Capturing organisational knowledge from Educational Enhancement: Identifying Patterns for Curriculum Innovation

Su White and Hugh C Davis
University of Southampton

ABSTRACT: On-line and blended learning is much fêted, particularly by university management as part of the solution to many issues currently facing higher education. However, experienced academics lack examples of suitable pedagogically engaging on-line activities, and remain sceptical or resistant to change. This paper describes a case study of an initiative taken by a newly formed centre with responsibility for introducing such change within a university. It uses a single module to demonstrate a range of on-line activities blended with conventional face-to-face approaches which may then be presented to staff as reusable patterns with generic applicability. At the same time we show how these approaches can meet the requirements of the university management.

1 Introduction

The changes and initiatives recounted in this case study take place in a large English, research intensive university, however the observations are relevant to institutions of all types, shapes and sizes. Every teaching programme is likely to undergo incremental change in response to environmental contexts such as student feedback, reflective monitoring and changing and emerging practices, knowledge and understanding. Systematic periodic review or widespread changes in the student cohort can also bring changes which range from minor innovations to widespread redesign.

The authors of this paper, as well as being lecturers in Computer Science are the Director and an assistant Director of the Centre for Innovation in Technologies and Education (CITE www.cite.ac.uk), which has recently been created to take responsibility for research in Technology Enhanced Learning (TEL), horizon scanning, strategy and deployment across the University. In attempting to encourage and support the uptake of on-line and blended learning in the University, it became apparent that many academics and programme teams had little exposure to the possibilities afforded by TEL, and were unable to imagine the kind of authentic on-line activities that we were advocating. For this reason we decided to use the course we would be teaching as an exemplar of a number of different activities, from which to extract generically re-usable patterns.

The module, Professional Development, is itself quite generic, mostly concerned with learning, skills and employability topics which will appear in many degree programmes in one form or another. Features identified in the case study combine aspects of incremental change with a more widespread external impetus for change, brought about by a programme wide revision of taught modules.

The development team comprises learning designers working in partnership with the authors, who are established and experienced academics. The academics, Davis and White contribute disciplinary expertise with extensive practical and academic experience of implementing curricula and technological innovations (2004, 2005, 2007). Since the team is working under the auspices of CITE, capturing the details and experience of the process is an objective of equal importance as the ultimate success of the project from the students' perspective. Workflow analysis is a strong component of the approach. Further challenges

arise in making the optimal use of the institutional learning environment alongside Open Educational Resources (OERs), real world tools and the institutional teaching and learning repository (EdShare http://www.edshare.soton.ac.uk). White et al (2013) have provided a more detailed account of the curriculum specific challenges; this case study focuses on the capture and documentation of organizational learning with a design patterns approach.

2 Background and Motivations

The innovation came about through the routine review and revision process of curriculum design. A need to standardize the size of modules across the university meant that two existing undergraduate modules, previously taught in different years and essential for professional accreditation needed to be combined into one single module taught in the first year of study. Not only did the modules deal with professional, legal and ethical issues, they also addressed the development of academic and professional skills and were designed to support students to develop an understanding of their own preferred approaches to learning.

2.1 Institutional Priorities

As was explained in the introduction, this work is part of a set of initiatives developed with the support of CITE. These initiatives are expected to act as patterns or exemplars, which as well as addressing pressing local needs, also realise benefits for the university, which can be demonstrated against the framework shown in Table 1.

Table 1: Institutional benefits framework (from analysis of successful internal project funding)

Impact Areas	Specific/ Generic	This Case	Objective
Student Learning	S	✓	Increase the active participation of students to take more responsibility for their own learning
	S	✓	Introduce situated technologies which develop students' mastery of digital literacies
	G	✓	Address needs of students learning on and off campus simultaneously
	G	e	Increasing student performance
Student Experience	G	e	Increasing student satisfaction
	G	e	Improving retention
	G	e	Improved employability
Institutional Benefit	**G**	**e**	**Reduce costs, increase income**
	G	n/a	• Saving use of specialist equipment
	G	p	• Extend reach of education on-line to wider audiences
	G	p	• Extend reach of education in remote campuses/ on line
	G	p	• Increased/sustained recruitment
	G	p	• Scalability to larger classes
	S	✓	• Reduce demand on large lecture theatres
Institutional Indicators	**G**	**e**	**For institutional indicators - increase scores in key indicators**
	S	e	• Increasing student satisfaction
	G	e	• Increasing student performance (attainment, retention, progression)
	S	✓	• Improved employability
Faculty Benefit	**G**	**e**	**Decrease work load, enhance efficiency**
	G	✓	• Reduced teaching time
	G	✓	• Reduced admin/workflow management time
	G	✓	• Reduce assessment marking time

Key: G: Generic; S: Specific;
✓: explicitly addressed and to be evaluated;
e: consequential benefit which needs to be evaluated,
p potential benefit, not explicitly evaluated at this time

This benefits framework was not constructed from the top down, but rather engineered from the bottom up, by inferring from the history of strategic funding agreed to develop education, the list of operational priorities which prevail in the university.

The two lead academics had both been module leaders for the predecessor modules. These academics specifically wished to incorporate activities which would actively develop practical approaches established by Harris et al (2010) to cultivate students' digital literacies and to introduce students to the idea that they might be preparing for jobs which did not yet exist. Although it might be expected that students of computer science and IT would have high level of computer literacy, it had been observed that there was some variability in the extent to which such students understood the potential value or importance of generic IT tools. Similarly there was variability in how effectively students operated in their online behaviours and practices. Since the students would be graduating and very likely working in environments where awareness of current technologies would of itself be a valuable capability, developing proficiency and deep understanding of the 'technology affordances' of new tools, was considered particularly relevant to the learning outcomes of the wider degree programme. The module redesign sought to address these issues and the team were keen to incorporate assessment activities which developed what Boud and Falchikov (2005) describe as "the kinds of highly contextualised learning faced in life and work".

Sharples et al (2012) from the UK Open University have observed that the current pace of change of innovative pedagogy is rapid and wide ranging. The academics at Southampton wanted the module to incorporate the use of current and emerging popular technologies. It also needed to be highly interactive, combining online preparation, lectures, self and peer assessments, computer assisted assessment and portfolio preparation. A special challenge for the change is to make effective use at the available standard platforms while at the same time being able to incorporate learning from external innovations over time.

2.2 Introducing and managing change

The module redesign was one of three activities selected by CITE which would act as a demonstrator or proof of concept for appropriate and effective integration of technology into face to face teaching activities common on a campus based university. The methods employed needed to demonstrate to colleagues in other parts of the university the strengths and advantages of the change. A simple summary of effective methods for working in academic contexts was proposed and developed by Geoghegan (1994,1997), building on earlier studies of innovation from Rogers' classic 'The Diffusion of Innovation' (1983) and Moore's 'Crossing the Chasm' (1991).

The approach to innovation taken by CITE has been heavily influenced by previous institutional wide approaches to introduce and sustain change in the university reported by White (2007), which itself drew heavily on those earlier works.

Table 2: The needs of early adopters vs. the mainstream, adapted from Geoghegan 1994

Early Adopters	**Mainstream**
• Like radical change • Visionary • Project oriented • Risk takers • Willing to experiment • Self-sufficient • Relate horizontally	• Like gradual change • Pragmatic • Process oriented • Risk averse • Need proven uses • Need support • Relate vertically

Geoghegan adopts a socio-technical perspective which differentiates between the needs of

early adopters and the needs of the mainstream. Key features of those differing needs are summarised in Table 2. The considerations highlighted by Geoghegan, have also been influential in guiding the redesign exercise.

2.3 Design Patterns

Alexander et al (1977) introduce the concept of using of replicable design patterns which emerged from the work of architects and which has become a powerful idea among software developers, who like architects need to design to solve specific problems at the same time as addressing specific needs of the client.

The development of blended learning can be considered as a special case of software design. The same arguments for identifying and recording patterns have already been applied in an educational context by Goodyear (2005) and Goodyear and Retalis (2010). Design patterns can provide a powerful means to articulate replicable and pedagogically clear responses to recurrent educational problems. It is intended to use the patterns to expose approaches in a clear and systematic manner. The development team are working to identify design patterns within the curriculum design process.

Taking into account the needs of the majority, and the experience of working with patterns in an educational context, the CITE team are of the view that recording and analysing the processes in the form of patterns which are specifically designed to be replicated are essential if the example innovations are to be of longer term value to the university.

3 Redesigning the curriculum

The curriculum development team incorporates experienced academics, learning designers and student interns. Graduate teaching assistants and interim evaluators who have previously been taught on the matching and preceding modules are also engaged in the team to provide integrative evaluations.

The module is taught during one twelve week semester to a typical cohort 150 students studying on three different but closely related degrees, all accredited by the British Computer Society. Two academics and one teaching assistant are responsible for the teaching and assessment during the first year in which the module has been presented to students.

An initial plan of topic areas and the sequence which students would be expected to follow was created at the same time as defining and refining the agreed learning outcomes for the module. The module learning objectives expect students to develop and demonstrate:

an understanding of
- legal, ethical and professional issues relevant to an IT specialist during their working life;
- student's personal learning preferences;

an ability to
- research and communicate technical information;
- incorporate objective reflection and critical evaluation of their own and other's work in their routine learning practices.

Skills relevant to employability are also of high importance and are a sub-text to many of the academic and learning activities. The formal syllabus description presented to the student summarises the module as follows:

- The aim of this module is to help students develop an understanding of the fundamental professional, ethical and legal issues, how they are being developed and applied.
- The lectures, on-line activities and associated courseworks will involve an active approach to the module content which is designed to develop a sound and personally

relevant understanding of these issues.

- A further aim is to provide the opportunity for students to experience a realistic approach to individual learning close to that adopted by researchers and professionals in the computing and IT domain. This approach aims to enable them to develop individual approaches to independent learning, identifying personal preferences, strengths and weaknesses

The teaching methods of the predecessor classes are a mix of large active lectures (~150) and small group sessions (6x ~25). The revised module has replaced small group activities with guided online private study. The new module could be allocated three lectures per week, but the redesign has incorporated only one formally scheduled lecture and one feedback lecture slot used as requested or deemed necessary by the academics. Table 3 summarises of the changes

Table 3 Student activities and assessments

Original Modules		12-13Additions/Changes	
Individually			
1	Prepare a CV	✓ m	Peer review CVs Reflect on CV
1	Research and write a technical report	✓ m	Mark a sample technical report Peer mark a technical report
1	Non assessed – tutor led small group activities which rehearse and discuss processes needed for assignments	✗	
2	Prepare an annotated bibliography	✓ m	Peer review and contribute revised work to a shared bibliography
2	Demonstrating basic legal understanding via an online test	✓ m	An end of module online test which checks basic legal understanding plus other understandings studied independently during the module
2	Undertaking an open book exam evaluating professional issues in a seen case study	✗	Some aspect of open book preparation retained in final online exam
1	An online Academic integrity tutorial and test	✓ m	Made into a formal assessment rather than recommended activity
N			Prepare an individual portfolio, identifying and evaluating personal skillset
As a group			
1	Researching and making a group presentation on a technical topic;	✓ m	Research and prepare a group presentation on a legal, ethical or technical topic
2	Building and creating an information resource;	✗	
2	Creating and presenting a group poster.	✗	
N	Annotated bibliography		Peer review and contribute revised work to a shared bibliography
N	Feedback lecture		Requested via group discussion, scheduled if responses are complex or unresolved by online discussion/email

Key 1 (year 1); 2 (year 2) N (new) ✓(retained); ✗ (removed); m (modified); + (extended); - (reduced)

3.1 Institutional Constraints

The blended system was subject to a number of constraints at the design phase. As a university demonstrator it was essential that use is made of the established technology infrastructure. That infrastructure comprises a mix of commercial products and local written software which is specific to the university (Table 4). While traditional user guides and

training exist for these resources, the objective of generating and capturing patterns is an essential component of this exercise in curriculum development. The module needs to use and test the capabilities of existing infrastructure, and provide useful and usable information for our academic colleagues in the future.

Table 4: technology constraints imposed by existing systems

Type	Name	Description
Commercial products		
	Blackboard	Virtual learning environment
	Turnitin	Plagiarism, grading and peer review
	QuestionMark	High stakes assessment engine
Local tools		
	EdShare	Open educational repository
	ECS Notes	Linked data driven module information pages
	C-Bass	Electronic handin and tracking system
	eFolio	Persistent online Portfolio

Alongside the existing supported infrastructure there was a need to introduce and familiarise students with the use of authentic tools in a contemporary way what Morris et al identified as 'worldware' (1994) which is relevant to skills needed for 'living and working on the web'; a phrase from a Curriculum Innovation module led by our colleagues Lisa Harris and Fiona Harvey www.southampton.ac.uk/cip/studentcurriculum/newmodule/digital_literacies.page

Building on existing experience within CITE the learning design team is basing their approach on an adapted version of a co-design and co-deployment methodology which has been successfully used by Millard et al in previous projects at the University (2009). This is being realised as follows: a) Developing use cases which directly align with the module learning outcomes. b) Integrating a Learner Context approach adapted from Betty Collis' (2011) Learning Footprints.

The structure which emerged was able to address the priorities of pressure on teaching space and the academic workload caused by assessments. Although three lecture slots are nominally allocated to a module of this size, only two were used, one for a weekly pacing and motivational lecture, and one for a feedback lecture. The act of merging two modules resulted in a 75% reduction in notional hours of study compared to the predecessor modules. It was clear from previous evaluations and discussion with students that the previous practice had not made working time for these modules a high priority. The academics involved were therefore keenly aware that it would be necessary to carefully engineer the workflow and the learning activities to ensure that the students actually invested an appropriate amount of time to this module.

A series of self assessment activities have been scheduled, also designed for pacing. The university VLE was used to drive the workflow, which we also plan to use to derive learning analytic data. The self/peer assessment approach was inspired by Hamer and Kwong (2005) who describe how online tools have been used to automate peer marking based on a model developed in New Zealand using Turnitin to manage the process.

All resources are stored in, or linked into the institutional teaching repository EdShare (edshare.soton.ac.uk) ensuring they are available after the academic year-end, and after graduation. An end of module exam online is designed to test and validate the achievement of learning outcomes documented in the personal portfolio or undertaken through guided independent study. Using automated testing demands extensive preparation work before the assessment is administered however this team generated reusable resource which reduces workload pressure on individual academics during the inevitably very busy marking period.

4 Interim Observations

The first presentation of this module to students was still underway at the time of writing. A plan for evaluation and formal reflection exists, some interim feedback from students has been gathered. The redesign of this module has benefited from the collective effort which was possible through the participation of learning designers.

The content of this module, and the method in which it is presented to the students has for the most part shifted the emphasis in student learning towards structured online activities which are a prelude to face to face lecture classes. Although it does not conform to the model of a video led 'flipped classroom' approach, it does subvert the traditional pattern which predominates in the STEM based subjects at this research-intensive university.

4.1 Patterns

A number of activity patterns have thus far been identified, they are expressed as syllabus items to remove the contextual aspect of their place in the module:

Syllabus item	Pattern
Library and information skills	Micro activities; WebQuest
Academic integrity	Mini-MOOC with required quiz
Report writing	Learning by marking, self review; peer review
Personal skills	Skills audit; E-portfolio task to identify skills gaps
Self presentation CV and LinkedIn profile	Self evaluation
Group working Time management Project management	Produce group presentation under difficult time constraints to required standards; internal team evaluation
Sustainability, ethics, legal issues, professional bodies/ codes of conduct	Subject of group presentations; Annotated bibliographies

Micro activities: These activities were taken from our University's existing study skills toolkit. They are short interactive exercises, with frequent objective or self evaluation tests, each of which might take around 20 minutes, and which teach subjects such as citing and referencing, selecting and evaluating the providence of papers from searches etc.

WebQuests: A webquest was created for the course, incorporating the excellent "Internet Detective" tutorial from the University of Bristol (www.vtstutorials.ac.uk/detective) which encouraged students to search and evaluate a set of suitable reference materials for a chosen topic. The Webquest is subject-independent and could be used in any discipline-

Mini-MOOC with required Quiz: The course contains a quiz (on academic integrity) which must be passed (with 90% pass mark) in order for students to progress. The quiz may be attempted on multiple occasions but questions are selected from a question bank so that simply learning the answers is not a realistic option. The students are provided with multiple sources, including two podcasts prepared by the library, some interactive micro-activities, the Student Union's guide to academic integrity and the official university rules and statements on AI. This quiz has questions relating to Computing, but the exercise could be and already has been converted for use in other disciplines.

Skills Evaluation: Students were asked to complete a the VIA Institute Character Strengths Survey, then to reflect on the skills they demonstrated, and the skills they needed to develop using an ePortfolio. This was in preparation for producing and developing their CVs.
Self and Peer Evaluation: An extremely important outcome of the course is the development of criticality and objectivity. We aim to help the students to take greater responsibility for their own learning, by developing self-critical skills. We ask students to demonstrate self

evaluation in three ways:

1. All Blackboard activities have a self-assessed completion checkpoint. Students are asked to confirm that they have successfully completed each activity, and that they need no further help or feedback. If they need feedback, they are encouraged to specify their problem and we arrange to meet them face-to-face to provide help. (This option was used very little).

2. For the technical report, we provided a detailed (and well used) marking scheme specifying the typical characteristics for each grade under a number of headings (report structure, report content, quality of writing, use of references etc.) and we asked the students to learn to grade existing reports, and then comparing their grades with grades awarded by experienced staff. When they had learned to do thus, they were then invited to write their own reports and to grade both their own report and two other peer's reports.

3. In producing their CV's students were given examples of poor CVs and good CVs, along with detailed criteria for creating good CV. They were then asked to create their own CV and to comment on what it would take to improve their CVs.

All of the above activities from a re-usable pattern that is discipline independent, although the exemplar reports and marking schemes may need choosing for the discipline.

Groupwork, Time Management and Presentation Skills: In order to develop the above, we asked students to give group presentations, working in their tutor group of typically 5-8 people. The presentation topics were deliberately distributed one week before the Easter vacation, and the presentations were to be done one week after the Easter vacation. This devise put pressure on the students to get their groups together early and required them to work well as teams to have quality presentations ready in time, and possibly needing them to continue some virtual team communication over the vacation. The presentation topics were all concerned with the parts of the course surrounding Sustainability, Ethics and Legal Issues, and since all students were required to present in one session and form a peer review audience for another session, they were able to see presentations covering a wide part of the syllabus.

Annotated Bibliographies: This task involves preparation for future writing activities, incorporating an introduction to and practice in reading and summarising academic texts. The mechanics of providing a set of baseline documents for initial review and then allowing the student free choice in selecting additional texts is a logical follow on from the initial information skills activities. Peer review and self-evaluation are also incorporated restating the meta-learning objectives of developing criticality and reflective skills.

In creating this course we have thus demonstrated a number of shareable patterns of educational strategies which possess only small discipline specific features. The next stage is to formalise the patterns and to assemble a peer review panel for scrutiny and revision. By initially sharing and refining our patterns we will also establish an informed network of colleagues who will be able to disseminate and validate the use and relevance of the patterns within their own fields of study. We also anticipate using this process as a means for acquiring further patterns from other contexts. We anticipate a six monthly review cycle, integrated with reporting from the CITE team to be used as a means to establish this as a routine working process associated with educational innovation at the university.

5 Conclusions and Future Work

This case study presents a work in progress. Although that does not preclude interim reflection and the documentation of learning from the process, a formal evaluation remains to be conducted. The intention is to compare student feedback and evaluation with the

experience in the two predecessor modules, to conduct semi structured interviews with the actors involved in the development and teaching aspects of the module development. Further evaluation will be conducted via a research survey and focus group discussions.

Table 1 described the framework to evaluate the institutional benefit of educational innovations. This module, after an initially high start up cost will run at a significant saving to the university in terms of the staff time for lecturing, supporting students and assessment. It also uses one third of the time in large lecture halls (space is at a high premium on campus). At the same time, as the result of increased use of self-review and peer-review the students have been required to engage with a wider range of learning, and at a deeper level. Initial reviews demonstrate increased student satisfaction with this aspect, although we had the usual initial concerns about the use of peer review to provide summative marks. Previous experience has shown this will be less anxiety inducing for students in subsequent years, as the experience of fair and equitable final outcomes are communicated from year to year.

There will be further revisions and refinements made to the module which will be monitored. Formal estimates of time and effort components will be made. Teaching staff are satisfied by the quality increases in all work except the face-to-face group presentations, which had suffered from the lack of small group presentation tutorials usually delivered in previous version of the module. The tutorials were time consuming to deliver to such a large class, but will be considered next year in order to improve on current results. A realistic understanding of the cost of innovation and routine development of modules is a valuable piece of organisational knowledge which provides context to the patterns in their bare bones form.

For Southampton, further external pressures have emerged since the start of these innovations which extend the potential value of the design pattern approach. The university has committed to work with FutureLearn (futurelearn.com), during to produce two MOOCs and around six further 'mini MOOCs'. Lessons learnt in the design assembly and delivery phases with MOOCs will need to be captured and compared with experiences in more conventional educational settings. Institutional expertise and knowledge has been generated by the process of mixed team development, and identifying and refining design patterns. It is hoped that this will be as useful to the early adopters engaged in the MOOC developments as they are to more cautious colleagues who are engaged in the relatively low-profile activities of new programme and module development, and curriculum innovation within the more familiar context of students registered and attending on the main university campus.

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