Design and Integration Issues in Developing a Managed Learning Environment Which is Responsive to Changing Curriculum and Policy Requirements

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ABSTRACT

The virtual learning environment for undergraduate medicine at the University of Newcastle ('the NLE'), was established by 1998 and currently supports over 1,400 students and over 1,600 contributing staff. The NLE and wider managed learning environment is continually developed and refined in response to changes in curriculum and policy requirements, including support for learning over a wide geographical area. The purpose of this paper is to report on the design and integration issues of the NLE with reference to these changes. We provide usage data and critically examine the implications of the integrated approach at Newcastle and relate this to student learning.

Keywords

virtual learning environments, networked learning environment, design, integration, electronic portfolios, medicine

INTRODUCTION

The Networked Learning Environment (NLE) supports the undergraduate medical curriculum at the University of Newcastle. Like many other medical schools (for example Ward et al., 2001, Ellaway et al., 2003, and Roberts et al., 2003), Newcastle developed a 'home-grown' virtual learning environment (the 'NLE') because of the complex curriculum requirements of medicine were not easily satisfied by commercial VLEs. However, as a content-independent system the most of the issues raised in relation to the NLE can be readily applied to other contexts and disciplines.

The NLE was initially developed as part of a collaborative TLTP3 project led by Newcastle (Skelly, et al.1997, Jordan et al, 1997). The NLE formed the basis of the online curriculum support systems for medicine used by the project partners at Newcastle, Durham, Sheffield (Roberts et al., 2003) and Nottingham. The NLE at Newcastle supports a programme which currently has over 1,400 students and over 1,600 contributing staff. The medical degree programme is nominally five years in length with the first two years (referred to as phase I) at Newcastle and the final three years (phase II) being hospital-based. It supports three different entry points into the medical degree programme; a standard 5 year programme, an accelerated four year programme for students with a prior science degree where the initial phase I is compressed into one year and a joint programme with Durham University where the students have their phase I training located at the Queens Campus, Stockton and their phase II training with Newcastle. During phase II, students are dispersed over a wide geographical area where their training and administration are provided by four regional clinical centres called 'base units'. This means that throughout almost all their phase II training, the students are not physically located at the Newcastle campus. In this paper we describe the features of the NLE, report on the design and integration issues with reference to changing policy and curriculum requirements, discuss evaluation issues and relate these to student learning.

FEATURES OF THE NLE

Components of the current version of the Newcastle NLE include:

Personalised portal views

Once users log in with their username and password their view and access privileges to the NLE are determined by their role (students, staff or admin). Students are presented with a 'portal' view which is customised for their current year (Figure 1). This portal provides an overview of the year with Study Guides (commonly referred to as 'eGuides'), learning resources, and on-line self-assessment questions for each strand of the curriculum. The portal also allows users to view the eGuides, resources etc. for other years and versions for previous years.

Electronic study guides for all modules in the curriculum

The eGuide content is written by curriculum officers and module leaders. The eGuides provide detailed curriculum information customised for year-group and calendar year. The content management system of the NLE is described in more detail later in this paper. It allows formatted Microsoft Word documents containing each study guide to be uploaded into the NLE. The system then 'dissects' the documents to form the basis of the content and the structure of the online curriculum.
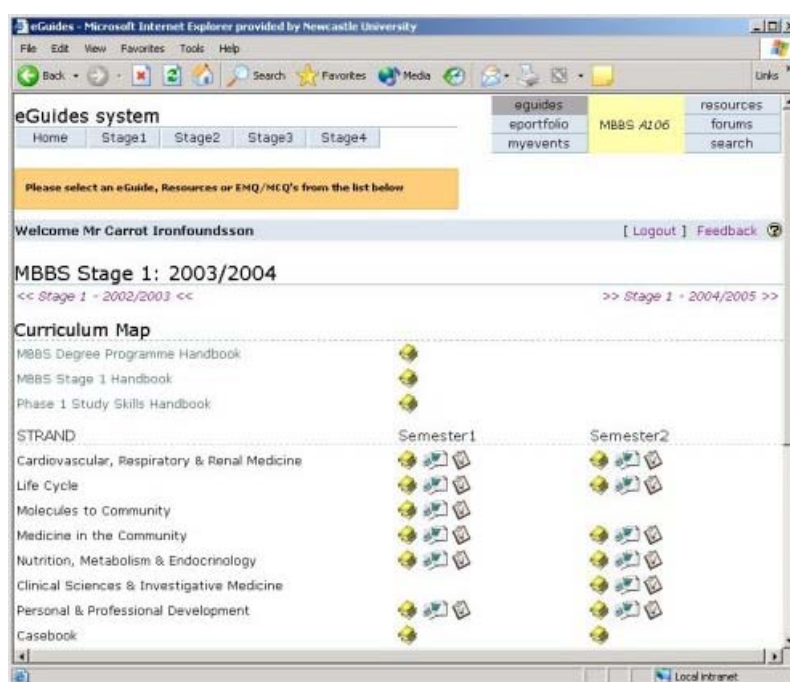

Figure 11. The NLE portal view for a year 1 student integrating study guides, learning resources and self-assessments for each strand of the curriculum.

Learning resources (internal and external)

Learning resources (documents, presentations, spreadsheets etc.) are uploaded by teaching and administration staff into the NLE. There is contextual metadata attached to each resource that defines its location within the NLE. New resources are brought to students attention and all resources can be searched for keyword and title across the entire NLE. To prevent information overload, students are initially shown only those resources applicable to their year, but they are able to view and download any resource across the entire curriculum.

Patient based case scenarios

The course at Newcastle has been designed around eight major longitudinal themes that span the whole five years:

- personal & professional development

- medicine in the community

- clinical sciences and investigative medicine

- nutrition, metabolism and endocrinology

- cardiovascular, respiratory and renal medicine

- thought, senses and movement

- life cycle

- and student selected components

Each of these themes are addressed during each semester through the eGuides and a series of patient based case scenarios. The patient case scenarios are designed to cross multiple longitudinal themes. As a result the students get to revisit each case scenario from a range of different contexts as they progress through the curriculum.

Library data

Reading lists are managed by the medical library using their own database. A workflow process ensures that when the medical library information is updated, the NLE database is automatically updated as well. This ensures that the latest reading lists are made available to students online. Additionally, each book is presented onscreen with a live link to the central library databases. This allows the students to reserve a book online, search for similar books and articles and perform many other tasks.

Self-assessment

The NLE supports both multiple choice and extended matching questions. Students attempt these questions either as a random quiz or through an eGuide specific self-assessment paper. Questions are logged and provide the student with a record of which questions they have attempted and their scores. Students can reattempt the self-assessment questions as often as they like.

Reflective ePortfolio

Electronic portfolios ("ePortfolios") are being trialled for undergraduate medicine at Newcastle in 2003/4. The ePortfolios provide a means of recording, reflecting on, and evidencing the attainment of learning outcomes. They are integrated with on-line curricula, eGuides and other on-line support resources for undergraduate Medicine.

Assessment marks and feedback

Course related assessment marks and personalised feedback is published online through uploading into the NLE, minimising the queues at the exams office and more importantly reducing the need for students dispersed across the region from having to visit the main central administration office.

Discussion forums

Discussion forums are new for 2003/4. There are a number of forums, including those for specific year-group discussion.

Course announcements

During Phase II students are located off-campus at one of 4 'base units'. This means it is vital to communicate course announcements to them in a timely and accurate fashion. The administration staff communicate directly with the NLE, specifying what year and group the announcement is intended for. The announcement is made available automatically to the appropriate students via an 'In Box' facility. Additionally, this facility is used to inform students when they are required to complete in-course evaluations and other tasks, with the message only being removed once the evaluation or task has been completed.

Course evaluation

A system for online module evaluation has been integrated into the NLE. Students are reminded via the course announcements system to fill out the online forms during the last week of their rotation.

Timetable information

Databased versions of the Phase I campus-based timetables are available online. Both daily and weekly interactive views are available, with each timetabled session containing information on who is delivering the

session, what the subject is, where it is to be delivered and which eGuide it belongs to. Students can use these interactive views to access any resources associated with a session and look-up which location the sessions will take place in**.**

Curriculum Map

The introduction of the new outcomes lead course at Newcastle is currently in its 3rd year. The use of online databased management systems for production of eGuides has enabled Newcastle to provide and compare the terminal outcomes maps for several degree programmes. These curriculum maps support the quality assurance process by identifying potential imbalances in the overall degree programme.

DESIGN AND INTEGRATION

Design Philosophy

The fundamental philosophies in the design and integration of the Newcastle NLE are: 1) that data is only entered once, ideally by the people responsible for it, and re-used as far as possible throughout the NLE and associated systems. 2) The focus is on developing online, user-friendly, content management systems that are accessible to non-technical administrators. 3) That, as far as possible, non-technical users are empowered to independently manage their content online. 4) That internet technologies based on open-source software be used to the widest extent possible. 5) Presentation and content is customised for the individual, depending on their role. Other innovations within the NLE include support for student progression, longitudinal 'themes', and multiple versions of eGuides to reflect changes in the curriculum.

Content Management

As the NLE is designed to be used by non-technical users this has led to the adoption of Microsoft Word documents as the 'source' for most of the online content and structural frameworks of the system. A translation engine, used to dissect and convert documents into XML, enables document structures and content to be uploaded to a standard SQL database. The NLE contents and frameworks are then dynamically derived from this database, giving the flexibility to include 'value-added' features to the online experience. These features may be other subsystems within the NLE or external systems and services that have a documented interface to allow remote querying of the available data. For example documents and presentations uploaded by teachers, links to external learning resources, and library data are integrated into the eGuides at both the module and the learning session levels (e.g. for specific lectures or practicals within the eGuides). Integration is facilitated by metadata – including codes for modules, lectures and learning outcomes – which are used to link together the various components of the NLE.

Integration with the wider MLE

Figure 2. Simplified representation of the wider Newcastle MLE for medicine

The NLE is part of a wider Managed Learning Environment (MLE) used within the Medical School (Figure 2). This includes a student support and communications system, a student-selected component selection and submission system, and a programme administration interface. These systems draw on the same central University data sources for authentication, communication and to personalise content. The systems are highly integrated, but can function independently of each other. This helps to ensure that data is not re-entered and that the most appropriate person is 'closest to the data'. The flexibility of the approach is underlined by the fact that the central Management Information System was migrated to SAP Campus Management over the summer 2003, and the NLE and associated systems functioned normally and were available for the new academic year.

TRAINING AND SUPPORT

An aspiration of the NLE at Newcastle was the implementation of self-supporting internet systems. The use of the NLE within its medical programme is continually growing and is now part of the structured course feedback and evaluation system. Its continual evolution and the use of comprehensive central data with authentication has enabled the development of dynamic user portals with context sensitive help that are relevant to the user's needs. All the students (both Newcastle and Durham) have a timetabled 'hands-on' session during the start of the first term to familiarise them with the NLE. Student familiarity with the system is implicit with its use being an integral requirement throughout the course.

Staff also receive formal training sessions on how to use these systems. The implementation and provision of these formal training sessions for the web-based administration of the NLE has enabled the annual management lifecycle to function with a very low level of technical support. This is in addition to the rolling staff development programme run by the Faculty of Medical Sciences to support teaching in medicine and dentistry, which has seen over 3,000 attendances by around 1,00 individuals over a 5½ year period.

RESPONDING TO CURRICULUM CHANGE AND POLICY REQUIREMENTS

Newcastle is a regionally based Medical School with its Phase II students now formally located 'off-campus' at one of four 'base-units' (described in the introduction). Since 2001, a new outcomes-based curriculum has been introduced at Newcastle as well as a new four year accelerated programme and a joint programme with Durham University where the students complete their Phase I education at the Queens Campus, Stockton. As a content-independent system, the NLE has been readily adaptable to support these changes in the curriculum and

multiple course formats, as well as providing on-going curriculum support for learners who commenced their degree prior to these changes. With the shift in teaching and administration to the base units, the drivers for change in the NLE have also changed, with a much higher proportion of effort expended on administration systems than has been the case in the past, when the NLE was seen purely as a teaching and learning tool. This has made the role of the NLE even more crucial to the success of the Medical degree programme: the practical implications for course management and communications with both students and teachers across the four base-units has led to the NLE becoming a crucial administration tool for staff involved in the medical degree programme.

There have been increasing demands for developing independent life-long learners (Spencer & Jordan, 1999) with the skills and attitudes appropriate for assessment, appraisal and professional revalidation. These are reflected in national policy directives for medicine (GMC, 2003) and indeed have been a long-standing ethos of the Medical programme at Newcastle. In addition, there are national policy requirements in Higher Education to support personal development planning (NCIHE, 1997 and QAA, 2001). In response to these policies, reflective ePortfolios, initially developed on a stand-alone basis, have been integrated into the NLE in 2003 as part of a multi-institutional collaborative project[21]. Recent development work in the NLE has also placed more emphasis on the use of style sheets in response to institutional and national accessibility policies (SENDA, 2001).

SUPPORTING INDEPENDENT LEARNING

A key ethos of the Medical programme is developing independent learners with the skills and attitudes required for life-long-learning, which are necessary to meet the changing needs of their patients. In particular, there is a dedicated strand of 'Personal and Professional Development' which runs through the undergraduate curriculum. The NLE complements this ethos by providing on-line formative self-assessment, access to assessment results (self monitoring), access to supplementary learning resources and literature, and module evaluation (input into the continuing curriculum development cycle). Also, Newcastle has an outcomes-based Medical curriculum and explicit learning outcomes are included in the eGuides. This transparency is an aid to independent learning.

In 2003 ePortfolios have been integrated into the NLE as part of a multi-institutional collaborative project. The ePortfolios are designed to allow students to evidence the achievement of learning outcomes. They also include reflective elements designed to help foster independent learning by providing students with a means to monitor, build and reflect upon their personal and academic development. The ePortfolios will help satisfy both local needs and national policy directives which emphasise the need to develop independent learning in undergraduate Medicine and wider HE. The ePortfolio project includes implementations of internationally recognised standards of interoperability, so that portfolio data will be transferable to support continuity in life-long-learning.

USAGE AND EVALUATION

The Newcastle NLE has been online for over 5 years, it currently receives an average of 5,100 logins per month and a typical student downloads 2 unique learning resources each login, 94% of students have used the self-assessment system.

The NLE has been developed on an on-going 'action-research' basis, developments have been influenced by annual programme review processes, quality assurance processes, active feedback encouraged from staff and students, student focus groups and from analysis of content usage. Current approaches are using more 'research' oriented methodologies in order to evaluate the increasingly complex demands placed on the NLE.

The Newcastle focus on the development of re-usable, scalable and content-independent systems has empowered its NLE to concurrently support multiple course formats on its undergraduate medical programme and to rapidly adapt to changing curriculum and policy requirements. The approach does however raise issues relating to training requirements (formatting documents and uploading resources), quality control issues and change-management.

The information gained from feedback and focus groups has been invaluable in identifying areas where the NLE is weak and where improvements would be most effective. The amount of information in the NLE and wider MLE is vast, and this has lead to some confusion over where to find the most appropriate information.

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[21] Managed Environments for Portfolio-based Reflective Learning. Integrated Support for Evidencing Outcomes. http://www.eportfolios.ac.uk

We are working with our focus groups to streamline the presentation of the NLE to alleviate this problem. A major problem has been in ensuring that information is available to students in time, both in paper and online forms. So far, students have always received this information in a timely manner, but this has happened with significant effort on the part of teachers and admin. staff. We are addressing the workflow involved in creating the documents and this work is proceeding well. There is the perennial problem all online systems have with access to IT and networked learning resources, but happily the situation there is improving too with additional computing resources being made available at base units and more students have their own internet enabled computers.

DISCUSSION

The unique curriculum demands for medicine have resulted in many medical schools developing their own 'home-grown' virtual learning environments (VLEs), such as the NLE, rather than using commercial systems. However, the NLE is functionally independent of the content of the curriculum and the features are not discipline-specific and share common issues with other subject areas. The core of the Newcastle NLE for medicine is the content management system which drives the online curriculum, this integrates eGuides, learning resources and self-assessment. Additional functionality has been added over time; recently ePortfolios and discussion forums have been successfully integrated into the NLE.

The NLE has been developed in what can be considered an 'action research' approach where feedback from staff and students, content analysis, regular review processes, and changing policy requirements have fed into the iterative development cycle. The medical curriculum at Newcastle promotes a student-centred approach to teaching and learning (Spencer & Jordan, 1999). The features of the NLE compliment this student-centred view by providing resources for self-directed learning, self-assessment and ePortfolios. Such features also aim to meet policy requirements, including QAA requirements for personal development planning and professional requirements for developing the skills for life-long learning.

In the past quality assurance for virtual learning environments has concentrated on content and content delivery. However, as more emphasis is placed on independent learning within the VLE, in association with the move from instructional to constructionist approaches, this raises difficult challenges for evaluation and quality assurance (Vermetten et al., 2002**,** and Beaty et al., 2002). The medical curriculum at Newcastle has an extensive rolling programme of course evaluation which feeds into curriculum development. The use of online evaluation, integrated into the NLE, may potentially enhance this process by making student feedback more rapidly available. The move towards more student-centred approaches has implications for staff development. Firstly, it may require training on learning pedagogy (Lonka & Bolander, 2002 and Laurillard, 2002). Secondly, it requires support for the teachers, some of whom may be less IT literate than their students, in the use of information technologies (Tenbush, 1998 and Cravener, 1999).

Considerations for future developments of the NLE include the prospect for further increasing the levels of interactivity for learners with learning content. Indeed, increased levels of interaction may be associated with deeper learning (Gao & Lehman, 2003). This greater interactivity also encompasses communications technologies, which may include more participative forums, rather than just the traditional passive forms of communication (Ward et al., 2001). Another area for development is likely to include the use and management of reusable learning objects (RLOs). This will have resource implications for development and staff training, but may result in greater sharing of resources between medical schools (Harden & Hart, 2002).

In conclusion, the Newcastle NLE provides its users with a range of integrated features and it has proved responsive to changing curriculum and policy requirements. The integrated approach taken here will be important for the continuing evolution of the NLE as part of the wider MLE. As more emphasis is placed on online learning, rather than just content delivery, systematic evaluation and research are becoming increasingly important.

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