Changing Practices in the Development of Digital Resources

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ABSTRACT

The scale of investment in new technologies by learning organisations now generates e-learning projects whose long-term success is no longer independent of the character and structure of the host organisation. Organisations expect an efficiency that will allow their investment to generate impact beyond the lifetime of any individual project. To achieve this successfully requires an organisational shift in the processes and practices associated with an innovation. Linking process with practices opens the way for generating measurable and specified change in terms of human and organisational behaviour. This can be set in the context of a production or content life-cycle.

The e-Learning Maturity Model (eMM) provides a first step in being able to identify process and practice sets that may be associated with individual educational-technological innovations, such as adopting a content management system (CMS). The question is how to approach managing the changes that adopting a CMS will bring? eMM can provide a framework to help identify stakeholders in both old and new practices, to identify and agree information flows and dependencies as well as ownership and use of artefacts and information and the scope of responsibilities. This approach, fully consistent with established socio-technical approaches to organisational management and driven by the capacity for shared understanding provided by high level modelling, provides a promising way of embedding new practices in e-learning.

The HEA Pathfinder project at the University of Manchester builds on Manchester's benchmarking pilot in which eMM was trialled under the constraints presented by UK Higher Education. This included its ability to assess high-volume data representing sub-organisation level units (such as individual faculties) and specific organisational functions, rather than being based primarily on data generated by projects that are considered to be representative of an organisation. This ability to use eMM as a tailored tool provided the basis for its use in identifying and constructing new processes and information flows relevant to the introduction of new technologies.

KEYWORDS

Benchmarking E-learning, Practice Change, Quality Enhancement, Digital Resources, Content Lifecycle.

INTRODUCTION

The scale of investment in new technologies by learning organisations now generates e-learning projects whose long-term success is no longer independent of the character and structure of the host organisation. Organisations expect an efficiency that will allow their investment to generate impact beyond the lifetime of any individual project.

Petch et al (2006) describe the persistent limitations of successful embedding of e-learning within Higher Education Institutions in spite of better project management and greater knowledge of the aspects of e-learning, implying that the experience is not unique to the educational sector:

> Success in an organisation is however integrally linked to the structure and organisation of its environment. It cannot be entirely the objective of a limited duration project. To be successful a project must have impact on the organisation, on the people within it and on the way they work. This requires detailed knowledge of the organisation and engagement with key stakeholders as well as an understanding of how project outcomes can be brought in to an existing structure. It also requires an organisation that is capable of being sufficiently responsive and able to accommodate successfully designed developments into its structure within normal resource constraints. For change to be engineered successfully from projects therefore requires an organisation-wide approach that encompasses all aspects of e-learning. (Petch et al:2006: 273)

The authors indicate how adaptations to Marshall's (2005) e-Learning Maturity Model (eMM) can offer a practice-oriented evidence-based benchmarking tool that can help achieve the knowledge of the organisation that is required. The adaptations described primarily consider how to take account of a wide institutional evidence base that is not specifically project oriented, and how the eMM can be adapted to include local variations and newly emerging practice without losing the benefit of international comparability or overall integrity of the model as a whole.

Calverley and Dexter (2007) further describe how combining change-management techniques with benchmarking and process modelling, offer an approach to improving the embedding, longevity and practice for e-learning innovations in Higher Education Institutions.

This paper considers two approaches that can extend the use of eMM beyond its original concept of whole institution capability assessment. The eMM Pilot results indicate that it is possible to provide e-learning capability assessments for organisational sections that are smaller than whole institutions. Conversely, this suggests there is merit in examining how the eMM practice-base can be used to

generate improvements related to a given working or development area within a Higher Education Institution.

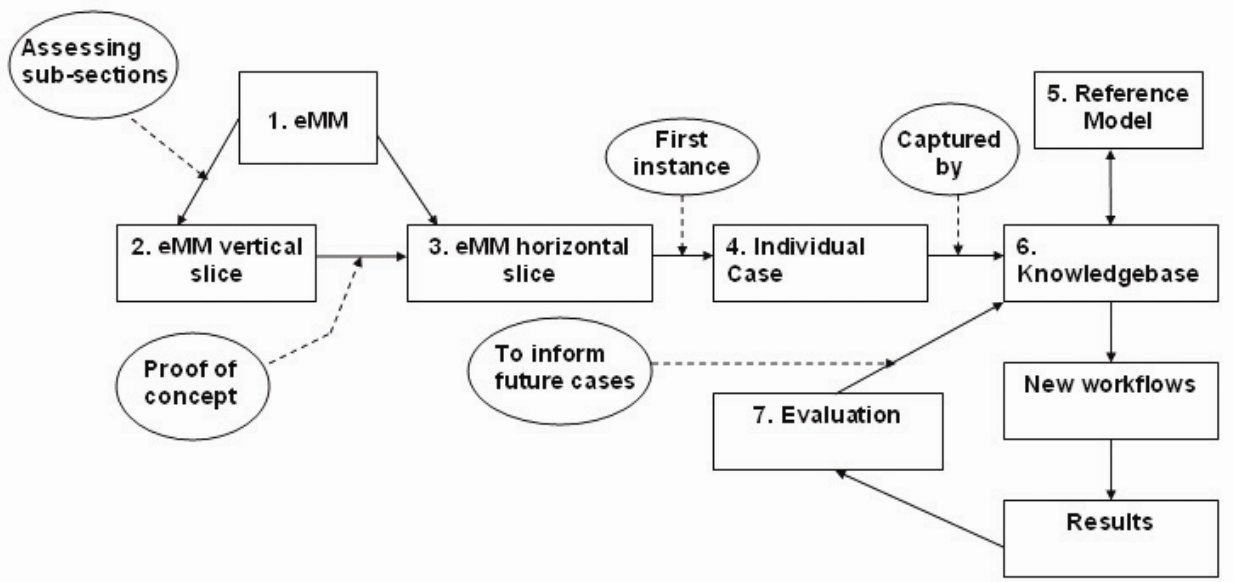

Figure 1: eMM implementation workflow

Figure 1 shows a schematic representation of the work done by the team at Manchester in delivering the project. Each part of the diagram is described in this paper, providing the background and rationale for the work and anticipated progression of the project.

The e-Learning Maturity Model (eMM)

eMM was developed at the University of Wellington, New Zealand by Stephen Marshall and Geoff Mitchell (Marshall and Mitchell 2002) and was derived from Carnegie Mellon's Capability Maturity Model, a tried, tested and established model developed in the software industry. The eMM method is based on gathering evidence about the many and interdependent processes in the e-learning and student lifecycles and takes a holistic view of maturity, addressing multiple aspects. eMM is process-driven and technology independent.

eMM is based on processes that occur within an organisation i.e. aspects of what an organisation does. These are grouped into categories, process areas, which contain distinct but related processes. The five process areas contain 35 separate processes, each of which comprises a set of practices.

Each Process has five different dimensions that can be assessed using evidence of an organisation's current capability in carrying out a particular process. The dimensions are not hierarchical but should be considered in a holistic way, with capability in one dimension not dependant on capability in a lower dimension.

For the purposes of benchmarking an organisation's capability in e-learning, evidence is taken from representative projects or courses and mapped directly to practices that have been identified against different process dimensions. An organisation's capacity for carrying out the practices can be established both from the evidence itself and further discussion based on the context of that evidence. The results are aggregated for the sample projects and represented as a block of colour on a Process matrix, with darker shading representing greater capability in that dimension (Figure 2.) In this way, an easily interpretable schematic of an organisation's capability can be achieved and a benchmark established.

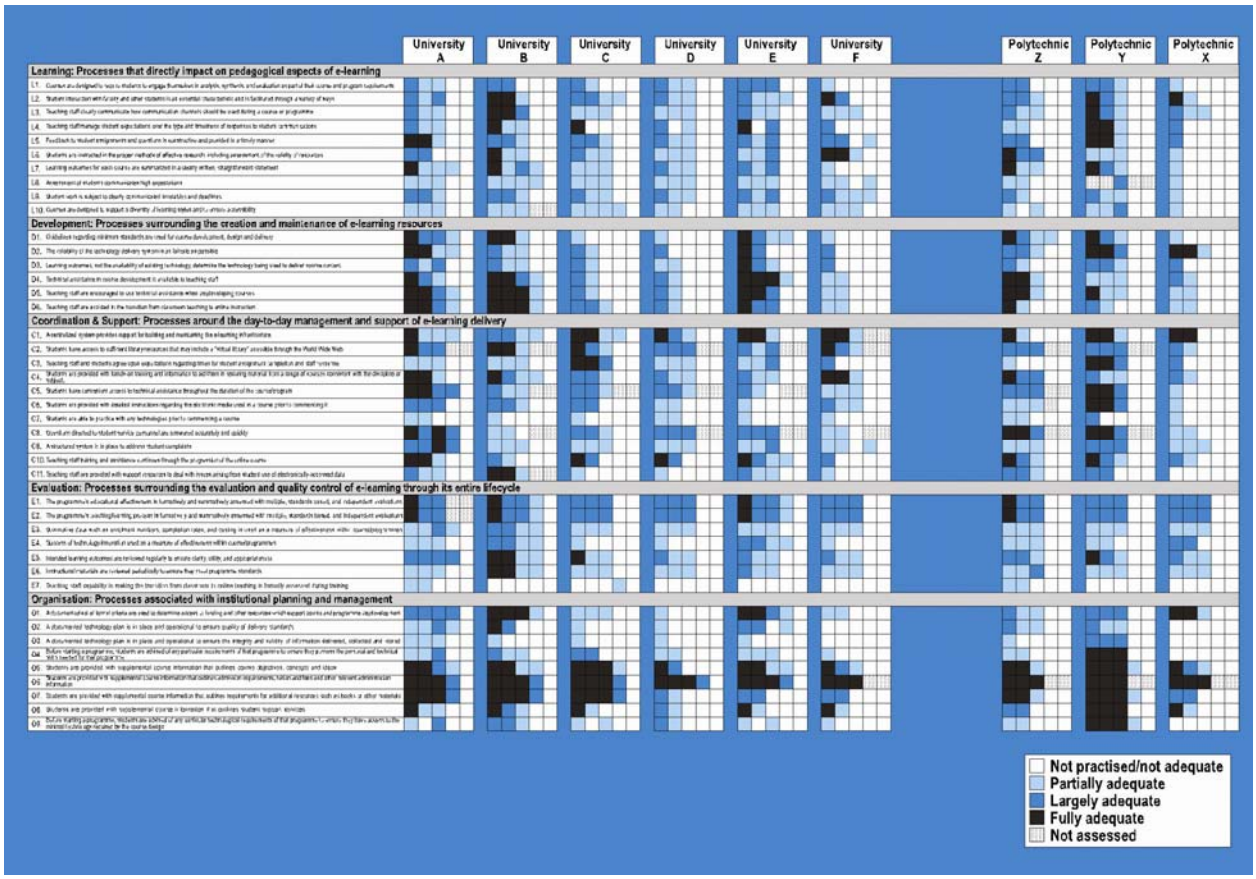

Figure 2: A typical results matrix from an eMM organisational wide assessment based on project level evidence collection (from Marshall 2006).

Assessing organisational sub-sections by vertically slicing eMM

While eMM is primarily designed for whole organisation benchmarking, subsequent work by the team at the University of Manchester has indicated how eMM can also be used to examine sub-sections (e.g. individual faculties or schools) of a large organisation while taking account of the range of central functions available to the individual sub-sections.

The restriction defining the smallest sub-section that can be assessed will be where there is insufficient evidence to indicate whether or not a practice is occurring for that

unit of the organisation. To some extent this will depend on how and where the evidence is generated within and for a particular organisation. For example, if a stated practice is demonstrated at a faculty level but complete evidence is not available at school level, even though the school benefits, it is unlikely that assessment at the school level will accurately reflect what is occurring across the larger organisation. In addition, the role of central service generated data must also be considered differently since it provides an independent contribution across multiple result sets rather than a dataset to be integrated as a whole into a single result set.

Therefore, although account must be taken of central functions and how they can enhance capability of the sub-units studied, care must be taken with how this data is interpreted. There are also implications for data where a single type of evidence may be generated from different sources.

During the University of Manchester eMM Pilot, information technology (IT) services and quality assurance (QA) data were collected separately and analysed before being cross-referenced to preliminary results obtained from independent, faculty-provided data. What became clear was that a number of distinct and potentially separate components of capability existed in data only available through central services. This related to centrally based evidence of practices that could contribute to a faculty profile, but which faculties may or may not carry out themselves.

The reason why some of the central evidence does not appear in faculty profiles may be, for example with IT, that some of the day-to-day running of central IT services will only become apparent from those unit records, and additional capability will be evidenced mainly from those faculty areas that rely on central IT services instead of internal provision. The lack of appearance of QA material presented as evidence by faculties is potentially due to its relationship to traditional teaching & learning QA processes. Marshall (2006) comments more generally on the relationship of ‘traditional’ teaching and learning processes to e-learning processes reflected between v1 and v2 of eMM, clearly demonstrated through the re-assessment of original eMM study data against both versions of the eMM process set. Also, because QA is inherent to all course processes it may not specifically be offered by faculty within exemplar data for their e-learning work.

This suggests the reasons for the appearance of certain data types in certain locations would need to be more closely examined for a full benchmarking exercise of sub-sections to ensure greatest possible accuracy for the exercise.

A faculty-level capability diagram generated from faculty-specific data shows what a faculty is capable of achieving in its own right. It may or may not be capable of building additional capability in specific areas on its own. Additional capability within the organisation can be demonstrated from evidence obtained specifically from within central services. This evidence can be tested against faculty practices to see where it offers enhancement to what is already occurring in each of the faculties or components. Different results will occur for the same central data in different faculties, depending on

the faculty base into which it is to be integrated. This activity indicates in what cases central services can or do enhance the practices and capacity of faculty components in an organisation. In other words where there is added benefit to the faculties of belonging to the organisation as a whole, and which activities need to be supplied by the organisation.

Figure 3 shows the anonymised Faculty-based results from the University of Manchester eMM Pilot that demonstrate how institutionally-sampled (rather than project-sampled) data can provide an effective assessment of sub-units of an organisation. This example is corrected for additional capacity based on central service evidence.

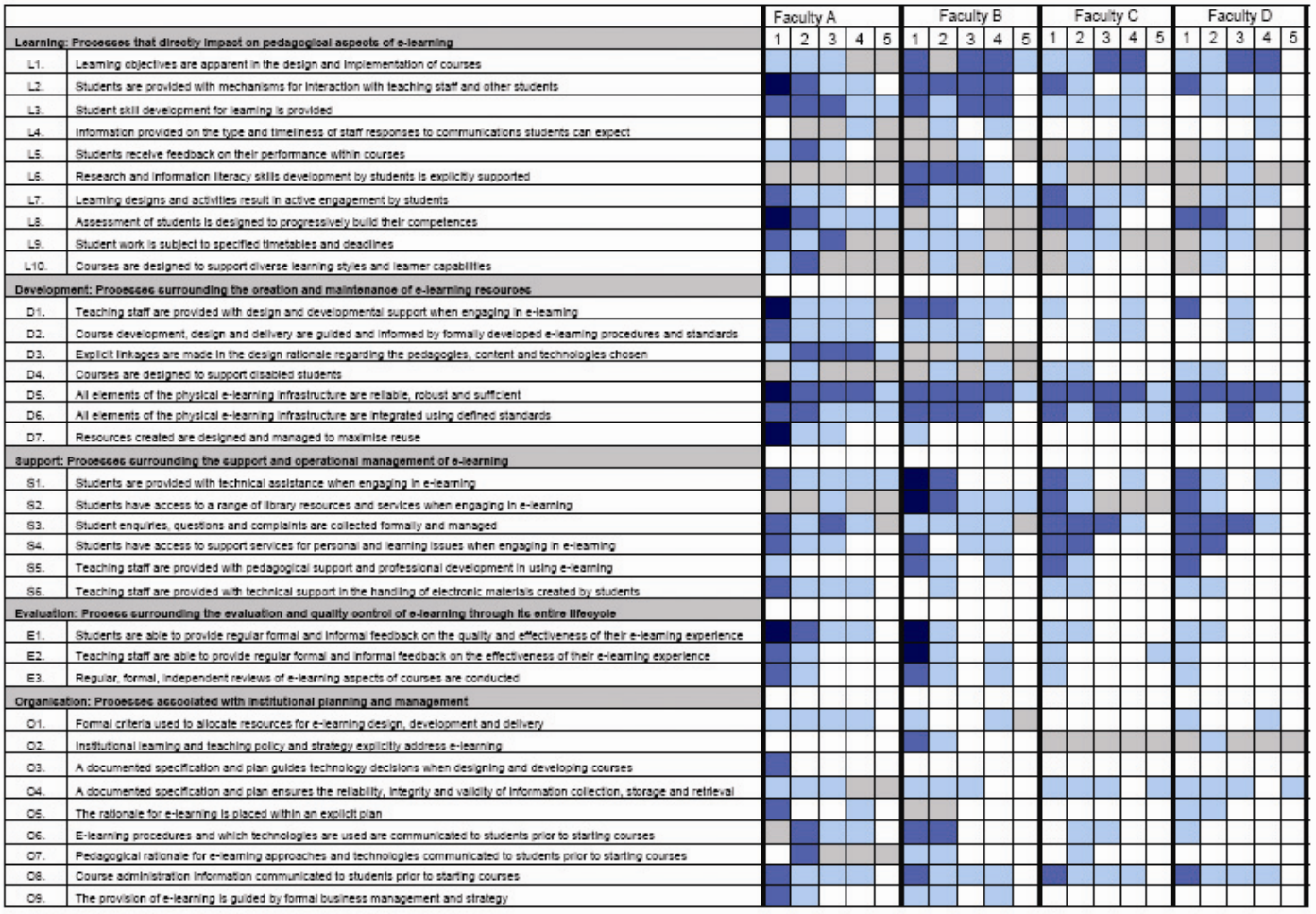

Figure 3: Anonymised Faculty-based Results from the University of Manchester eMM Pilot demonstrate how institutionally-sampled (rather than project-sampled) data can provide an effective assessment of sub-units of an organisation.

This indicates that using eMM to assess organisational sub-sections can be a useful tool for management wishing to justify or improve resourcing at the centre of an organisation in respect of where each of its faculties already demonstrate strengths and weaknesses. It can be equally useful to faculties who wish to demonstrate where their strengths are independently gained or where they require additional central support.

The activity can help the corresponding roles of the centre and faculty to be more clearly defined in terms of e-learning and organisational process.

Taking a horizontal slice through eMM to assess and improve specific activity areas

The above approach to using eMM, suggests a potential extended use of eMM to examine specific areas of organisational activity on a practice basis by identifying processes and practices relevant to the chosen activity. This 'horizontal slicing', or 'focussing' of eMM, in theory, offers a method of generating improvements that would later be reflected in a full organisation assessment using eMM. To achieve this requires including change management and process modelling techniques to maximize the chance of effective improvement occurring.

Success assumes that the practice matrix is sufficiently rich in respect of the activity area being assessed. It may also highlight areas that have less potential to benefit from eMM, if the match between the academic practice area and the eMM practice matrix is too thin. However, it is more likely that such an exercise will serve to enhance the practice base or to highlight emerging good practice in e-learning.

Selection of activity may be effective if used within a case-based process, aimed at existing initiatives within the organisation, where the cases chosen will incur elements of practice change. For example, the development, deployment and adoption of Re-usable Learning Object (RLO) repositories or Content Management Systems (CMS) by an institution is a complex process that opens technical, human, cultural, management and organisational issues.

In theory, the use of CMS has huge benefits for collection and management of digital resources, for design, development and maintenance of learning materials and for archiving for re-use. One aim might be to allow academics to produce content autonomously and effectively as part of their everyday work. The question is how to approach managing the changes that adopting a CMS will bring?

Major risks to realising the potential benefits of the new technology are resistance to change by those affected and the design of procedures that will be accepted and used. A managed change in the behaviours and practices of those responsible for designing, developing and using content made available this way is required. A shift at the organisational level is also required to support the associated processes and practices of an innovation like this, and to guide development of sustained good practice generated by its introduction.

The e-Learning Maturity Model (eMM) provides a first step in helping to identify the particular set of processes and practices that relate to the development of re-useable content, both current and improved, and to set these in the context of a production or content life-cycle. This provides the framework to:

- establish instances of new and emerging practice,
- identify stakeholders in both old and new practices,
- identify and agree information flows and dependencies,
- identify and agree workflows and dependencies,
- identify and agree ownership and use of artefacts and information,
- identify and agree the scope of responsibilities,
- generate measurable and specified change in terms of human and organisational behaviour.

Individual case

As part of the University of Manchester's pathfinder project, cases are being identified that allow the use of eMM this way to be tested. One case, involving adoption and implantation of a CMS in a particular school, has provided the opportunity to apply the concept described above.

Working with a representative team of stakeholders allows the eMM processes and practices, appearing most relevant to the activity area, to be presented to the team. The team can then refine and reduce the initial presentation to a set of practices that appear most pertinent to them, improving chances of their engagement in the change. This is necessarily an iterative approach, as only a small number of practices can be realistically targeted for change at one time. Also, more than that sub-set may be required to reach the overarching activity goals desired by the stakeholder team. So it will be important to prioritise practices into groups that align with the development progression of a case.

Figure 4 indicates the eMM processes and the associated practices that have been provisionally identified by University of Manchester researchers as most applicable to cases that involve Repository or CMS use. Figure 4a presents an example of how the practices have been prioritised by three different researchers as a trial of the technique in advance of its presentation to a representative team of stakeholders. It is inevitable that the prioritisations are fluid, and will change again to accommodate the stakeholder needs.

Learning: Processes that directly impact on pedagogical aspects of e-learning	
L1.	Learning objectives are apparent in the design and implementation of courses
L2.	Students are provided with mechanisms for interaction with teaching staff and other students
L3.	Student skill development for learning is provided
L4.	Information provided on the type and timeliness of staff responses to communications students can expect
L5.	Students receive feedback on their performance within courses
L6.	Research and information literacy skills development by students is explicitly supported
L7.	Learning designs and activities result in active engagement by students
L8.	Assessment of students is designed to progressively build their competences
L9.	Student work is subject to specified timetables and deadlines
L10.	Courses are designed to support diverse learning styles and learner capabilities
Development: Processes surrounding the creation and maintenance of e-learning resources	

D1.	Teaching staff are provided with design and developmental support when engaging in e-learning
D2.	Procedures and standards to guide course development, design and delivery are formally developed
D3.	Explicit linkages are made in the design rationale regarding the pedagogies, content and technologies chosen
D4.	Courses are designed to support disabled students
D5.	All elements of the physical e-learning infrastructure are reliable, robust and sufficient
D6.	All elements of the physical e-learning infrastructure are integrated using defined standards
D7.	Resources created are designed and managed to maximise reuse
Support: Processes surrounding the support and operational management of e-learning	
S1.	Students are provided with technical assistance when engaging in e-learning
S2.	Students have access to a range of library resources and services when engaging in e-learning
S3.	Student enquiries, questions and complaints are collected formally and managed
S4.	Students have access to support services for personal and learning issues when engaging in e-learning
S5.	Teaching staff are provided with pedagogical support and professional development in using e-learning
S6.	Teaching staff are provided with technical support in the handling of electronic materials created by students
Evaluation: Process surrounding the evaluation and quality control of e-learning through its entire lifecycle	
E1.	Students are able to provide regular formal and informal feedback on the quality and effectiveness of their e-learning experience
E2.	Teaching staff are able to provide regular formal and informal feedback on the quality and effectiveness of their e-learning experience
E3.	Regular, formal, independent reviews of e-learning aspects of courses are conducted
Organisation: Processes associated with institutional planning and management	
O1.	Formal criteria used to allocate resources for e-learning design, development and delivery
O2.	Institutional learning and teaching policy and strategy explicitly address e-learning
O3.	A documented specification and plan guides technology decisions when designing and developing courses
O4.	A documented specification and plan ensures the reliability, integrity and validity of information collection, storage and retrieval
O5.	The rationale for e-learning is placed within an explicit plan
O6.	E-learning procedures and which technologies are used are communicated to students prior to starting courses
O7.	Pedagogical rationale for e-learning approaches and technologies communicated to students prior to starting courses
O8.	Course administration information communicated to students prior to starting courses
O9.	The provision of e-learning is guided by formal business management and strategy

Figure 4: eMM Process Version 2.1 with green processes representing those provisionally identified by University of Manchester researchers as most applicable to cases that involve CMS or Repository use.

Process	Dimension	Practice	Researcher 1	Researcher 2	Researcher 3
L1	1	Learning objectives are aimed at supporting student cogntive outcomes			
L1	2	E-learning design and development activities reference the learning objectives and use them to determine the nature of content used			
L1	3	Training, templates are provided on how to use learning objectives in the design of course learning activities			
L7	1	Learning activities are designed to encourage analysis and skill development			
L7	2	Learning activities and assessment tasks are designed to build student engagement			
L7	3	Teaching staff are provided with training and guidelines for designing learning activities			
L7	4	Courses are reviewed to ensure that staff are incorporating learning activities consistent with the expectations of the school			
L7	5	Information on the extent to which courses are proviing learning activities are used when designing future			
L10	1	Course materials and activities avoid inappropraite bias and stereotypes			
L10	2	E-learning design and development procedures include formal testing and review of diversity support			
L10	3	Staff provided with training and templates that illustrate how to support diversity			
L10	4	Course materials reviewed to ensure that diversity policies are implemented			
L10	5	Effectiveness of attempts to provide support for diversity is measured and used to inform planning			
D1	1	Technical design and development assistance available to staff designing courses			
D1	2	Assistance in course development is planned for throughout the process of course design			
D1	3	Teaching staff are provided with training when engaging in development activities			
D1	4	Course design and development activities are subject to formal quality assurance reviews			
D1	5	Information on the effectiveness of assistance provided is used to guide the nature of assistance for future e-learning initiatives			
D2	1	Technical design and development guidelines, procedures and standards provided			
D2	2	Teaching staff are provided with time, recognised, rewarded			
D2	3	Standards and guidelines covering technical and pedagogical aspects are available			
D2	4	Use of e-learning procedures and standards by teaching staff is measured and reported on by staff			
D2	5	Information on the effectiveness of e-learning procedures and the outcomes of courses is used to inform strategic and operational planning			
D3	1	Activities, content and assessment used in the course design are linked with common learning outcome statements.			
D3	2	E-learning design activities reference the learning objectives and use them to determine the nature and relationship of content, activities and assessment used in delivery (metadata!)			
D3	3	Institutional policies require that a formal statement of learning objectives is used as the starting point for course design and (re)development.			
D4	2	Formal design and development approaches used to ensure variety and accessibility issues			
D4	3	Standards, guidelines and key principles for accessibity are provided to all staff			
D7	1	E-learning resources packaged and stored for re-use beyond initial delivery			
D7	2	A searchable repository of e-learning resources is provided			
D7	2	E-learning design and development procedures include explicit consideration of licensing or purchasing and reuse of pre-existing resources before new resources are created			

Figure 4a presents an example of how the practices have been initially prioritised by three different researchers as a trial of the technique in advance of its presentation to a representative team of stakeholders (Yellow indicates a secondary importance rating).

Creating a reference model to enable transferability of individual case-based information

The above approach is fully consistent with established socio-technic approaches to organisational and change management. It is driven by the capacity for shared understanding provided by high level modelling, and provides a promising way of embedding new practices in e-learning. However, in order to ensure the approach is repeatable in future instances, there is a need to both capture and represent the process in a meaningful and appropriate way. Hence, a major element of the pathfinder project is to construct a Reference Model which provides a framework for future change.

A Reference Model identifies a common learning, teaching, research or business requirement and shows how one or more Services can be used to meet this need. A Reference Model also provides cross-links to the Services that it uses. The purpose of the Reference Model in this case is to *facilitate* the move towards capability maturity in the end-to-end process of e-learning provision. The move to capability maturity involves bringing about change in the practices that comprise the end-to-end process of e-learning provision.

Titled “Reference Model of Process Change Management for Attaining Capability Maturity in e-Learning”, the model was conceived covering five operational areas as services:

1. Benchmarking
2. Change Management
3. Analytics and decision support
4. Enterprise architecture management
5. Process guidance

The success of the Reference Model is dependant on the capability of a properly designed and constructed knowledgebase to record and structure activity and knowledge derived from the cases.

Constructing a knowledgebase

Calverley and Dexter (2007) describe an approach to improving the embedding, longevity and practice for e-learning innovations. They show that to help achieve the changes required by an HEI, it is possible to introduce industry standard, or accepted best-practice, tools and methods in a planned and structured way. All of these can be provided to the institution in a coherent form as a knowledgebase for change. This knowledgebase can be populated by logging instances of change and change outcomes derived from cases within the organisation.

It is necessary to collect and store data generated by each case in a consistent manner, to enable cross-case analysis and comparison of data. This allows the generalisation capacity and transferability of the Reference Model to be tested, and any necessary adjustment and refinement to the Knowledgebase Information Model can be made. In order to achieve this, the following knowledge elements were identified as entities within the operational areas:

- Role (Actors)
- Process (Business process)
- Task (Activity)
- Task detail (Steps)
- Resources required for a task (Artefact)
- Deliverables (outputs) of a task (Artefact)
- Activity sequence in a process
- Rules (constraints) operating on tasks, transitions between tasks.
- Interdependencies between processes
- Guidance for a task
- Task and instances of the task in a process
- Preservation or modification of task instances
- Glossary of terms including synonyms
- Metrics: Method; Process; Product
- eMM process area

The knowledge elements form a basic ontology, the Knowledgebase Information Model, which defines the attributes of, and interactions and relationships between each entity. A prototype relational database has been produced from the Knowledgebase Information Model, which will allow the storage of multiple case data.

For each case, three collections of knowledge elements are anticipated:

- Project Knowledge [elements solely concerned with delivery of project and note directly with any change of e-learning practice]
- Change Knowledge [elements concerned with bringing about successful changes specifically within the organisation, and the sector more generally]
- E-Learning Process Knowledge [elements derived from the e-learning lifecycle as it exists within selected cases.]

The change knowledge elements are generated by adoption and implementation of a change management approach to individual cases, to which the framework provided by the e-Learning Maturity Model (eMM) contributes.

E-learning process knowledge elements emerge as part of the identification of current practices and defining new practices, as illustrated in Figure 4 and 4a for cases that involve CMS or Repository use. Hence the knowledgebase can be used to record those practices which have been identified as priorities for the adoption of a CMS and in

doing so, be used to construct a new set of workflows. These workflows create a framework for staff to work from, offering support and guidance in the adoption of new practices, and a tool for the successful implementation of the change required.

As the change is implemented, and new practices adopted, the resulting change in capability of the Institution can be captured though a re-assessment of the relevant practices using eMM. However, a more challenging aspect of the project is to create a real-time evaluation model which allows both the change-management approach and change outcomes to be formatively evaluated and used to guide the future development of the project and the Knowledgebase, without impinging too heavily on the day-to-day activities of the project.

Creating an evaluation approach

Working to achieve embedded evaluation practice as part of the daily activities and ongoing project feedback, requires a detailed consideration of the practicalities of gathering information in real-time to inform the project as it progresses. This allows evaluation to be recorded in the knowledgebase in so far as it can be linked to the day-to-day activities performed as part of investigating project cases. Outcomes relating to high level issues can then be traced through to the specific and individual activities that are accountable to them. A monitored picture of this kind, provided by the knowledge base, is in line with the concept of continuous improvement, in place of a ‘snapshot’ evaluation mechanism as a fixed project outcome which would only provide the required information retrospectively.

Already, from the first version of the Knowledge base, the following issues have arisen for the information model:

- Case granularity issues
- Decision point recording

Some of these issues have been addressed through further development of the information model, and have resulted in updates to the relational model.

We anticipate further issues to arise, both case specific and general, when stakeholder teams become involved in prioritising the practice selections in view of their own case and generating active practice change based on these selections.

In this way, the knowledge base improves capacity to learn from change elsewhere in the organisation and to encourage effective knowledge transfer.

CONCLUSIONS & FUTURE WORK

While taking into account the resource constraints involved in any benchmarking or practice change exercise of this kind, pilot findings indicate it is feasible to use eMM to examine sub-sets of an organisation restricted only according to the level at which data is made available within a given organisational structure. However, there are scaling issues associated with performing a full exercise in a complete manner.

The practice matrix within eMM can usefully guide activity-oriented change efforts in attempt to improve specific areas of an organisation's work. But it has yet to be proven that achieving specific practice change in this way will directly help to meet a stakeholder team's wider activity goals. Future work trialling the adaptations of eMM described over a range of activity areas in the University should help us to be able to determine the level of effectiveness we can expect for any given range of eMM-derived practices.

ACKNOWLEDGEMENTS

With thanks to Stephen Marshall for conversations leading to greater clarity and consistency regarding interpretations surrounding the institutional evidence base.

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