Are your foundations sound? Information literacy and the building of holistic professional practitioners.

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Abstract: An engineer cannot be holistic without being information literate. Information literacy is "a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (ALA, 2006). These abilities are identified within university graduate attributes and the Australian Engineering Competency Standards – Stage 1.

This paper outlines the process of addressing information literacy within the undergraduate engineering curriculum at Queensland University of Technology. It explores the blending of information literacy into a large faculty-wide first year unit. Discussed are collaborative partnerships between faculty academics and librarians in content creation, teaching and assessment, success factors and areas for ongoing development to enhance learning outcomes.

Introduction

This paper discusses the importance of information literacy within the educational and professional environments, and the necessity to blend information literacy skills into the engineering curriculum. This is most effectively achieved through collaborative partnerships between academics and librarians. As librarians, we discuss the strategies and tools used to blend information literacy into a large, faculty wide first year unit, BEB100, Introduction to Professional Learning, at Queensland University of Technology (QUT).

Information literacy at university and within industry

The term "information literacy" can be traced back to the 1970s, where it was defined by Paul Zurkowski of the Information Industry Association, as those who are "trained in the application of information resources to their work"(Mokhtar & Majid, 2006). The term today still encompasses the application of skills to information resources, but is broader in referring not only to work, but also life in general. The American Library Association (ALA) define information literacy as "a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (1989).

The numerous definitions of information literacy generally mirror the ALA definition. This paper recognises the Australian and New Zealand Institute for Information Literacy's (ANZIIL) framework (Bundy, 2004) which asserts that the information literate person:

1. recognises the need for information and determines the nature and extent of the information needed
2. finds needed information effectively and efficiently
3. critically evaluates information and the information seeking process
4. manages information collected or generated

5. applies prior and new information to construct new concepts or create new understandings
6. uses information with understanding and acknowledges cultural, ethical, economic, legal, and social issues surrounding the use of information

Massive growth in the information landscape has changed our approach to information, as "finding information is no longer the challenge; rather, it is finding the *best* information from the best source available" (Nerz & Bullard, 2006). Indeed, we seem to be happily embracing the countless possibilities at our fingertips, but consequently a new problem is emerging where the ability to understand where information comes from and how it fits together is being lost. Conveniences such as hyperlinks, single sign-on and link resolvers subvert the traditional information hierarchy and although they are tremendously useful in everyday life, in the academic environment they can mask the underlying structure of the information environment. Thus, today it is equally as important to promote an understanding of this environment as well as focusing on the process of information retrieval.

The importance of information literacy has long been recognised in the education sector as the foundation of lifelong learning. Lifelong learning is the ongoing pursuit of knowledge and skills throughout one's lifetime. Many universities specify lifelong learning as a graduate capability or outcome, and endorse the blending of information literacy skills into the curriculum to help achieve this outcome. At QUT the "capacity for lifelong learning" is identified as a graduate capability citing skills such as "searching and critically evaluating information from a variety of sources using effective strategies and appropriate technologies" (QUT, 2005). Information literacy outcomes at QUT are specified in the Library's Information Literacy Framework and Syllabus (ILF&S), which "provides models and strategies for developing and evaluating information literacy initiatives in terms of quality student learning outcomes, curriculum development and assessment" (QUT, 2001, p15).

Recognition of the importance of these skills extends beyond the education sector and into industry, where information literacy skills are identified as essential competencies for professional engineers. Accreditation bodies in Australia (Engineers Australia) and America (ABET) establish the relevant professional competency standards for graduates, and all contain elements easily matched to skills associated with information literacy. For example, general statements in the ABET standards include "the ability to communicate effectively", "a recognition of the need for and an ability to engage in life-long learning", and "a knowledge of contemporary issues" (2008). However, some of the clearest links to information literacy skills can be drawn from the Engineers Australia Stage 1 Competency Standards (Engineers Australia, 2008). Table 1 below highlights the alignment between the core ANZIIL standards (Bundy, 2004), the learning outcomes defined by QUT in the ILF&S Plans (2001, p.15), and the competency standards specified by Engineers Australia (2008).

Given this strong linking between information literacy standards and engineering competencies, it is hard to see how universities can expect to create holistic engineers without giving serious consideration to the fundamental skills associated with information literacy by blending them in a structured manner throughout the engineering curriculum.

Effective blending of information literacy into the curriculum

Information literacy, the enabler for lifelong learning, traditionally falls within the librarians' domain yet "faculty establish the context for learning and the inspiration for continuous exploration. Information literacy provides the skills that allow students to pursue and acquire information" (Oxnam, 2003). If effective blending of information literacy throughout a curriculum is to be achieved and information literacy skill development is to occur in a structured manner, librarians and academics must form collaborative partnerships. Academics are in control of the engineering curriculum design, content and delivery but they have a valuable resource in their faculty librarians who have specialised skills in information literacy and are available to assist with the process of teaching and blending information literacy skills through the curriculum.

Information literacy outcomes are more effective when skills are developed in a linear, reiterative way throughout a curriculum (Andrews & Patil, 2007; Nerz & Bullard, 2006; Welker, Quintiliano, & Green, 2005), as opposed to tacking on a "library skills" component to a single unit within an entire

course in order to tick a box to say IL has been covered. This is a philosophy backed by QUT's ILF&S which states, "information literacy knowledge, skills and understandings are most effectively learned when established within a discipline related need" (QUT, 2001, p.15).

Table 1 – ANZIIL Standards linked to QUT Core Learning Outcomes and Engineers Australia Stage 1 Competency Standards

ANZIIL Standard	QUT Core Learning Outcomes (Students)	Engineers Australia – Stage 1 Competency Standards
The information literate person recognises the need for information and determines the nature and extent of the information needed	The student will recognise and prioritise their information needs	"Professional engineers are responsible for bringing knowledge to bear from multiple sources to develop solutions to complex problems and issues…" GD "Seek advice from appropriate sources, including advice on latest applicable technologies" PE2.4c "Recognise limits to own knowledge and seek advice, or undertake research to supplement it" PE3.6a
The information literate person finds needed information effectively and efficiently	The student will have knowledge of, and understand, information principles and information retrieval processes The student will access and use effectively a wide range of information resources and technologies	"Ability to locate, catalogue and utilise relevant information, including proficiency in accessing, systematically searching, analysing and evaluating relevant publications" PE3.2a "Propensity to seek out, comprehend and apply new information, from a wide range of sources" PE3.3d
The information literate person critically evaluates information and the information seeking process	The student will apply information seeking and usage principles to a broad range of problem based situations and reduce complex information problems to manageable forms	"Ability to assess the accuracy, reliability and authenticity of information"PE3.2b
The information literate person manages information collected or generated	The student will access and use effectively a wide range of information resources and technologies	Ability to manage information and documentation PE3.2
The information literate person applies prior and new information to construct new concepts or create new understandings	The students will become independent learners	"One hallmark of a professional is the capacity to break new ground in an informed and responsible way" GD "Have produced at least one major report demonstrating mastery of the subject matter and ability to communicate complex material clearly to both technical and lay readers" PE2.5c
The information literate person uses information with understanding and acknowledges cultural, ethical, economic, legal, and social issues surrounding the use of information	The students will view their information environment from multiple perspectives	Understanding of professional and ethical responsibilities, and commitment to them PE3.4

The authors have taught over 200 hours of information literacy to over 6500 students over the last two years, and are acutely aware of undergraduate research skills and attitudes towards library classes. Nerz and Bullard (2006) observed that "Engineering students do not always understand research as something that "engineers do"…even though it is no less important that engineers be able to function in the new information society". Yet "retrieval and use of technical documentations is an important component of engineering education including design projects and postgraduate research" (Chanson, 2007).

The relevance of information literacy to engineering professions should be stated explicitly and in context but the skills must be taught throughout the students' university career. Rather than first year students considering the "library class" as something that is part of a university induction, they need to see the relevance of information literacy skills to succeed in their chosen profession and for lifelong learning. If librarians and academics are aiming to create holistic professionals who go beyond the basic content of their course, then information literacy skills must be addressed.

Explicit links, connecting information literacy to professional competencies, are easy to demonstrate as we have illustrated in Table 1. For an effective learning outcome these skills should be seamlessly blended into the curriculum, developing in a scaffolded manner just as the technical content is developed, rather than a one-off library lecture. While it is recognised that engineering courses are high in technical content there are many opportunities to blend information literacy throughout the curriculum, such as in professional studies units and project units, but ultimately academics must be willing to engage with their librarians and actively seek their input.

Academic support for information literacy, and the blending or embedding into the curriculum varies from faculty to faculty, between schools and academics. At QUT, the Built Environment and Engineering Faculty recognise the importance of information literacy and many partnerships exist between academics and librarians, in a range of professional studies and project units. One of the most successful is with the faculty wide first year unit BEB100, Introduction to Professional Learning.

The collaborative partnership between faculty librarians and the academic staff of BEB100 has developed over a couple of years and aims to engage students in becoming information literate as early as possible in their academic career. A crucial element of this partnership is the strong advocacy and recognition, from the academics responsible for this unit, that information literacy skills are foundation skills required by engineers.

Making it happen

This partnership and collaboration really took off when it was pointed out by academics that the only reading the students didn't really have as part of the set text for the unit was on researching and library skills. It was suggested that this was something that we, as liaison librarians, could source or indeed write specifically for the unit. We jumped at the opportunity, discussed expectations and requirements, and after seeking feedback on drafts, the resulting text *Researching for the Built Environment and Engineering Professions* (Milne & Thomas, 2008) was produced.

This custom text is a great resource for many reasons. It was bundled with the set text, and we ensured that we retained copyright, making it possible for an author copy to be freely available on the *QUT ePrints* repository (http://eprints.qut.edu.au). The text contains a large amount of information that goes beyond what can be delivered in a 50 minute lecture. It provides pointers to additional learning resources where appropriate, such as to *PILOT*, QUT's Information Literacy Online Tutorial (http://pilot.library.qut.edu.au). The text is a resource that students can use throughout their course, and we have already used this with other units at various stages in the curriculum. Examples in the text are in context with the engineering disciplines using resources specific to the profession and the text itself is structured around the ANZIIL standards.

With the establishment of a set text many small details could be left for the students to read for themselves and we could concentrate on value added content in the lecture. The lecture design and delivery was important to both librarians and academics. We held several meetings with the

academics to discuss the lecture's structure and design so that it followed the common format of other lectures in the unit. This included techniques to keep the students engaged with the content, one area of the partnership which particularly benefited the authors as we could draw on the teaching expertise of the academics.

One particular comment obtained from feedback in 2007 that struck a chord was that the library lecture "was helpful…but was still boring and dragged out". Many librarians lecture and demonstrate search skills and information tools at the same time but we felt that this was a major problem in engaging with the 500 or so students in each lecture. We tackled this by having one librarian to 'drive' the demonstration and another to interact and present to the audience. We also brought in other technologies to provide variety to the lecture and we created a multimedia clip to open the lecture which made the explicit links as to why information literacy skills are so important for the engineering professions and for life in general. The lecture delivered the skills that students were expected to gain within the context of the assignments that had been set for the unit, using specific information tools that would best meet their needs. An introduction from the academics was invaluable in ensuring the students understood the importance of the skills being taught, and that it wasn't just the 'library lecture'. Academics also discussed plagiarism in a separate lecture.

To aid with the tutorials, we assisted in the development of the tutorial activities and attended the tutors' weekly briefing to ensure they understood the tasks involved. We were also available throughout the entire unit to address FAQs ensuring the entire student cohort received consistent answers to their questions.

We also assisted in the development of the Criterion Referenced Assessment (CRA) in relation to the research skills that were expected to be demonstrated. In addition, we developed a bank of questions for a Blackboard quiz and the final exam. Of the final exam questions, thirty two percent (32%) were based on information literacy skills. A basic analysis of these results was undertaken to get an impression of students' capabilities. Two major stumbling blocks were identifiable: the use of call numbers to locate items within the library, and; locating the full text of a journal article from a citation.

As librarians we gained a lot from the collaborative partnership and being part of the teaching team for this unit, and believe that students engaged with the concept of information literacy more than in previous years. The text will again be used in 2009 but will be revised based on feedback from students and academics.

From participation in this unit and rough analysis of exam results we gained useful feedback as to where students are succeeding and failing in their information literacy skills. This will be integrated into the content for next year's lecture to ensure that the areas that caused most difficulty are dealt with in more detail. We will continue to liaise with academics on the development of materials for this unit to ensure that it continues to meet student needs.

Conclusions

It is hoped that next year we will be able to conduct surveys to assess student levels of information literacy as they enter their academic careers in an effort to better understand their skill levels and needs. As students rely more and more on electronic resources and search engines such as Google, librarians and academics need to ensure that students understand the flow and structure of the information environment, as well as equip them to use search tools effectively. Students are likely to have access to fewer full text resources when they leave university but search engines such as Google Scholar provide access to open access and pay per view documents. Therefore, ensuring students have an awareness of what is available and why and how they should be searching the various resources (Aydelott, 2007), is essential.

A building can only survive with solid foundations. Core skills such as information literacy that empower students to go beyond the basic content of the curriculum and continue their learning in industry and beyond, enable the creation of holistic professional practitioners.

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