Managing Student Support: A Holistic Approach

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ABSTRACT
With the advance and scaling up of e-learning and distance learning provision, the scope of student support systems has extended and deepened, demanding consideration of the methods for its planning and implementation. Management of student support is used as an example of a key business process that is one part of a higher education enterprise's end-to-end process of e-learning provision, with a model-driven, holistic approach to its management. The proposed management method is based on implementing workflow process models that are supported by a context sensitive knowledgebase. The modelling approach already developed is advanced by the introduction of the idea of bridging principles.

Keywords
Student support, process model, process mentor, knowledgebase, quality of service, bridging principle

INTRODUCTION
Institutions of higher education are re-engineering and scaling up their teaching and learning operations and moving away from a 'cottage industry' mode of operation to a more professional approach (King, 2002). This is being driven by the widespread adoption of e-learning in its various forms. Support is a key element of the academic and non-academic aspects of e-learning provision (Phipps & Merisotis, 2000) and its planning and execution need to be fully integrated with the lifecycles of both the e-learning products and of students.

In processes such as setting up and managing student support a number of people carry out activities in a sequence to complete the tasks that are their responsibility. When the processes are undertaken in a mature way then people follow documented and managed procedures. In organisations in which process support has developed to a high degree, procedures are followed in part with the support of tools and software applications. Within the higher education enterprise there are many such sequences taking place concurrently, whether documented or not. These multiple threads can influence each other at various points in their execution, with both immediate and delayed effects, creating overall, a complex and dynamic system. As with all such systems there are many factors determining effectiveness and efficiency and usually it is not obvious how to control or improve them (Smith and Fingar, 2003, Muehlen, 2004). A first step in doing this is moving to more formalised and mature systems and this demands that they be modelled and that a holistic or 'systems' approach is taken.

Formal modelling allows consideration of multiple aspects of a system within a single coherent framework. The principle underlying this paper is that of the Model Driven Architecture (MDA) approach (Frankel, 2003, OMG 2003a) both to managing services such as student support, and to providing a knowledgebase that will enable staff to execute process functions utilising the best available practice. Additionally, once a process is captured as a versioned model then changes to it can be planned and managed. The model will evolve as more is learned and as organisations change in response to changing requirements. The point here is that the model captures and articulates processes and allows them to be examined, managed and optimised. Additionally, as the model develops, so does the knowledgebase and hence the capability for staff to accommodate change. By documenting the processes in an intuitive and consistent manner, the models also provide a channel of communication between the various roles or communities of practice involved in providing e-learning.

It is axiomatic for any systems approach to consider whole systems and their environment or context and their operating conditions. The issue of boundaries and where to draw them belongs to all system definitions and while this problem is recognised it is not dealt with explicitly here. Rather the emphasis is on the need to look at the wide perspective of the system for developing student support, emphasising both the detail of the process of development and the complex array of steps and artefacts that make up the wider system. In particular, emphasis is given in the approach to the place of the process model in a much wider system or model.

THE HOLISTIC MODEL

The end-to-end process model context

Dexter and Petch (2004) have outlined the concept of the end-to-end model for e-learning design, development and delivery that sets out the underlying principles for the scope and structure of processes for e-learning from initial idea to decommissioning. The place of such end-to-end processes in the service provision of organisations has been developed (Dexter and Petch, 2003) in terms of a Quality of Service Framework and in terms of the need to base such an approach on Reference Models (Barn et al., 2005). The significance of the sector wide effort to develop reference models for e-learning (Blinco et al., 2005) is seen primarily in the shared acceptance yet to be fully articulated, of an end-to-end view of teaching and learning. It underlies the emergence of the idea of service architectures in JISC (Olivier et al, 2003)

The process model for the development of student support which is examined here is easily seen to be part of a wider model for design and development of e-learning, or for that matter of any approach or channel for teaching and learning. It forms part of the planning stage of the development life cycle for courses following from the initiation phase and leading to the design phase.

Process Models

The model developed here is articulated as a process driven knowledge base (Dexter and Petch, 2006) and the core set of elements is illustrated in Figure 1.

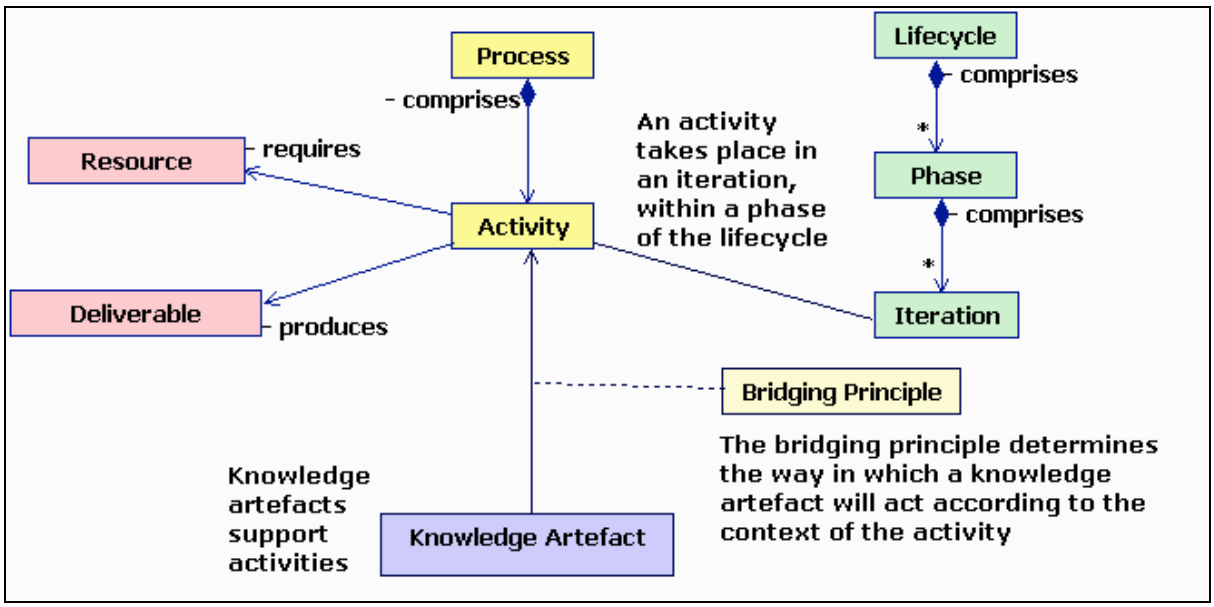

Figure 1 Conceptual model of context-sensitive use of knowledge artefacts

A process is made up of a sequence of activities, their order being partially pre-determined and partially determined in response to business rules. Activities consume resources and produce deliverables. The activities may be grouped logically into Practices, the criterion for grouping being their common concerns and dependencies. The lifecycle of an e-learning product is made up of a particular sequence of activities that may be found within the different practices. The lifecycle processes are implemented over a period of time. This period may be divided into phases and each of the phases may be divided into iterations. For a particular activity taking place in an iteration of a phase there may be knowledge artefacts available to assist the role executing the activity. The way in which a knowledge artefact is used in a particular context is defined by a Bridging Principle. The set of artefacts the process uses (and may or may not modify) is termed the knowledgebase of the process.

Knowledgebase

The knowledgebase consists of the explicit knowledge of the e-learning provider, including general informational and notification documents, policy statements, research papers, white papers, user manuals, standards documents, guidelines, checklists, choice lists and others. In an organisation it may be distributed across multiple physical locations but will have a unified logical classification structure. The process models,

including roles, activities, rules and information flow, are used to ensure that the appropriate elements from the knowledgebase are made available to the right people at the right time.

A knowledge artefact is used during an activity according to the current context. The following table (Table 1) shows the attributes of the Task, Knowledge Artefact and Bridging Principle that together determine the manner in which the person carrying out the task is supported by the knowledge artefact.

Table 1. Task, Knowledge Artefact and Bridging Principle Structures

TASK
Task Name
Task goal
The roles that must collaborate in the current task
The roles that need to be informed of the current activity and its outcomes
Resources required for this task
Outputs (deliverables) of the task
The service level agreement for these deliverables
KNOWLEDGE ARTEFACT
Artefact Name
Type (Guideline document, template, policy, protocol, checklist…)
The problem types addressed by the artefact
Operational description
Constraints on the use of the artefact
Source location
BRIDGING PRINCIPLE
Bridging Principle Name
Function of Bridging Principle
Place in the end-to-end process (current task)
Place in the task workflow process (current activity)
The manner in which the knowledge artefact is to be utilised
Quality metrics of the deliverables relevant to the role of the artefact
Quality metrics of the task workflow process relevant to the role of the artefact
Constraints or rules for the execution of the task

Process Mentors

The people processes and technology involved in student support management are considered as a system, one that may involve academic and administrative staff, possibly controlled by central staff and that interfaces to other institutions. The variety and complexity of processes in these systems mean that staff responsible for tasks need support in their work. Unless a process guidance system exists to support staff then even their efforts to refer to procedure documentation, to checklists, policy documents and good practice guides will be at risk. Process guidance is an essential component of quality assurance and of the evaluation framework of modern systems (Kruchten, 2001, Shapiro and White, 1999) and active process guidance is seen as a key technology in improving development practices and controlling cost (Murphy, 2004).

Quality driven processes

The process model is meant to be part of a quality of service (QoS) framework, that is, it is meant to ensure that a particular service, the provision of student support, is delivered to an agreed and understood level, or to a quality standard or criterion. The ways in which the QoS framework does this, as exemplified in the support development model, is by ensuring that all the necessary steps in the planning process are followed in the correct order and making use of all relevant documents. The bridging principles ensure that documentation is used correctly in the context and the right stage of a process and the process mentor ensures that the necessary stages are carried out by the right people in the right way.

Many of the tasks, decisions and outputs of the process can be prompted and checked using checklists (Dexter and Petch, 2005). Such checklists are widely used in e-learning design and development (Franklin et al, 2004). What the QoS Framework adds to their use are quality assurance and benchmarking functions (Wilcox and Petch, 2005). Properly designed and used within separate processes, the checks can be used as metrics for quality assurance and for benchmarking processes. Indeed, a well planned process includes not only the documented stages with process mentors but also the means of ensuring that the desired processes has been executed and the process model must form the basis for any such harmonised system.

STUDENT SUPPORT IN E-LEARNING: THE HOLISTIC MODEL

The Student Support Prototype

The system described here is not a real system in that it is not based on empirical observation of an actual Higher Education Institution (HEI) nor could it be since the underlying objective is to promote improvements on current systems in HEIs. Nor is it an amalgam of a set of cases. It is hypothetical but is based on several concrete sources of knowledge. Following a cross-domain mapping approach (Dexter and Petch, 2005), the system is a product of a UML model on the one hand and a set of checks for developing support systems on the other (Dexter and Petch 2006) that have been collected form a variety of sources.

Knowledgebase

The student support process was divided into three principal stages: planning, set up and delivery. The student support activities from these three stages take place at a number of different points in the end-to-end process for e-learning provision. That is, the student support activities are embedded in both the e-learning lifecycle and the student lifecycle. When an activity that is relevant to student support is taking place it triggers the knowledgebase to provide the relevant items to assist the people who have to plan, set up and deliver student support.

Process Mentors

The student support management knowledgebase is driven by a detailed model of the student support provision process. The process model is written in UML (Unified Modelling Language) (OMG, 2003b) with a UML profile for process authoring (OMG, 2005) that controls the knowledgebase application. The metamodel of the e-learning lifecycle that provides the process context is derived from the Rational Unified Process metamodel (IBM-Rational, 2004b, Kruchten, 2004)..

The design of a working process driven knowledgebase that could be tested with e-learning processes was based on the infrastructure and method provided by the Rational Unified Process (RUP) (IBM-Rational, 2004a) and its underlying Process Engineering Process (PEP) (IBM-Rational, 2004b) which is sufficiently flexible to allow the definition of any process that fits the underlying metamodel. The knowledgebase can be used in the process context or by keyword search and is both a reference document and a process director

A skeleton of the e-learning lifecycle process was created and the points at which student support management processes were relevant were identified. A model of the student support processes for its three phases, planning, setup and delivery, was created and a prototype of the process mentor was created as a web application.

Sample of using the process mentor

Figure 2 illustrates the roles, activities, knowledge elements and bridging principles for a small part of the setting up process and shows how the overall activity is broken down in to a logical sequence of steps. At each step, where appropriate, the knowledge artefact is specified and, more importantly, how, in the Bridging Principles, that artefact is used at that stage. Of course an artefact can be used at many stages but how it is used will differ between stages. The bridge Principles are a key element of the system since they contain the knowledge, generic and local, that allows the system to work and to work effectively in any particular situation.

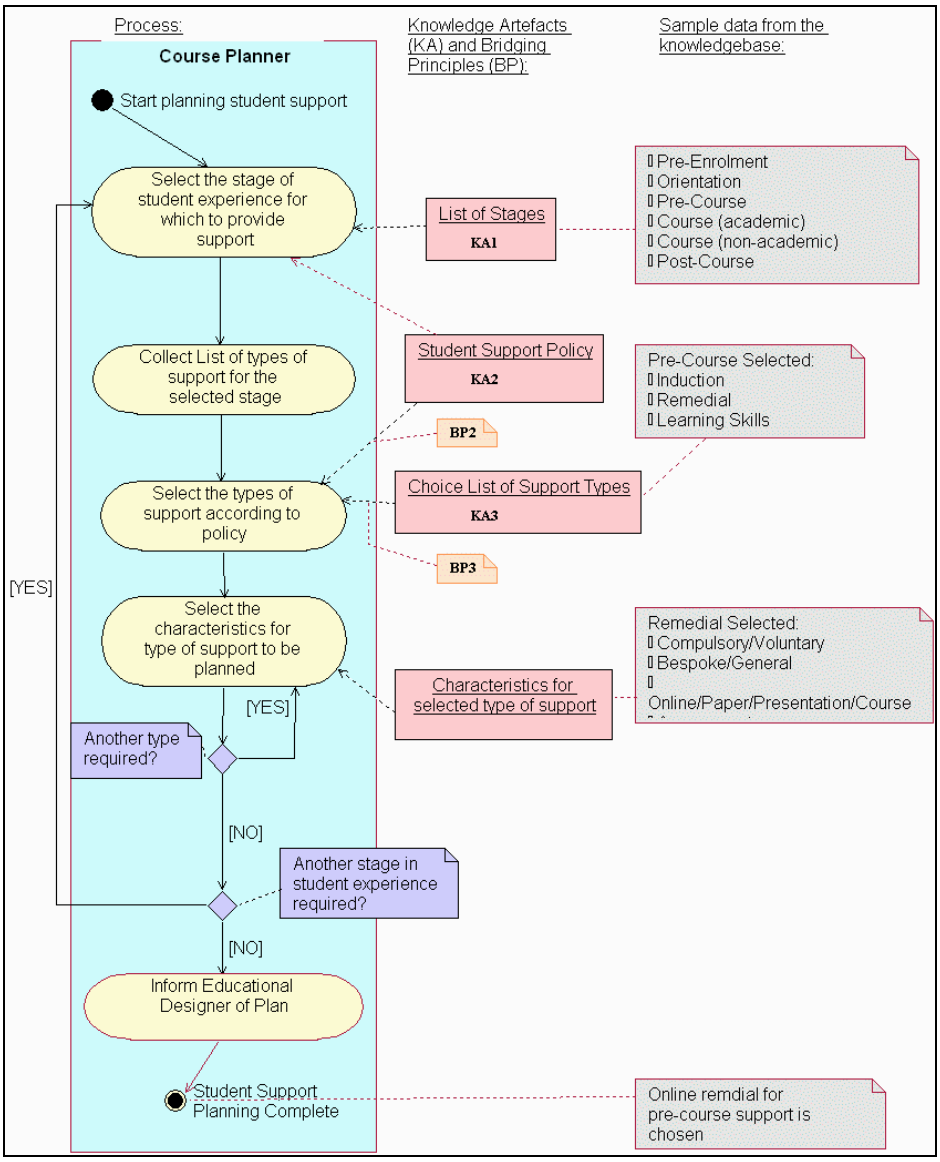

Figure 2 The Planning Process

The following tables (Table 3 and 4) provide descriptions of a sample of the knowledge artefacts and bridging principles that are defined for the 'Plan Student Support' process. The labels in the diagram of the process (Figure 2) correspond to the headings in the tables.

Table 3. Knowledge Artefacts in the Planning Process

KNOWLEDGE ARTEFACT	**KA1**	**KA2**	**KA3**
Artefact Name	List of Stages	Student Support Policy	Support Types list
Type	Choice list	Policy document	Choice list
Problem types addressed by the artefact	Identification of stage at which support is to be provided	All situations which require reference to principles to guide choices	Data/option selection
Operational description	List of stages in student experience	Text with identified policy statements	List of support types
Constraints on the use of the artefact	Courses have enrolment	Currency of policy to course plan	Selection of stage of student Policy on student support
Source location	File address of	File address of	File address of

	document	document	document

Table 4. Bridging Principles in the Planning Process

BRIDGING PRINCIPLE	BP2	BP3
Bridging Principle Name	Policy interpretation for support selection	Selecting support type
Function of the Bridging Principle	To ensure support type fits policy	Assigning support type to stage and to student characteristics
Place in the end-to-end process (current task)	Part of course design	Part of course design
Place in the task workflow process (current activity)	Stage in selection of support services	Stage in selection and specification of support service,
The manner in which the knowledge artefact is to be utilised	Interpretive	Choice list
Quality metrics of the deliverables relevant to the role of the artefact	Fit to policy	Appropriateness Viability Cost effectiveness
Quality metrics of the task workflow process relevant to the role of the artefact	Executes policy	Matching of the support type to stage unambiguously and completely
Constraints or rules for the execution of the task	Currency of policy	Support policy Budget Staff resources Technical resources Student profile

Again (cf. Dexter and Petch, 2005) it is emphasised that this process can be articulated in different forms, both as software tools, presented perhaps as here as web services, or as checklists, or as accumulated knowledge in people's heads. Parts may be captured in software and parts not. The model is neutral on the issue of software implementation. What it is not neutral on however, is the need to specify the fullness of these processes if, as is argued here, we are to develop professional ways of working in which practices can be shared between people and institutions, can be managed and optimized (Marshall 2004).

No such system will work unless processes are modelled and knowledge 'harvested' and organised. Without such full systematic approach to modelling there cannot be a move away form cottage industry types of operation. Yet, what is immediately clear is the immense detail in comparison with the normal level of documentation of such processes (cf. Marshall 2004, 2005). The main implication is the investment required in analysing processes and the necessary changes this initiates as well as the investment in 'harvesting' knowledge. What is particularly difficult and potentially resource hungry, is 'harvesting' tacit knowledge that resides in organisational norms, practices and in the unspecified culture of academics and administrators.

ISSUES IN DEVELOPING THE HOLISTIC MODEL

Extent of formalisation – how far down the Model Driven Route

The process driven knowledgebase is placed in the context of the whole lifecycle of an e-learning product. A conceptual model for that lifecycle is proposed and linked to a conceptual model of the required knowledgebase. Using these models we show how a particular activity taking place in a phase of the lifecycle may access knowledge artefacts to assist the person executing the activity. Knowledge artefacts may take a number of forms and a generic metamodel is given for knowledgebase items. Example instances of knowledge elements that would assist the various roles in student support management are given. However, an issue in each real instance of developing and applying such models is the level to which the formalisation should be taken. This will depend on the extent to which it is believed that tasks, decisions and outcomes are real. Where development is undertaken by a team and is perhaps managed across institutions and where product and service standards are high than a detailed model might be appropriate. Where individuals are undertaking many or all aspects of the development cycle then detailed models developed by the individual will be inappropriate but use could well be made of a tested template process developed for the whole organisation.

Cost Effectiveness

We show a plausible method for capturing processes and constructing a knowledgebase for these types of processes in HEIs. However, the investment in capturing all the required detail of processes is far from negligible. The key questions for HEIs adopting such an approach are therefore the extent to which putting the knowledge elements in the process context is cost-effective and how to lever benefits from such developments and ensure that they lead to improved quality, efficiency and effectiveness. It might be that in future the problem for HEIs will be assessing what management/guidance tools are required for all mission-critical tasks.

One of the merits of the knowledgebase developed here is that it is web-based and therefore easily available to all. It is not dependent on integration with other tools and so can be rapidly deployed and does not have to wait for a full enterprise system to be developed and put into commission. The implication is that the move to knowledge driven processes can be undertaken in stages and thus investment can be spread. Experience shows that the graphical interfaces are intuitive to use and that staff derive not only locally useful information but also develop a stronger holistic appreciation of processes. What this points to is an awareness that the benefits to be gained from modelling business processes and from a quality of service approach are not to be measured in terms of existing work practices and procedures.

Canonical models and the sector

A related issue to that of cost-effectiveness is the collaborative development of reference (canonical) models by the HE sector. Clearly, if common reference models of business processes can be developed then not only will the cost-benefit equation be altered favourably but also there are real possibilities of collaboration and of raising standards across the sector.

Currently the JISC is supporting a programme of investigation and development in to the development of reference models and the HEA is supporting a programme of development in to benchmarking of e-learning. These initiatives hold the promise of a step change in the quality of HE business processes if they are managed and coordinated well.

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