AN INCREMENTAL APPROACH TO TECHNOLOGY-SUPPORTED CURRICULUM DESIGN AND APPROVAL

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ABSTRACT

Technology-supported approaches to curriculum design and approval have recently emerged as an important area of development within the tertiary education sector. Such approaches offer a number of potential benefits, including improvements to curriculum responsiveness and enhancements to pedagogy. However, at present there is little consensus on the technical approach that should be adopted for such systems. This scenario is complicated by variability and complexity of the processes such systems attempt to model and the uncertainty that pervades requirements analysis. This paper provides a case study of an incremental, lightweight technical approach to technology-supported curriculum design and approval using OOB solutions ("out of the box") which attempt to ameliorate these issues while also effecting improvements in curriculum design quality and approval efficacy.

KEYWORDS

Technology-supported curriculum design, e-learning, requirements analysis

1. INTRODUCTION

Better understanding the area of technology-supported curriculum design, approval and review has motivated research and innovation, particularly within the UK higher education sector (Knight 2012); however, there are currently no off the shelf tools available and specifying, developing and implementing bespoke approaches can be problematic owing to the large number of diverse stakeholders involved. Requirements can be difficult to elicit and the peculiar organizational structures of universities are often such that an accurate model of institutional processes is not possible until late in the system development lifecycle. This increases uncertainty in systems development. Sequential system development approaches (e.g. "waterfall") are therefore inappropriate and technical approaches must therefore be extremely flexible and capable of accommodating emergent requirements.

In this paper we provide a case study of an incremental approach to technology-supported curriculum design and approval using low impact OOB ("out of the box") MS InfoPath and SharePoint technologies, as part of the Principles in Patterns (PiP) Project (http://www.principlesinpatterns.ac.uk/). This approach attempts to respond to these challenges whilst simultaneously enabling loose coupling to other corporate systems, effecting improvements in curriculum design and approval efficacy, and enabling the manipulation of curriculum designs for other aspects of institutional business. Being founded on existing processes and practices the approach is minimally disruptive yet still has the potential to facilitate fundamental change.

2. BACKGROUND

2.1 Tech-supported curriculum design and approval

Innovative approaches to technology-supported curriculum design offer an opportunity for improving academic quality, pedagogy and learning impact (McGill 2011). Those approaches that are innovative in

their use of technology offer the potential of an interactive curriculum design experience within which the designer is offered system assistance to better adhere to pedagogical best practice, is exposed to novel and high impact learning designs from which to inspire reflective design, and benefits from system support to detect common design issues which might otherwise delay curriculum approval or usurp the resources of academic quality assurance teams.

It is also anticipated that technology-supported approaches can improve the efficacy of curriculum approval processes at universities, thereby increasing the curriculum responsiveness of institutions and supporting improved and rapid review mechanisms which may support enhancements to pedagogy (Bartholomew & Everett 2011). Whilst pedagogical planning tools exist (e.g. Phoebe 2012, Laurillard 2008), these focus exclusively on teaching delivery and not on the wider issues of curriculum portfolio management and approval. Responsive curriculum design and approval, and the rapid generation of curricula that this infers, is increasingly necessary to respond to changing academic contexts and the changing needs of stakeholders (e.g. employers, professional bodies, etc.). For example, new technological or environmental developments, particularly within the sciences and engineering disciplines, mean that the rapid reengineering of curricula or the embedding of new skills is increasingly necessary to maintain academic and market relevance (Desha et al. 2009). The emerging globalized university sector (Robertson 2010) also contributes to these pressures by frequently necessitating the creation of specialist curricula, either to attract international students or to render curricula conducive to delivery at international branch campuses (Lane 2011).

2.2 Uncertainty and emergent requirements

The novelty of tech-supported curriculum design and approval has inspired a great deal of activity within the UK; but agreement on the preferred technical framework and development approach remains undecided (CETIS 2012). Part of the difficulty lies in the organizational scope of such technology and its peculiar implementation context, all of which increases uncertainty in the system requirements and its subsequent development.

Curriculum design and approval at universities generally involves multiple stakeholders, including, academics, academic quality personnel, university and faculty scrutiny committees, as well as registry and regulatory departments, finance, libraries, timetabling and estates management. The peculiarities of public sector organizational structures is also such that responsibility for processes tends to be shared among numerous stakeholders and often demonstrates labyrinth-like qualities, extending well beyond the boundaries of single departments to encompass entire organizations (Sundberg & Sandberg 2006). Stakeholder specific perceptions of how the approval processes operates and myths about organizational procedures and a stakeholder's role within certain procedures, some of which are themselves mythic, contribute to the uncertainty surrounding the curriculum design and approval process. Myths are not uncommon in organizational contexts and are often considered necessary in functioning bureaucracies (Meyer & Rowan 1977). The novelty of inserting technology into the pedagogical process of curriculum design further compounds stakeholder uncertainty. Users have few examples of tech-supported curriculum design and approval from which to draw inspiration during requirements analysis, making the elicitation of stakeholders' requirements problematic. Tech-supported approaches require (depending on the technical solution adopted) a greater rigor, predictability and standardization than afforded by existing opaque document and person-centered workflows. As a result systems analysts can find themselves asking questions of the existing processes that have never needed an answer before; let alone a definitive answer.

Uncertainty in requirements analysis has been well researched and approaches conducive to responding to it have been proposed (Harker et al. 1993). Although system designers generally have a clear holistic goal for the system, the "emergent requirements" approach acknowledges stakeholders' inability to articulate precise requirements and that time is required for stakeholders to understand their issues and goals, or to appreciate the technical opportunities available to satisfy these goals. Harker et al. (1993) summarize the benefits of the emergent approach; suffice to state that it incorporates aspects of participative design (Kjær & Halsov Madsen 1995) and prototyping. Only then is it possible to begin to clarify and elicit requirements and development needs.

3. TECHNICAL APPROACH AND ARCHITECTURE

The architecture of the technical solution C-CAP (Class & Course Approval Pilot) responded to the drivers that motivated the PiP Project and was for a standalone, self-contained curriculum design and approval system with a loose coupling to other corporate systems, thereby allowing broad stakeholder access to the contents of the system, as in Figure 1.

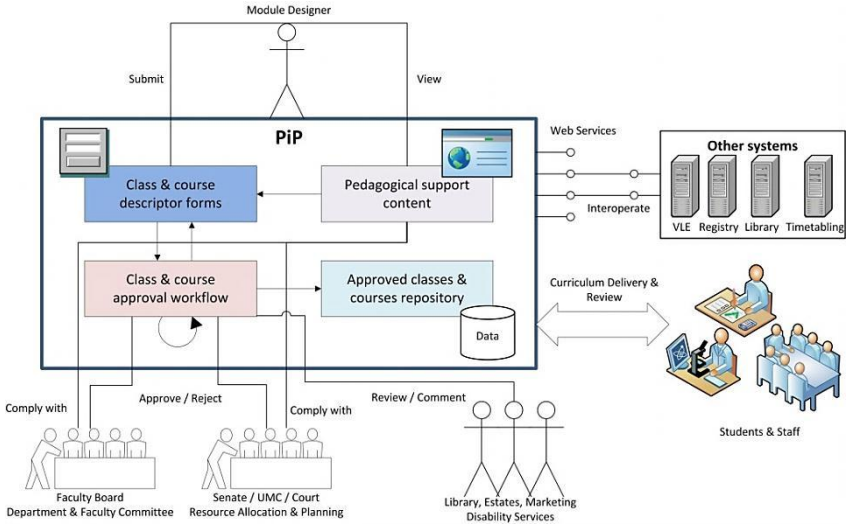

Figure 1. Class and Course Approval Pilot System (C-CAP) architecture

Fundamentally, corporate systems (e.g. student records system) are typically designed for data entry by a small group of specialist staff rather than the widespread participatory engagement required by the C-CAP system. Corporate systems are also designed as the "source of truth" whereas the curriculum design and approval process is essentially one of draft-feedback-redraft-approval with a final version only emerging at the end of an extensive scrutiny process. Data structures within student records, etc. represent only a subset of the information used by faculty quality committees to make approval judgments; primarily because this sort of data is not relevant to the other functions. Pragmatically the current corporate systems were the subject of long standing and extensive development programs that could not easily accommodate the incremental development required of our tech-supported curriculum design approach.

The C-CAP system is built on Microsoft SharePoint. SharePoint offers a highly flexible platform from which to offer browser-based services through a web interface that can be adapted to offer a rich range of resources and interactivity. Most University support staff using C-CAP are already regular users of various services delivered through SharePoint while academic staff are exposed to the platform through several different applications (e.g. committee management, knowledge exchange information, and even booking attendance at graduation events). The main difficulty identified was the ability to customize the user interface and the underlying data structures against the technical skills required to build and maintain the system. SharePoint native features were clearly inadequate to the complex data collection, validation, review and version control that were envisaged. A custom .NET application, benefiting from the SharePoint interface, authentication and workflow features that offered the most comprehensive toolkit with which to develop a course and class approval system and initial prototypes were very promising. However, the difficulty of the approach was its requirement for continued programming expertise to create and maintain; something which lacks agility and sustainability in the light of requirements uncertainty (Bartholomew & Everett 2011).

An alternative OOB approach incorporating Microsoft InfoPath better accommodated the development scenario. "Microsoft InfoPath … is a forms-creation and data-gathering tool that helps organizations streamline business processes. InfoPath … is designed for both advanced business users and developers…" (Microsoft 2012). InfoPath allowed the development of complex, adaptive forms using "power users" rather than programmers, deliver these forms through web forms that required no additional client software and

were (largely) cross-platform and, easily and quickly adapt and extend the forms as requirements were uncovered and clarified, and as users contributed feedback. Expediency therefore motivated an OOB approach and better supported rapid prototyping and ergo the incremental development process. Such a conventional lightweight OOB approach appears to have effected transformative organizational change in areas such as process transparency, academic quality, approval efficacy and has promoted the concept of the curriculum design as a knowledge asset (Macgregor 2012), all without the requirement of developing and maintaining complex bespoke systems. The approach is therefore a rejection of complexity and recognition that technology-supported curriculum design is principally concerned with supporting and improving pedagogy and academic quality, irrespective of the technical approach adopted.

Using InfoPath has also allowed the following features to be incorporated into the C-CAP system:

- roles which can be managed by academic quality staff and the writing team themselves
- permissions based on role and process stage ensuring the right people can edit the right sections at the right time, and only at that time
- rules-based views that only show the areas of the form relevant to a particular role, process stage and options selected, which dramatically decreases the amount of irrelevant information/options presented to the user
- context sensitive help and advice, which provides immediate access to information enhanced with links to additional resources
- feedback and review stages that preserve the comment history so that reviewers can verify what actions have been taken in response to the comments
- automated notifications and alerts prompting actors with the next stage in the process while ensuring transparency throughout the approval process
- version control and logging of all significant updates

The underlying data captured by C-CAP is held in SharePoint as a single XML file for each proposal. This data is accessible both within SharePoint and to external systems for further manipulation, e.g. curriculum design reuse and sharing, archiving, business intelligence analytics, etc. Future work will also explore the transformation of XML curriculum designs for serving to XCRI compliant aggregators (eXchanging Course Related Information 2011) and pushing KIS and UCAS data (KIS 2012).

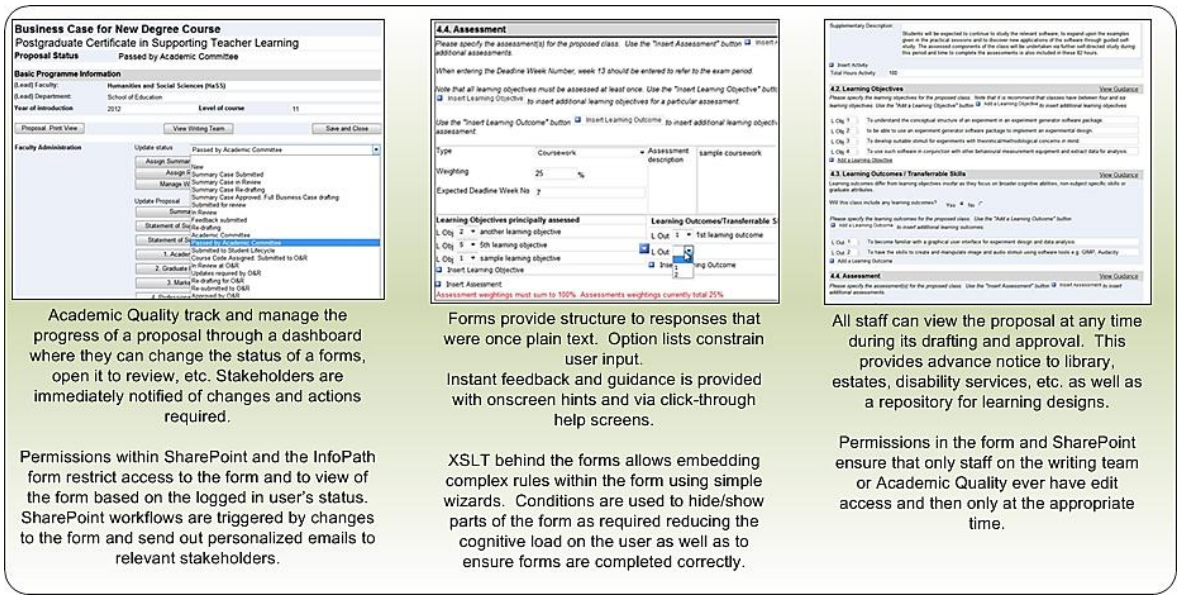

Figure 2. Examples screens from C-CAP of design and approval process and academic quality management

4. CONCLUSION

The unique nature of curriculum design and approval at universities is such that those institutions wishing to pursue innovative technology-supported approaches need to develop bespoke solutions. This brief paper provides a case study of an OOB approach to technology-supported curriculum design and approval that better corresponds to the often chaotic nature of organizational processes and the uncertainty in systems development that results from this scenario. The approach facilitates an alignment with the emergent requirements method, enabling rapid prototyping and adjustments to system logic, interface features, workflows and process modeling, thus better modeling the ultimate requirements of stakeholders and promoting high levels of system acceptance; but also facilitating high levels of data reuse and interoperability. The success of our approach has recently been corroborated by an extensive phase of evaluation activity intended to explore the system's impact on approval process efficacy and the academic quality of curriculum designs. Results from this activity are expected to be disseminated in the academic literature soon. Longer term evaluation - expected to follow an extended period of institution-wide embedding - will seek to capture evidence on the wider organizational impact of the system, including the extent to which the system has enabled organizational change with respect to the management, reuse and sharing of curriculum designs among academics and the institutional competitive advantage to be gained from the curation of curriculum designs as knowledge assets.

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REFERENCES

Bartholomew, P. and Everett, J., 2011. Socio-technical Ramifications of a New Approach to Course Design and Approval. *JISC Innovating e-Learning Online Conference.* Available: http://goo.gl/Jpys4.

CETIS., 2012. *PROD – monitoring projects, software and standards*, available: http://goo.gl/BAPdH

Desha, C. J. et al, 2009. Addressing the Time Lag Dilemma in Curriculum Renewal Towards Engineering Education for Sustainable Development. *International Journal of Sustainability in Higher Education*, Vol. 10, No. 2, pp. 184–199.

eXchanging Course Related Information., 2011. *XCRI Knowledge Base*, available: http://www.xcri.co.uk/

Harker, S.D.P. et al, 1993.The Change and Evolution of Requirements as a Challenge to the Practice of Software Engineering. *Proceedings of IEEE International Symposium on Requirements Engineering*. Los Alamitos, Calif., pp. 266 –272.

KIS., 2012. *Key Information Sets*, available: http://www.keyinformationsets.com/

Kjær, A. and Halskov Madsen, K., 1995. Participatory Analysis of Flexibility. *Communications of the ACM*, Vol. 38, No. 5, pp. 53–60.

Knight, S. 2012. *Institutional Approaches to Curriculum Design*, available: http://www.jisc.ac.uk/curriculumdesign.

Lane, J. E., 2011. Importing Private Higher Education: International Branch Campuses. *Journal of Comparative Policy Analysis: Research and Practice*, Vol. 13, No. 4, pp. 367–381.

Laurillard, D., 2008. The teacher as action researcher: using technology to capture pedagogic form. *Studies in Higher Education*, Vol. 33, No. 2, pp. 139-154.

Macgregor, G., 2012. *WP7:38 Impact and process evaluation - Piloting of C-CAP: evaluation of impact and implications for system and process development*, University of Strathclyde, Glasgow. Available: http://goo.gl/65fp6

McGill, L., 2011. *Curriculum Innovation: Pragmatic Approaches to Transforming Learning and Teaching Through Technologies.* JISC, Bristol. Available: http://goo.gl/yTx0h.

Meyer, J. W. and Rowan, B., 1977. Institutionalized Organizations: Formal Structure as Myth and Ceremony. American *Journal of Sociology*, Vol 83, No. 2, pp. 340–363.

Microsoft., 2012. *InfoPath 2010 features and benefits*, available: http://goo.gl/2PTo4

Phoebe., 2012. *Phoebe – pedagogical planner*, available: http://www.phoebe.ox.ac.uk/

Robertson, S. L., 2010. Corporatisation, Competitiveness, Commercialisation: New Logics in the Globalising of UK Higher Education. *Globalisation, Societies and Education*, Vol. 8, No. 2, pp. 191–203.

Sundberg, H. P. and Sandberg, K. W., 2006. Towards E-government: a Survey of Problems in Organisational Processes. *Business Process Management Journal*, Vol. 12, No. 2, pp. 149–161.