Peer review of online learning and teaching: Harnessing collective intelligence to address emerging challenges

Denise Wood and Martin Friedel
University of South Australia

In 1983 Donald Schon argued for the development of "an epistemology of practice which places technical problem-solving within a broader context of reflective inquiry" (Schon, 1983, p. 69) in response to the complexity, uncertainty and instability of professional knowledge. This paper reports on a collaborative project led by the University of South Australia, which designed and developed a comprehensive, integrated peer review system that harnesses the power of the collaborative web to engage academic staff in the development or redevelopment of their own courses through the kind of reflective processes Schon (1983) advocated. The project builds on extensive work that has been undertaken both within Australia and overseas to support and stimulate the scholarship of online learning and teaching, and it has the capacity to demonstrate quality learning and teaching through course development, evaluation, improvement and interactive learning. Evidence produced through such processes can be used by academic staff as evidence to support claims for recognition and reward. The project has evolved in response to changing technologies and recognition of the need for a more adaptable system that enables academics to play a significant role in the creation of criteria and in contributing their own exemplars using a Web 2.0 approach. A major feature of the approach is its educative dimension, which is responsive to supporting online teaching and learning at a time when new Web 2.0 and 3D virtual learning technologies are presenting new challenges for educators. This paper describes the project and argues that online learning and teaching in this changing landscape is an emerging area of scholarship which needs to be supported and encouraged.

Introduction

The project reported in this paper focuses on providing professional development to academic staff in online learning and teaching. The approach involved the development of an online peer review system and associated website through funding provided by the Australian Learning and Teaching Council (formerly Carrick Institute for Learning and Teaching in Higher Education), to provide a scaffold for the development and evaluation of online courses or components of courses. The approach drew on the Boyer (1990) paradigm of scholarship, a framework in which the four scholarships identified by Boyer (discovery, teaching, integration and application) are considered integral to an environment that stimulates and engages learners. This framework has been applied to the design of a peer review instrument in which all four scholarships are considered essential for online learning and teaching and this has been achieved through the design and development of a checklist of agreed good practice. The approach is also consistent with Taylor and Richardson's (2001) recommendations relating to the design and construction of information and communication technology (ICT) based teaching resources, in which they advocated

"the development of an explicit and shared understanding of the scholarship underlying the design and development of these resources" (p. 8). Such shared understanding, according to Taylor and Richardson (2001), can also form the basis for validating the quality of the resources. The system under development utilises current technologies to harness the collective intelligence of academics through reflective practice, enabling them to create, share and revise evaluation criteria in a timely and efficient manner, in response to rapid technological change and increasing uncertainty (Schon, 1983).

This paper describes the development of the online peer review instrument and supporting website, in which shared understanding about the scholarship of learning and teaching in resources developed for online delivery is made explicit. The project builds on extensive work that has been undertaken both within Australia and overseas in the development of peer review of online learning and teaching, which supports and stimulates the scholarship of online learning and teaching. It has the capacity to demonstrate quality learning and teaching through course development, evaluation, improvement and interactive learning. Evidence produced through such quality assurance processes can be used by academic staff as evidence to support claims for recognition and reward; a process which is required as an indicator against which Australian universities report via the Australian Government's learning and teaching performance fund.

The principles underlying the development of this approach are:

- Criteria for standards of development have been gathered from the full range of relevant academic literature surrounding online teaching and learning. This affirms the work of academics in this area and provides it in a highly practical form, accessible to a broadly based audience.
- The approach locates responsibility for the quality of learning and teaching with the academic staff conducting it. Staff can use the items to guide the development or redevelopment of their own courses through reflective processes.
- Academics are empowered to construct their own tailored evaluation checklists and to contribute to the developing database of criteria.
- The instrument and its associated website provide an opportunity for just in time academic staff development by providing the accepted standards, information about how to meet these and exemplars contributed by academics themselves.
- The instrument is flexible and adaptable to accommodate changing technologies.
- The supporting website is designed to provide a model of best practice, utilises latest Web 2.0 and database technologies, and has been validated using the W3C Mark-up Validation Service, and the W3C CSS Validation service, and complies with *W3C Web Content Accessibility Guidelines 1.0.*

The first section of this paper provides the rationale for the project and identifies the academic community as fundamental in all scholarly activity, and provides the rationale underpinning the project.

The second section provides a general overview of the instrument and website. It argues that a highly detailed instrument is required because of the relatively low levels of expertise of the intended audience in online teaching and learning and the need to establish comprehensive standards derived from research. The development of the general approach and the specific instrument are outlined, with the four major areas (instructional design, interface design, use of media and technical aspects) specified.

The third section of the paper outlines the strategies adopted to address the limitations and to incorporate features enabling the instrument to be dynamically updated in response to changing learning technologies, and to engage academics in being active contributors to the project using Web 2.0 technologies. The dynamic data driven approach adopted by the project to accommodate changing learning technologies is explained in some detail.

The strategies for engaging the higher education community to contribute to the project are outlined in the fourth section, and in the final section of the paper, the importance of this approach to the scholarship of learning and teaching is discussed. The instrument is seen as an instrument which is derived from scholarly research and has the potential to contribute to scholarly interaction around online teaching and learning.

Rationale for the project

The project focuses on providing professional development to academic staff in online learning and teaching. One of the critical aspects of this approach is that it seeks to achieve scholarly outcomes in course development through processes which are, of themselves, scholarly. The Boyer approach to scholarship based on an understanding of the communal basis of all scholarly activity: that scholarship by its very nature is a public rather than private activity; that it is open to critique and evaluation by others; and that a field of study is progressed through the scholarly activity of building new ideas which are then open to the same processes of public scrutiny. All of the scholarships are exposed to the same rigorous approaches of peer review as a way of gaining quality, transparency and accountability (Shulman, 2002). Within this framework the scholarship of learning and teaching has emerged as a major theme in the higher education sector. The project described in the following sections addresses an identified need for an objective and accessible system that supports academics in the development or redevelopment of their own courses through reflective processes and enables them to use these same criteria to have their work evaluated. In exposing their work to scholarly appraisal and such public scrutiny, academics can also have their work affirmed and used as evidence when seeking promotion within their institution.

Review of other instruments

An extensive review of the literature and a range of peer review instruments published over the last six years identifies various approaches that have been developed to both identify and validate evaluation indicators designed to measure the intended outcome of online courses (e.g. Seok, Meyen, Aust, Fitzpatrick & Newberry, 2006), several focusing on the development of theoretical frameworks that can be applied to the evaluation of online learning and teaching materials (Barbera, 2004; Franklin, Armstrong, Oliver & Petch, 2004; Chua & Lam, 2007), and others that have focused on the development of instruments that take a quantitative approach to the evaluation of courses according to specified criteria. On the basis of this review, several limitations were noted:

• Some of the instruments reviewed have been developed to address particular aspects of course development and are partial in their scope rather than comprehensive.

- Many of them are very general, open ended instruments. Although there may be some justification for this in terms of providing a generic framework, these instruments make considerable assumptions about the level of expertise of those involved in the processes of online learning and teaching.

- Some instruments have been found to be comprehensive in their scope, but unnecessarily complex because the instrument and supporting online materials are not integrated.

- Most of the online instruments (including some listing accessibility as an important criterion for online course development) are inaccessible for users with disabilities.

- Most instruments fail to harness the collective intelligence of the academic community utilising latest collaborative technologies.

- Very few of the online instruments reviewed are responsive to rapidly changing technologies and the transitory nature of professional knowledge and performance.

The more comprehensive instruments reviewed require the use of additional applications (for example an *Excel* spreadsheet) and lack seamless integration with the supporting online material. Furthermore, many of these instruments treat aspects relating to accessibility and usability as separate considerations rather than embedded within criteria relating to instructional design, interface design, use of media and technological aspects. None of the approaches reviewed provide a fully integrated peer review system in an accessible format that enables staff to record their achievements in online learning and teaching, and to use that information in support of their applications for academic promotion.

The project builds on the knowledge gained from these existing approaches to peer review of online learning and teaching to develop an open source, web enabled peer review instrument.

Relationship to institutional priorities

The project, which involves collaborative national and international partner institutions, aims to provide an adaptable approach that can be tailored to address an institution's learning and teaching priorities, while still addressing the need for a learner centred, flexible, technologically mediated and accessible, integrated online peer review system, in which criteria relating to inclusivity are embedded, and which provides guidelines and exemplars of best practice. This next section describes the ways in which the project addresses the University of South Australia's learning and teaching strategies.

Teaching is a highly valued and respected activity at the University of South Australia. The University has adopted the four scholarships framework promoted by Boyer and this approach to the scholarship of teaching frames all aspects of the University's teaching enterprise, from academic induction to the more formal process required in the University's promotions and teaching awards processes. The University's *Learning and Teaching Strategy 2006-2008* outlines the distinctive, University-wide approach to the scholarship of teaching, which involves engaging in reflective teaching practice through an iterative process of action, reflection and refined action that is both informed by the practices of peers, and open to their critique. This requires:

- gathering data about one's own teaching and learning performance - whether in preparation, facilitation or evaluation - and engaging in analysis of such data for the purpose of improving teaching and learning (i.e. being a reflective teacher),
- being cognisant of and open to the knowledge about teaching and learning which peers have generated through publishing and presenting, and using this to inform and improve one's own practice (i.e. being a scholarly teacher), and
- making public one's own work through presentations and writings in refereed contexts to contribute to knowledge and understanding of teaching and learning at national or international levels (i.e. contributing to the scholarship of teaching).

The University of South Australia has a strong commitment to online learning and all programs have some aspect delivered online. The strategic combination of learning opportunities - a blend of traditional distance education, electronic engagement and face to face activity - enables learning to be tailored towards particular student groups, both onshore and offshore, to achieve high quality learning outcomes. The University also adopts an inclusive approach to equity, by developing resources and providing opportunities that enrich learning for all students, as well as making specific arrangements for those who have experienced educational disadvantage. Online accessibility is an important priority for the University, and the institution has a detailed web accessibility policy, which outlines the technical requirements that authors must meet to ensure their online materials are compliant with the World Wide Web Consortium's (W3C) *Web Content Accessibility Guidelines* (1999). Compliance with these guidelines helps to ensure that course materials are accessible to a diverse student audience including students with disabilities, students of non-English speaking background, and students who are located in isolated regional locations with limited access to high speed Internet connectivity.

The next sections of the paper describe the ways in which these priorities have been incorporated into the instrument and accompanying website, beginning with an overview of the project and then a more detailed explanation of the structure of the peer review instrument.

Overview of the project

This project builds on the experience gained by the project team leader, who is the first author of this paper, and two members of the proposed project team from a project that led to the design and development of a prototype of a peer review instrument. The prototype was trialed at the University of South Australia and the results of the trials published (George & Wood, 2003; George, Wood & Wache, 2004; George & Wood, 2005; Wood & George, 2003). While limited in scope and functionality, the findings from the trials together with the enthusiastic response from the higher education community at conference presentations, suggested that the proposed system when fully implemented as an open source instrument would be well received.

Negotiations with potential partner institutions confirmed an interest and commitment in progressing the prototype to a fully developed instrument, and in 2007 an application was submitted to the Australian Learning and Teaching Council for priority funding to enable the project to proceed. Funding was received for a two-year project in July 2007, to be completed in July 2009. The project's website is:
http://www.unisanet.unisa.edu.au/peerreview/

The specific objectives are as follows:

- Encourage and raise awareness and practice of the scholarship of online learning and teaching, and the collection of evidence for promotion purposes by academic teaching staff who use the online environment to support learning.
- Assemble comprehensive online learning and teaching standards based on research with associated nationally agreed on criteria that can be used to guide academic staff who are not skilled in developing and practising online learning and teaching.
- Affirm the work of academics in the area and provide a highly practical approach to peer review of online learning and teaching, accessible to a broad audience.
- Locate responsibility for the quality of learning and teaching with academic staff and guide them in the development or redevelopment of their own courses through reflective processes, and use these same criteria to have their work evaluated.
- Facilitate "just in time" academic staff development by providing the accepted standards, information about how to meet these and examples of how this can be achieved within the one web-enabled peer review instrument.
- Support academic staff in the development of their courses by encoding the elements of good practice in an agreed checklist for online learning and teaching.
- Provide a comprehensive, integrated open source peer review system that enables staff to record their achievements in online learning and teaching, and to use that information in support of their applications for academic promotion.

The distinctive component of this project is its focus on developing, trialing and evaluating a research based, web-enabled instrument for peer review of online learning and teaching, based on an existing prototype that has been developed and trialed at the University of South Australia (George, Wood & Wache, 2004). The instrument incorporates banks of standards based criteria for use in peer review, explanations of the meaning of these criteria, exemplars and an underlying database that can record peer review results and make them available for promotion purposes. It has been developed as an open source application, to enable it to be adapted by other institutions to suit their learning and teaching and technical contexts. The project is also developing case studies of peer review using the instrument.

The instrument is constructed around four sets of considerations: instructional design, interface design, the use of multimedia to engage learners and the technical aspects of interactive educational multimedia. These areas have been developed through consideration of the literature. Several of these major sections are broken down into smaller subsections for ease of consideration:

- instructional design
  - clarity of expectations
  - building student knowledge
  - learning activities
  - assessment
  - evaluation
  - human interaction
- interface design
- use of media
  - interactive multimedia
  - writing style and accuracy of text
  - copyright
- technical aspects

In each of these sections (or sub-sections), items were developed. These items:

- relate directly to quality concerns agreed in the literature
- are expressed in non-technical ways
- use the same language and constructs as checklists developed for other areas of teaching such as lecturing
- incorporate an easy to use ratings system
- provide for qualitative feedback through comments

The rating system used to measure the extent to which the specified metrics meet these criteria is a 5-point Likert scale ranging from *strongly agree* to *strongly disagree* for metrics that involve value judgments, and from *always* to *never* for metrics that consider the frequency of occurrence. Each criterion also provides a free form text area for comments since a combination of quantitative (Likert rating scale) and qualitative (open ended comments by users) measures will most likely yield comprehensive results. Users can create new criteria and customise the method for rating performance against each of the criteria. Supported response options in addition to the Likert scale metrics include yes/no, drop down selections, multiple response, occurrence scales as well as the qualitative responses (Figure 1).

Figure 1: Selection of criteria and response type can be
customised by the academic staff member

Educative aspects

The educative dimension is central to both the 'just in time' approach to professional development and approaches which involve more formal educational development. Each of the items has a 'more information' button, which is a hyperlink to detailed information about the issue, including explanations and references to the literature. For example, one of the criteria specified in the sub-section 'Clarity of expectations' is

an item referring to the statement of objectives or learning outcomes. There is often confusion among reviewers about the difference between general statements about the overall goals and clearly specified objectives. By clicking on a 'more information' hyperlink, the reviewer can check their understanding of these terms and also learn more about effective techniques for specifying objectives or learning outcomes from the hyperlink references included in the related explanatory screen.

Inclusivity

Items addressing issues of inclusivity have been embedded across the four sections of the instrument. These relate to socio-cultural aspects including gender and culture, and have a particular focus on W3C *Techniques for Web Content Accessibility Guidelines*. The decision to embed these rather than to extract them into separate categories is based on the view that essentially the items reflect good teaching and ought to be seen in a more integrated way. For example, a course that includes streaming media presentations containing voice-over or dialogue would need to be reviewed to determine whether the media is accessible to students with hearing impairments. Information on the accessibility issues for people with disabilities and the relevant W3C checkpoints can be accessed by selecting the 'more information' link next to the criterion relating to synchronised captions for video clips that contain audio tracks in the 'Use of media' section of the instrument.

Flexibility

One of the issues around the development of the instrument has been to ensure it has maximum flexibility. For this reason, the instrument has been designed to be very detailed and also flexible so that it can be used in part or as a whole depending on the intended outcome. Potential outcomes may include:

- course development or improvement through personal reflection
- formative or summative evaluation of online materials by peers
- career advancement through providing evidence that supports applications for promotion, tenure or awards
- framework for professional development staff to use when working with academics.

Limitations of the original prototype

The original embodiment of the instrument was limited in the following ways:

- The number of categories included in the prototype and the range of criteria addressed within each of the categories was not comprehensive. Project team members have been assisting in the development of new categories and the addition of more extensive criteria within each of the categories.
- Not all criteria had been populated with links to detailed information about the criterion including explanations and references to the literature. Project team members and also academics using the instrument during trials will be able to contribute to and build their own banks of criteria.
- The original website was not linked to a database, and the Likert scales were static and non-functional. This means that the only way academics could use the prototype was by printing out the scales and completing the review by hand. In the redevelopment of the instrument, the peer review will be completed online and

results of the review stored in a data base for retrieval by academics in support of their applications for promotion and awards.
- There was no facility enabling academics to populate the instrument with their own criteria. The developing instrument incorporates a 'wizard' front end enabling them to select from banks of criteria, and add their own categories of criteria to tailor the peer review survey to best suit the nature of their specific courses to be reviewed.
- There were no case studies demonstrating best practice relating to the categories incorporated into the instrument. Project team members, through their extensive networks, will be progressing contributing to these case studies and provision has been made via the linked website of resources for academics not associated with the project to contribute their own case studies by registering their interest through an interactive form.

The next section of the paper outlines the strategies adopted to address the limitations, to incorporate features enabling the instrument to be dynamically updated in response to changing learning technologies, and to engage academics in being active contributors to the project using Web 2.0 technologies.

Technical features incorporated in the instrument

The original prototype was developed using static HTML, which meant that each page had to be manually coded to display specific content. While a static HTML page provides the developer with a degree of accuracy with how the content is displayed, such an approach lacks flexibility. The developing instrument has therefore been designed to function as a dynamic system and features server-side scripting to enable pages to be dynamically generated to display data and content in response to users' queries. A dynamic site, while more flexible, also features a greater level of complexity, including additional system resources and applications for the server to run. From the user's point of view, both static and dynamic versions of the site will appear the same, with no additional software required, however the dynamic version will be able to be dynamically prepared at runtime to better support the user.

The new dynamic peer review system is made up of the following components:

- A main *template* with consistent look and feel.
- Several modules that are designed to perform specific tasks for the user. Modules can be nested, meaning that the 'administration' module can contain a 'user' module, for example, to enable the administration of users. Each module can have set permissions to ensure only authorised users can access specific modules. For example, the administration module is only available to specified authorised users, while the change password module is available to all users.
- A *database* storing all of the data, including peer reviews, user data, criteria, glossary items and exemplars.

The most powerful feature of this dynamic approach is its runtime configurability. The static version of the instrument included a number of pre-defined categories and criteria to assist with the peer review process. While this set of criteria is useful and well-rounded, updates are hard to achieve, requiring input from a web developer to add, remove or modify any categories or criteria. Such an approach would have been problematic in view of the rapidly evolving new learning technologies including Web 2.0, *Flash*, AJAX-powered applications and 3D virtual learning environments.

The dynamic approach adopted for this project enables users to add, remove or modify criteria at any time through the use of the database and dynamically prepared web pages. This flexibility future proofs the system ensuring that as new technologies emerge they can be added into the system without additional programming work. The dynamic instrument also provides a greater level of customisability for each unique review. Some categories and criteria may not be applicable to all peer reviews, and the dynamic version of the instrument enables the user to choose from banks of existing criteria to create customised peer review checklists at runtime, without the need for technical HTML knowledge. This means that each peer review can be fully customised to suit the requirements of the review itself, independent to all other reviews in the system (Figure 2).

Open source technologies employed

The peer review system makes use of the following open source technologies:

- *Apache HTTP Server 2.0.63*, an open source HTTP server that enables the hosting and deployment of web pages.
- *PHP (PHP: Hypertext Processor)*, a server-side scripting language that can be embedded into HTML documents to enable dynamic pages to be created. This enables the developers to create powerful pages including features such as tables and form elements to be populated with data 'on the fly' based on the specific data requests of the user. PHP 5 is the current major version of this programming language.
- *MySQL 5.0.51a*, a powerful relational database management system (DBMS) that is well suited for web applications.

The decision to use open source technologies for the project addresses the concerns expressed by authors such as Neumann (1999) who argues that closed source proprietary software carries a number of risks, such as restricted customisation and interoperability, inflexibility, and more complicated black box system integration. While the development server is running MySQL 5, the framework for the system has been constructed using a series of database abstraction classes, which store all of the database logic, such as the construction and execution of queries. When a module in the system requires data, it calls a generic database method, which is passed on to the appropriate database handling classes. This means that each of the modules can be written without prior knowledge of the SQL syntax that the DBMS is expecting. Should future developers wish to implement the system using another database, such as *Postgres* or Microsoft *SQL Server*, the developer will only need to create a new set of database abstraction classes and modify the system configuration to use a different server type. This separation of SQL syntax logic from the modules is a key concept in ensuring the system is able to be extended to suit a variety of different DBMSs with a minimal amount of coding, and no re-engineering.

The instrument is based on a standardised XHTML form generation system, which creates customised forms including valid XHTML code. The system also generates meaningful error messages in the case of missing or inaccurate data and the appearance of the interface is controlled through an external style sheet (CSS file). The form generation system makes it easy to create a new form for a module without knowledge of accessible forms and XHTML, enabling the rapid and accurate development of new modules.

Figure 2: Design of the peer review system ensures
maximum flexibility and adaptability

The main template in the instrument is generated using the *Smarty* template engine [http://www.smarty.net/], which enables caching of templates as well as significant separation of business and presentation logic. This template includes the core architecture for the page such as the header and footer, as well as the global links the system uses, such as the menu and footer links. The remainder of the page content including forms and lists are complex, database driven pages including live and customer requested data which is then gathered from the database and placed into the main template. The main template file includes a specific tag which is replaced by the data-driven content at runtime by the templating engine, enabling the remainder of the template code to be adjusted without risk of designers changing the business logic.

Reviewer

Parent Access
  None

Authentication: Login
Authentication: Logout
Authentication: Reset Password
Help
Home
Review: Menu
Review: List Reviews
Review: Load Review
User: Menu
User: Edit
User: Change Password

Administrator

Parent Access
  Inherit all permissions from
  Reviewer
  Author

Administration: Menu
Administration: Banks
Administration: Banks Cascade
Administration: Banks Delete
Administration: Banks Manage
Administration: Banks Shuffle
Administration: Categories
Administration: Categories Delete
Administration: Categories Manage
Administration: Criteria
Administration: Criteria Delete
Administration: Criteria Manage
Administration: Criteria Options
Administration: Criteria Properties
Administration: Response Types
Administration: Response Types Manage

Author

Parent Access
  Inherit all permissions from
  Reviewer

Review Management: Menu
Review Management: Authors
Review Management: Banks
Review Management: Banks Add
Review Management: Banks Delete
Review Management: Criteria
Review Management: Criteria Delete
Review Management: Export
Review Management: Invite
Review Management: List
Review Management: Manage
Review Management: Options
Review Management: Publish
Review Management: Results
Review Management: Shuffle
Review Management: Supervise
Review Management: Unpublish

Super Administrator

Parent Access
  Inherit all permissions from
  Reviewer
  Author
  Administrator

Administration: Users
Administration: Users Approve
Administration: Users Manage

Figure 3: Four user levels and their respective module permissions

At runtime the instrument accepts instructions, which assist in the creation of the data-driven content, including which module to run and what data to request from the database. This generated content is placed in the main template and produces a valid XHTML page. All of the generated XHTML has been styled using cascading style sheets (CSS), which are stored externally to the code thus separating the content from presentation. The CSS when combined with the *Smarty* driven template produces a clean and professional appearance for each review. The separation of content from presentation through *Smarty* and CSS also enables future customisation of the instrument without the necessity for rewriting the program logic code. Any changes made to either the smarty template or the CSS will instantly and seamlessly be applied to every page in the instrument, making updates to the look and feel simple, efficient and effective. This feature is of significant importance in enabling academics to style the instrument to better suit their institution's visual identity.

Security of the system

The instrument uses a flexible and multi-tiered user authentication system that provides access to specific modules based on the logged in user's access level. By default there are four levels of access: reviewer, author, admin and super admin (Figure 3). The levels have been created with cascading privileges meaning that an author has the permissions of an author as well as all permissions of any levels below it. This cascading effect means that as the levels increase, permissions to modules do not need to be replicated across each access level. Further to this, the interface of menu structures changes based on the current user's access level. This enables administrative level modules and menus to be hidden from lower privileged users (Figure 4).
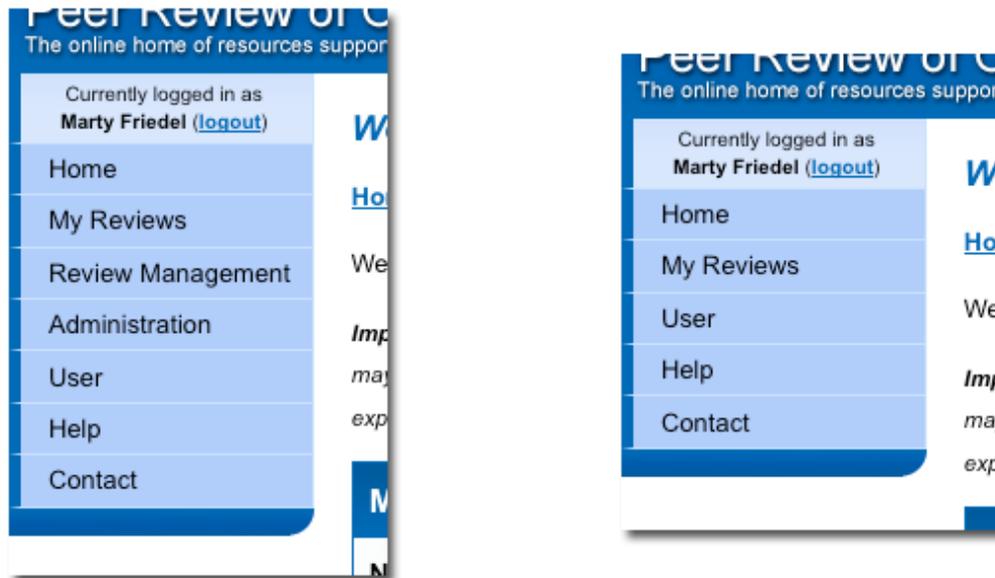
Figure 4: Differences in the user interface with the main menu for an administrator displayed to the left and the main menu for a reviewer shown at right

The access control mechanisms go beyond purely presentation and include protection from URL hijacking attempts. This added level of protection prevents users modifying a URL to the instrument in an attempt to load a module that they visually cannot select from a menu. In other words, even if a user knows the exact URL to a module, they will be presented with an error message if their access level does not grant permission to that module. The same level of URL hijacking protection extends also into the loading of objects within modules in the instrument, such as reviews. For example, only the owner and authorised authors are able to modify a review and if a user tries to enter someone else's review ID into the URL, they will be presented with an error message. This level of protection becomes important when the system is deployed in a multi-user environment, ensuring all users' data remains private and readable only to authorised users.

Generic input handlers have also been created to appropriately clean and present data transferring within the instrument, including the cleaning of GET and POST variables, as well as safe storage of SESSION variables and clean insertion and extraction of data

to and from the database. This additional cleaning of data helps maintain the system's integrity through the prevention of common web attacks such as SQL injection attacks, as well as safe insertion of data into the database including complicated characters, single quotes and double quotes, primarily known for creating issues when inserting and updating a database table.

Custom banks of criteria

The underlying data structure supporting the instrument enables administrators and users to maintain both generic and highly customised banks of criteria for their reviews. Each bank in the instrument can contain either one or more criteria, or one or more banks. This sequence enables banks to be nested within another "grouping" bank to assist with the assimilation of banks and criteria as illustrated in Figure 5.

Figure 5: Bank containing nested banks containing criteria

Administrators have access to build and manage sets of banks and criteria, which can then be released to authors who are creating a review. These administrator created banks can be also duplicated into an author's review as required as shown in Figure 6. Banks and criteria are duplicated from the administrator created data tables into the review based data tables. This means that while the administrator can make changes to the banks, the changes will not filter down into the author's review once the bank has been entered into a review. The duplication of this data ensures that when an author selects a bank and creates their review it remains as they intended, and is not affected by changes by the administrator. When duplicating an existing bank authors can either

select the highest bank (which contains more banks) or a nested bank (which only contains criteria).

Figure 6: Duplicating a parent bank and a nested bank

When duplicating a bank the author can also select the bank into which the content will be populated, thereby enabling authors to create their own nesting of banks as they create their review. Authors can also create their own banks and criteria, which are then flagged as their own, user created banks. These user created banks appear in the duplicate banks module when they create a new review and are visible only to the author. By default a user created bank is only available to the author who created the bank, however the author can choose to share a bank with other authors, or recommend that their bank be placed in the default, administrator created bank group. This collaboration feature of banks and criteria provides the instrument with a flexible means to extend and refine criteria in the system. The practical application of the functionality of the custom bank feature is elaborated on in the following section.

Examples of custom banks

The ability to create custom banks of criteria enables authors to focus on particular areas of concern within a course review. The following example illustrates the development of a custom bank of criteria focusing on the first-year experience. Drawing on the elements underpinning a quality first year curriculum defined by Kift (2008), Scutter and Wood (2008) developed a custom bank of criteria which incorporates Kift's six criteria for assessing the first-year curriculum: transition, diversity, design, engagement, assessment, evaluation and monitoring. Figure 7

illustrates the application of the first-year bank of criteria within a customised peer review of a first-year course.

Figure 7: Criteria from a custom bank focusing on the first-year experience

In this example, the custom bank applies to the review of a first-year course. However, the same principle can be applied to design of custom banks of criteria for reviewing an entire program. For example, a program coordinator might be interested in assessing the extent to which the teaching and research nexus is reflected across a particular program of study. Such a custom bank could draw on the typology of teaching and research links identified by Griffiths (2004), in which a review team might consider the extent to which teaching is research led, research oriented, research based or research informed within courses as well as whether the emphasis is on research content or research processes, students are treated as the audience or participants, or teaching is teacher or student focused (Healey, 2005) across a program of study.

There are many other examples of custom banks addressing particular areas of teaching and learning concern that an author might choose to develop. Such concerns might include: internationalisation of the curriculum; peer assessment; community engagement; career planning or experiential learning. Once these banks are established, authors can choose to extend the criteria based on current literature, adapt the criteria to suit their own institutional context, or integrate the criteria into more generic peer reviews of courses or programs.

The review process

Once an author has constructed and validated a peer review template they can invite their peers to complete the review. This process generates a personalised invitation, which is in turn emailed to the proposed reviewer. When a reviewer logs into the instrument they are presented with a module called 'My Reviews', which lists all of the reviews that the particular user has been invited to complete. This list identifies all upcoming reviews, including the dates the reviews are available. Links to reviews that are outside of the start and end date range of the review are inactive.

During the review process the reviewer is asked to complete the review bank by bank. Upon completing a bank and selecting the option to save, the reviewer's results are saved and they are presented with the next bank. If the reviewer has not fully completed the review their responses are saved and they can return to the instrument at another time to complete the review or change previously saved responses. As soon as a reviewer has completed or partially completed a review, the results can be viewed via the review management module. The results of a review are automatically made available to all authorised authors of the review. Results are presented on screen, including the number and percentage of responses received and any additional comments made by reviewers, as shown in Figure 8.
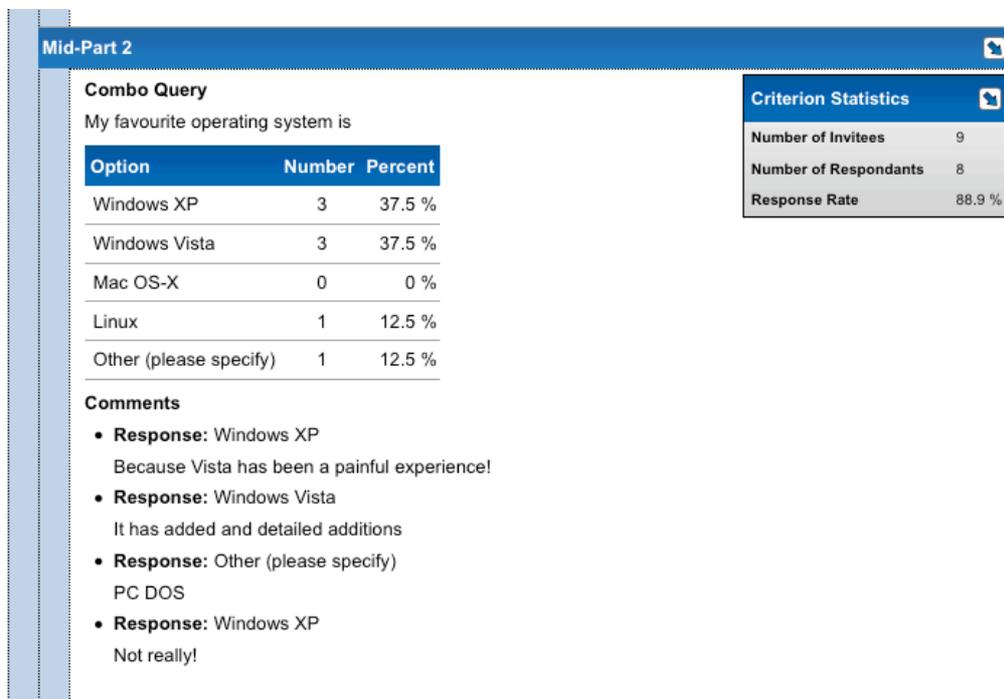

Figure 8: On screen results from a completed peer review

The author at this point can export the entire review or the responses within an individual bank to an *Excel* compatible spreadsheet. Once the review data is exported the author and any other authorised users can manipulate, analyse and graph the results to suit their specific requirements.

In summary, the modules of the peer review system have been designed to be flexible, extensible and adaptable to accommodate new and emerging learning technologies, while also utilising these latest technologies to facilitate user collaboration.

Engaging the higher education community

As suggested in preceding sections of this paper, the notion of an engaged, networked community of academics who contribute to a shared understanding of online learning and teaching, while reflecting on their own teaching practices, underpins the design and development of the peer review instrument. To facilitate and strengthen this learning community, Web 2.0 technologies have been employed, enabling academics to contribute to the developing database of criteria, glossary items and exemplars. To this end, a project Wiki has also been established enabling interested academics to contribute to the developing instrument (Figure 9) [available at http://peerreview. unisa.edu.au/wiki/index.php/Main_Page]. In addition, a dynamic bug tracking system has been developed to track user's feedback once the BETA version of the instrument is released to the higher education community for trials. The project website will remain a dynamic resource, populated with content from the higher education community once the development of the instrument has been completed, to enable ongoing sharing of resources and case studies demonstrating best practice in online learning and teaching.
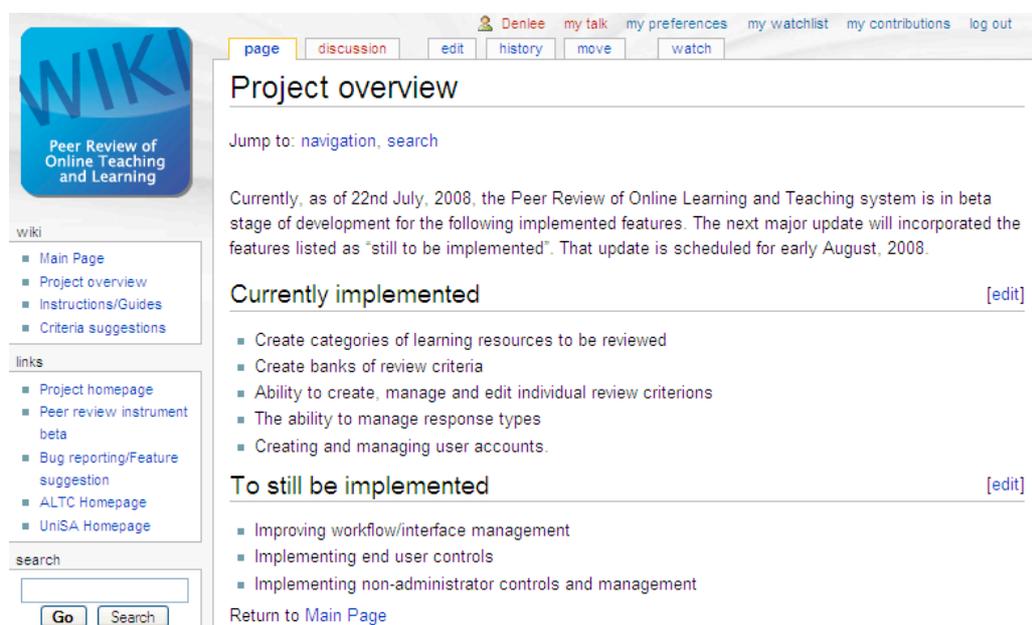

Figure 9: Project Wiki designed to engage the higher education community

Conclusion

This paper outlines a project that follows a scholarly approach to quality assurance in online learning and teaching. The project developed an open source, web enabled peer review instrument and an associated website that will assist academic staff with development of their course materials and provide a structured approach to peer

review. The design and development of the instrument has been informed by research into online learning and teaching and identifies criteria relating to online course development and the standards associated with them. These standards are codified into a checklist of simple statements, which can be used by staff without technical expertise. The interactive checklist is linked to a dynamic database so that the results of peer reviews of course materials are recorded centrally and the data can be retrieved by academics to support their applications for academic promotion and awards. The extensible nature of the approach ensures that the system is flexible and adaptable to accommodate new and emerging learning technologies, to address the challenges associated with a rapidly changing online learning and teaching landscape. The interactive peer view system, which is also supported by a website, provides highly focused, just in time information to enhance the knowledge and expertise of staff. This is consistent with a scholarly approach to learning and teaching because it supports staff in reflective practice, and provides a structured and informed approach to peer review. Beyond this, the system provides a means by which staff can have their work publicly affirmed and can use this as evidence supporting their applications for promotion and awards.

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Dr Denise Wood and Martin Friedel, School of Communication, Magill Campus, University of South Australia, St Bernards Rd, Magill, South Australia 5072
Contact person: Email: Denise.Wood@unisa.edu.au
Web: http://people.unisa.edu.au/Denise.Wood