Crafting a Rich and Personal Blending Learning Environment
An Institutional Case Study from a STEM Perspective

Su White[1], Hugh Davis[1], Kate Dickens[2] and Sarah Fielding[2]
[1]*Web and Internet Science, University of Southampton, Highfield, Southampton, U.K.*
[2]*Centre for Innovation in Technologies and Education, University of Southampton, Highfield, Southampton, U.K.*

Keywords: Institutional Initiative, Design Patterns, Disciplinary Differences, TEL, E-Learning, PLEs, Co-Design, Participatory Design.

Abstract: Institutional pressures to make optimal use of space can be powerful drivers to develop technology enhanced learning approaches to traditional curricula. Engaging students in active learning and reducing the academic workload are important and complementary drivers. This paper presents a case study of curriculum development in a STEM area at a research-intensive UK university. A team of academics and learning designers have worked collaboratively to build this module as a mix of online and face-to-face activities. The module addresses professional issues, so a strong emphasis is being placed on establishing authentic activities and realistic use of social tools. It is important to the university to carefully document the development process and identify reusable design patterns that can be explained to other academics.

1 INTRODUCTION

This case study provides a reflective account of the processes needed by a multi-skilled team to develop a blended learning module. A number of target curriculum areas have been identified as candidates to establish or demonstrate educational design patterns (Goodyear and Retalis 2010). The intention is to use design patterns to explain workable and pedagogically clear responses to recurrent educational problems which will be exposed in a clear and systematic manner enabling them to be more widely understood and then reused by colleagues across the wider university.

The selection of target areas has sought to take into account disciplinary differences (Biglan, 1973) and the consequent variability in prefered practice and effective strategies across different cognate disciplines (White and Liccardi 2006). The changes enacted, and specific modules identified as exemplars typically incorporate responses to local drivers for change which can be widely recognised. These encompass imperatives beneficial to learners, the institution and to teaching academics:

This case concerns the design of a 'professional issues' module which equates with 150 total teaching + study hours taken by a mixed cohort of Software Engineering, Computer Science and Information Technology students. Typical cohort size is 150 students, with the module being taught during one twelve week semester. The module will be led by two experienced academics who have designed and taught the two 100 hour predecessor modules on which the revised module is based. Some of the content and philosophy of the existing modules are being incorporated into the new design. Both academics have a had extensive prior involvement in curriculum design and establishing teaching innovations plus a practical and research experience in technology enhanced learning. The academics are keen to preserve, yet transpose, the activities which they have observed to be effective during the predecessor modules. They are also seeking to alleviate pressure points generated by trying to manually organise the workflow generated by activities which have evolved and now incorporate a high degree of complexity. The academic expertise of the multi-disciplinary design and development team is a particular strength. Experienced teachers and researchers are working alongside learning designers have extensive practical experience. They are already skilled at specifying, designing and deploying a broad range of educational resources and online learning activities. In addition they understand the potential benefit of participatory design and co-creation which enables

White S., Davis H., Dickens K. and Fielding S..
Crafting a Rich and Personal Blending Learning Environment - An Institutional Case Study from a STEM Perspective.
DOI: 10.5220/0004388901420147
In *Proceedings of the 5th International Conference on Computer Supported Education* (CSEDU-2013), pages 142-147
ISBN: 978-989-8565-53-2

them to gain insights to academics' educational motivations. For this reason, they particularly value the collaborative nature of this work.

The remainder of this paper provides a structured account of the technical and pedagogic balance which has been established during this design activity. It addresses the four themes of: i) Information technologies supporting learning; ii) Learning and teaching methodologies and assessment; iii) Social context and learning environments; iv) Technology enhanced learning in STEM disciplines. It provides an account of the working methods employed and presents an interim reflective evaluation of the activity.

2 BACKGROUND

The two professional issues modules which this design is seeking to replace are both taught in a predominantly face-to-face manner. They aim to develop soft skills using authentic activities to create opportunities for situated learning. All the degrees to which this module contributes are accredited by the British Computer Society, which to some extent determines and constrains the content which is addressed and the assessment methods used Students who successfully complete the modules will have demonstrated broadly:

- An understanding of the legal, ethical and professional issues relevant to an IT specialist during their working life;
- An understanding of their personal learning preferences;
- An ability to research and communicate technical information;
- Incorporating in their routine learning practices an ability to reflect objectively and critically evaluate their own and other's work.

The teaching methods employed in the predecessor classes are a mix of large lecture classes and small group sessions. The lectures incorporate individual and group student activities and are complemented by a number of assessments including, individually: Preparing a CV; Researching and writing a technical report; Preparing an annotated bibliography; Demonstrating basic legal understanding via an online test; Undertaking an open book exam evaluating professional issues in a seen case study. As a group: Researching and making a group presentation on a technical topic; Building and creating an information resource; Creating and presenting a group poster.

The design generates some key challenges. One obvious challenge is how to consolidate the assessments for the new module. This requires careful consideration. The new module has a nominal education study and contact time which is 25% less than the two established modules.

Clearly cuts and changes have to be made. The academics have a clear sense that students' behaviours, learning and perceptions of priorities are shaped by their experience of assessment. As Boud argues: assessment shapes learning, in addition, there is a clear need in this case to craft assessments which develop "the kinds of highly contextualised learning faced in life and work" (Boud and Falchikov, 2005). This argument is consonant with Bigg's emphasis on the value and importance of ensuring that the assessments are constructively aligned with the curriculum. Furthermore it may well be possible to gain mutual benefit for students and academics. Although it is front heavy to undertake the process of structuring and framing peer reflection and evaluation to be embedded in the teaching, this process may well reward academics with long term time saving, whilst the student experience is also enhanced.

There is a particular challenge in teaching professional issues to students from the computing disciplines. Such students typically have specialised in technical subject early in their academic career; as is typical in the UK education system. Many students acknowledge they purposefully selected study options which avoid any volume of writing. In disciplinary terms, their preferences, and the bulk of the topics, knowledge organisation and study practices are those of Biglan's Hard Soft fields of study, with some overlap into Hard Pure activities (Biglan, 1973). By contrast the topics of professional issues are more closely identified with the Soft Applied fields of study. The specific challenge is identifying and using teaching methods and associated study activities which are compelling and aligned with the soft applied. In order to address the challenge consequent of disciplinary differences in the existing predecessor modules, much care has been taken in the way in which the motivation for the study area is explained to the students. The modules are presented as providing an opportunity which will enable students with an acknowledged preference for the technical focus of their chosen degrees to:

- Demonstrate a broader understanding of the professional legal and ethical issues which complements their technical expertise;

- Individually tailor a high degree of matching knowledge and understanding for topics which relate to their personal technical preferences and specialisms
- Acquire expertise in knowledge and processes which will offer them opportunities for success in the job market and during future careers.

Activities and assessments are designed to meet the ambitions of the expressed motivations. Throughout the predecessor modules, emphasis is placed on working collaboratively with fellow students and actively engaging as a part of a team; both for formal assessments and as a routine part of developing a successful approach to learning.

Although the new module will be taught in the second semester of the first year of study, it is essential that the educational resources remain accessible to the students throughout their degree. Its role in professional development also requires that to some extent resources will be available after the students have graduated. The large cohort size and a requirement for rapid feedback on assessment tasks means that significant effort needs to be addressed to the assessment component of the final system.

3 DESIGN APPROACHES

The overarching objective for the design team is to make effective use of information technologies blended with face-to-face activities to support these broad educational, organisational and administrative aims.

Building on existing experience the design team is basing their approach on an adapted version of a co-design and co-deployment methodology which has been successfully used in previous projects at the University (Millard et al, 2009). An interim model of the learning design phase of this activity is being mapped. From this, the design team are: Developing use cases which directly align with the module learning outcomes. Learner contexts include: personal characteristics of the learner; cohort cultures; time available to the learner for learning; extrinsic and intrinsic motivations for learning; pedagogical practices of instructors.

The design team are keenly aware of the importance of recognising the technology affordances of the tools which are used to realise the design. The constraints of the existing institutional meta-level technologies is as follows. 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; eFolio: persistent online Portfolio: Mobile Lecture: feedback and learning analytic tool.

Whilst readers may be familiar with the functionality of the commercial tools, it may be helpful to provide a little more detail of the local ones. Computer Scientists at the University of Southampton have a history of working on hypertext, technology enhanced learning, the web, linked and open data and the semantic web.

ECSnotes, an open data driven information suite and EdShare, the institutional educational repository http:// http://www.edshare.soton.ac.uk are examples of local infrastructure tools which have been developed in association with research projects in these areas. The design team includes colleagues with a broad experience and understanding of the implementation and user interface factors of establishing repository use (Davis et al 2010). The academic team routinely use EdShare to organise and share educational resources. Resources stored in EdShare are tagged with course codes and then automatically populate the relevant ECS notes module page. Linked data, for example syllabus information, tutor profiles, student profiles, and handin specification; are automatically aggregated to a single location. Content can also be rapidly edited through wiki's embedded in the module page structure.

eFolio (http://www.efolio.soton.ac.uk) is a well-tested tool which was originally developed to support psychology students at the university and is also extensively used by undergraduates in medicine and health sciences. A further advantage of this solution is that the resultant portfolio can be accessed or exported after the student has graduated from the university (Furr et al, 2010). Since this module focuses on professional issues, the affordances of eFolio are being used to promote behaviours aligned with good professional practice from the start of the module e.g. reflection, digital literacy, online identity and portfolio development. Students will be guided into assembling a portfolio for self-assessment: auditing; evaluating; and critically reflecting upon their strengths and weaknesses in knowledge, skills and understanding within eFolio.

Mobile Lecture is a rapid feedback tool which has been developed as part of a current research project. It can be used to prompt reflection and self-evaluation of learning at the end of face-to-face

sessions. It also provides learning analytic information (Aljohani & Davis, 2012). The university does not currently have any particular specialist tool in use for peer assessment. After extensive evaluation, it was decided to use mix the peer evaluation features of Turnitin for more formal peer evaluation, and WebPA as the tool to support simple developmental peer assessment.

As a matter of principle, the design incorporates the use of Open Educational Resources (OERs) where possible. The cost of developing resources from the ground up is expensive, and there is an additional objective of ensuring students become familiar with the value and abundance of OERs. The affordances of EdShare in conjunction with Blackboard are being utilised. The implementation stores and catalogues discoverable resources (including links to OERs) in EdShare. Blackboard's role is as a tool to manage the workflow. A particular strength of Blackboard and EdShare is that both tools are capable of providing learning analytic information which may be useful in the short and long term. It is intended that such information will be used by the module team and where appropriate be presented to learners to enable them to calibrate their achievements and progress. QuestionMark and Turnitin are the two remaining commercially available institutional tools. QuestionMark is used as a standalone tool for high stakes assessments. In this module, student achievement will be demonstrated by a mixture of interim courseworks and a final summative examination. Turnitin is routinely used for all submitted courseworks to check the academic integrity of students' work. However its additional affordance is also being used in the context of peer assessment.

CITE is perhaps unusual for an institutional centre for educational innovation in that its co-location with an active computer science research group ensures that there is active participation in the design process by researchers who are also highly experienced in software engineering and user design.

The learning design team have experienced a crash course in this particular aspect of computing, and have responded to the challenge. Whilst the learning curve on heavyweight design tools is significant, pragmatic modifications has enabled the team to capture and communicate their designs in a well structured and ordered manner. This resulted in a set of formal specifications articulating the workflow created following discussions and negotiations with the academic members of the team who will be responsible for the teaching.

Mock ups and walk through are used to communicate work in progress, and to validate with the academics whether the online realisation matches (or even exceeds) their specification. Since the team is relatively new, some aspects of the workflow implementation are necessarily forcing them to explore new territory. In this respect the ambition to capture design patterns has an additional strength in that it forces the team to examine and articulate implicit understandings and reflect on the replicable and compelling aspects of their experience of the design and its process.

4 CONCLUSIONS

The endeavour which the design team have undertaken is an ambitious one. The two modules which we are seeking to transpose into a blended format are both already pedagogically complex. Where the design of the existing face-to-face predecessor modules is predominantly constructivist, the realisation of the new blended module is necessarily connectivist (Siemens and Page, 2005).

When considering information technologies supporting learning the area in which we expect to experience the greatest learning is in relation to disciplinary differences and technology affordances. The students will routinely make use of a wide range of information technologies. The blended approach presents web-based learning in a formal and informal context. Students will make use of wiki's and blogs. In ECS, it is unusual to use Blackboard, even though it is the university's adopted VLE. Our students will be much more familiar with the ECS notes system. We will be closely monitoring usage of both routes into the systems. Further insights need to be gained.

Use is being made of student generated content, and we anticipate a full interim review of the system after its first instantiation. Student interns will be working to analyse the evaluation data and also to provide individual analysis and input for the inevitable tweaking and modifications and redesign. Current experience in ECS suggests that the use of linked and open data is a powerful timesaver which facilitates simple integration of diverse learning materials. The first implementation will provide an opportunity to objectively evaluate the comparative benefits of data driven consolidation with handcrafted creation.

Reflecting on learning and teaching methodologies and assessment it is believed that the higher level objective of recording, analysing and

capturing design patterns will make a valuable contribution to fuelling a more informed discussion of these agendas across the university campus. It is interesting to observe the ways in which the team's working methods have evolved, and to compare them with similar, but different experiences – for example the collaborative creation of educational repositories in modern languages and the humanities.

The blended learning approach has also acted as a vehicle to purposefully design a 'flipped classroom' approach to the teaching. The design pattern and the evaluation of the experience will be valuable.

Turnitin for large-scale peer assessments has been implemented in Computer Science (Hamer et al, 2011), but is a novel departure for our university. The Southampton implementation is lighter weight than the earlier accounts and it will be interesting to compare the outcomes.

Students continue to exhibit a preference of default social software when left free to establish this social context and learning environment. However it would be possible to view this behaviour as a manifestation of the use of 'worldware' (Morris et al 1994) taken into the twenty-first century. The value of a purposeful requirement to make use of a wide range of authentic social tools, and to reflect on the viability and effectiveness of the methods chosen, remains to be evaluated.

In our local experience, the use of technology enhanced learning in STEM disciplines is not widespread. The model chosen by this initiative is to use technology as a workflow manager in conjunction with authentic tools and authentic tasks. It remains to be this experience is undermined by the acknowledged dissonance between the natural methods of predominantly hard applied fields of study compared to those which best match soft applied disciplines. One thing is sure, this particular design, and its design patterns may give us some insight. One thing which remains unanswered is whether the students will actually enjoy the experience.

The task of redesigning any area of the curriculum, whatever the discipline, is not one to be taken lightly. This paper has provided a case study of such an activity, where a specific objective of the team engaged in the redesign was to identify the pedagogic and learning design patterns inherent in blended learning.

The importance of the learning which results from producing systems, such as the one describe here, are valuable because they demonstrate a pragmatic solution to a real large scale problem constrained by existing infrastructure and established working patterns and practices. Whilst more powerful tools may exist, and ideal practices documented in the theory, transforming face-to-face teaching into effective blended learning, requires insights and understandings of the student experience in the specific context of their university studies.

The potential benefits of recording the steps required in such activities are manifold. It remains to report on a detailed evaluation of the experience; and it will be important that such evaluation considers the changes implemented and the interactions generated from the perspective of each one of the actors in the system. Perhaps most importantly the systematic acquisition and cataloguing of institutional or organisational knowledge is an activity which every university must surely value. Such knowledge can be of use to achieve diverse objectives; financial stringency, maximal student satisfaction or optimal use of all available resources. This exercise has, this far, yielded some valuable insights.

Information technologies supporting learning: There is a strong case for arguing that information technologies can be used to remove the barriers to learning. Providing access to information at anytime and anyplace makes a compelling argument.

From the academic's viewpoint, systems which manage workflow alleviate a major pressure point in the day-to-day working life at university.

It remains to be seen whether learning analytical information is as valuable to educationalists as customer profiles and analytics are to commercial organisations. It seems reasonable to assume that students might benefit from learning about successful practices (students who have a first class mark so far are looking at these web pages…).

University teaching has sometimes been described as the last cottage industry. Institutions like the UK's Open University have long established practices of working with a mixed team formally planning and creating learning resources to be integrated with specific educational experiences. Such an approach has provided a framework for much more clearly identifying and utilising preferred learning and teaching methodologies.

The systematic approach to learning design, has provided an opportunity to methodically make use of a wide range of approaches to assessment; a far wider range than might typically be found in a conventional face to face educational programme.

Students in the department were already making extensive independent use of technology for social learning activities. It remains to be seen if this structured approach will be acceptable, or be judged a poor second to the ad hoc solutions crafted from the preferred social network chosen and used by the vast majority.

At the university department being studied, there is a strong infrastructure of linked data driven module pages, many coursework submissions are electronic, and some examinations and tests take place online. Much information is published online, and some academics make wide use of the institutional repository. None the less, it is possible to argue that before this particular exercise technology enhanced learning has not widely used.

The predominant philosophy here is that technology is good for admin, but teaching and learning is a process where people and face-to-face interactions are prime. This detailed design activity is providing an opportunity to open up from that view, but it will only be more widely accepted if the student learning experience is at least as good, if not better than that afforded by conventional approaches.

There remains, of course, much future work which can be done. When the module is run it will provide a large volume of detailed evaluation data mapping student experience. Alongside routine and systematic evaluations which can be compared to previous years' and previous methods a range of different evaluation approaches are proposed.

Focus group discussions will be used to identify key strengths and weaknesses. These will be complemented by critical and reflective evaluation by academics at the end of the module. It is also intended to recruit students from the cohort to become participative evaluators and co-designers to help identify and create the inevitable and necessary revisions which will emerge.

Equally important, the learning designers will consolidate their knowledge, understanding and reflection of the process. Initial drafts of the formal design patterns will be circulated and subjected to peer review, and the whole pattern of integrative innovation will begin again.

REFERENCES

Aljohani, N.R. & Davis, H.C., 2012. Significance of Learning Analytics in Enhancing the Mobile and Pervasive Learning Environments. In *Next Generation Mobile Applications, Services and Technologies (NGMAST), 2012 6th International Conference on*. pp. 70–74.

Biglan, A., 1973b. The characteristics of subject matter in different academic areas. *Journal of Applied Psychology*, 57(3), pp.195–203.

Boud, D. & Falchikov, N., 2006. Aligning assessment with long term learning. *Assessment & Evaluation in Higher Education*, 31(4), pp.399–413.

Davis, H.C. et al., 2010. Bootstrapping a Culture of Sharing to Facilitate Open Educational Resources. *IEEE Transactions on Learning Technologies*, 3(2), pp.96–109.

Furr, A. et al., 2010. eFolio: a DIY ePortfolio. In L. Creanor et al., eds. *ALT-C 2010 - Conference Proceedings.* Nottingham: Association for Learning Technology.

Goodyear, P. & Retalis, S., ed. (2010), *Technology-Enhanced Learning: Design Patterns and Pattern Languages*, Sense, Rotterdam

Hamer, J. et al., 2011. Tools for "contributing student learning". *ACM Inroads*, 2(2), p.78.

Millard, D. et al., 2009. Co-design and Co-deployment Methodologies for Innovative m-Learning Systems. In *Multiplatform E-Learning Systems and Technologies: Mobile Devices for Ubiquitous ICT-Based Education*.

Morris, P., Ehrmann, S. C., Goldsmith, R., Howat, K. & Kumar, V. 1994. Valuable, viable software in education: cases and analysis, New York, McGraw-Hill (Primis).

Siemens, G. & Page, H., 2005. Connectivism : A Learning Theory for the Digital Age. *International Journal of Instructional Technology and Distance Learning*, 2(1), pp.1–9.

White, S. & Liccardi, I., 2006. Harnessing Insight into Disciplinary Differences to Refine e-learning Design. In *Frontiers in Education Conference, 36th Annual*. pp. 5–10.

White, S. & Davis, H.C., 2011. Making it Rich and Personal: crafting an institutional personal learning environment. *International Journal of Virtual and Personal Learning Environments (IJVPLE)*, 2(4), p.17.