on outputs such as student learning (Twigg 2001). Despite these limitations, this collection of standards and guidelines reflects the current level of understanding amongst e-learning practitioners.

Table 4: Prominent e-learning standards

Standard	Description	Source	Further information
Resource Discovery - Metadata			
Dublin Core	Interoperable metadata standard and vocabulary. Widely referenced by other metadata instances. Includes the DC-ED extension for educational materials.	DCMI	http://www.dublincore.org/
LOM-1484-12-1	IEEE Standard for Learning Object Metadata	IEEE	http://ltsc.ieee.org/wg12/index.html
IMS LRM	Reference implementation of the IEEE-LOM-1484 standard	IMS	http://www.imsglobal.org/metadata/
CanCore	The Canadian Core Learning Object Metadata Application Profile is based on the IEEE LOM and IMS Learning Resource Metadata and is customized for Canadian use	CanCore	http://www.cancore.ca/indexen.html
SingCore	Based on the IEEE LOM and IMS Learning Resource Metadata specifications and is customized for Singaporean use	ECC	http://www.ecc.org.sg/cocoon/ecc/website/standards/singcore.standards
EdNA Metadata	A subset and customization of the Dublin Core intended for use the Australian context	EdNA	http://www.edna.edu.au/metadata
Microsoft LRN	Implements IMS content packaging and metadata and SCORM standards	Microsoft	http://www.microsoft.com/elearn/support.asp
UK LOM Core	UK Learning Object Metadata Framework. Application profile within LOM-1484-12-1 customised for UK use.	CETIS	http://www.cetis.ac.uk/profiles/uklomcore
Systems Interoperability			
IMS Enterprise	Specification for transferring data about people and groups within an enterprise for HR, student records, training, and library systems.	IMS	http://www.imsglobal.org/enterprise/
IMS Learner Information Profile	A specification for recording information about students and teachers for interoperability between internet learning systems.	IMS	http://www.imsglobal.org/profiles/
IMS Content Packaging	A specification for packaging and transferring learning materials and their structure	IMS	http://www.imsglobal.org/content/packaging/
IMS Question & Test Inter-operability	An XML language describing questions and tests that supports the transfer of tests, questions and results between systems	IMS	http://www.imsglobal.org/question/
ADL SCORM	A reference architecture for an e-learning platform combining interrelated specifications	ADL	http://www.adlnet.org/index.cfm?fuseaction=scormabt
Miscellaneous			
IMS Simple Sequencing	Supports the authoring of learning experiences by allowing the description of navigation pathways through a collection of learning activities	IMS	http://www.imsglobal.org/simplesequencing/
IMS Learning Design	Specification to describe learning scenarios for reuse or transfer between systems	IMS	http://www.imsglobal.org/learningdesign/
AGRs	The Aviation Industry CBT Committee Guidelines and Recommendations are standards for the delivery and interoperability of e-learning for aviation	AICC	http://www.aicc.org/pages/aicc3.htm

Table 5: Pedagogical quality standards and guidelines

Teaching, Learning and Technology Group	Seven Principles	http://www.tltgroup.org/programs/seven.html
Council of Regional Accrediting Commissions and the Western Cooperative for Educational Telecommunications (WCET)	Guidelines for the Evaluation of Electronically Offered Certificate and Degree Programs	http://www.wiche.edu/telecom/Guidelines.htm
Western Cooperative for Educational Telecommunications (WCET)	Principles of Good Practice for Electronically Offered Academic Degree and Certificate Programs	http://www.wiche.edu/telecom/projects/balancing/principles.htm
American Distance Education Consortium	ADEC Guiding Principles for Distance Learning	http://www.adec.edu/admin/papers/distance-learning_principles.html
Instructional Telecommunications Council (ITC)	Quality Enhancing Practices in Distance Education	http://www.itcnetwork.org/quality.html
The American Federation of Teachers (AFT)	Distance Education: Guidelines for Good Practice	http://www.aft.org/higher_ed/downloadable/distance.pdf
National Education Association (NEA), Blackboard Inc. and the Institute for Higher Education Policy (IHEP)	Quality on the Line: Benchmarks for Success in Internet-Based Distance Education	http://www.ihep.com/quality.pdf
IMS Learning Design	Specification to describe learning scenarios for reuse or transfer between systems	http://www.imsglobal.org/learningdesign/
Southern Regional Education Board	Principles of Good Practice	http://www.electroniccampus.org/student/srecinfo/publications/principles.asp
Australian National Training Authority	Flexible Learning Toolbox	http://www.flexiblelearning.net.au/toolbox/
FuturEd, Community Association for Community Education (CACE) and the Office of Learning Technologies (OLT) of Human Resources Development Canada (HRDC)	Canadian Recommended E-learning Guidelines (CanREGs)	http://www.futured.com/pdf/CanREGs%20Eng.pdf

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