Using an authentic learning environment to help students see that there's more to research than Google and Wikipedia: a reflection

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***Abstract**: Authentic learning environments open up opportunities to help students learn about the value of research skills and the importance of professional sources (two aspects of information literacy). Individual students begin to see how limiting a reliance on Google and Wikipedia is to the development of their professional knowledge base. But, it is important to recognise that these skills and knowledge are built over time. Information literacy is not achieved in one course alone. It grows as discipline knowledge grows over an entire program.*

Introduction

This paper presents the reflections, of a course examiner (lecturer) and librarian, on an information literacy experiment conducted in a third level Engineering course. Course examiner and on-campus student dissatisfaction with the lecture format employed in the course and a demonstrated lack of student information literacy skills, led the course examiner to introduce (at short notice and for the on-campus group only) an authentic learning activity (Lombardi, 2007) based on a true life case study. Students developed their failure analysis and materials selection knowledge through a process of analysing the case study's problems, researching the elements identified in their analysis and writing a report. These activities were undertaken in the Library with both the course examiner and librarian present. It was hoped that, by holding the sessions in the Library, students would be coaxed into reconsidering their reliance on Wikipedia and websites of unknown quality, and incorporate professional sources into their research repertoire.

Background

The course

Materials Technology (MEC3202) is a third level course offered to both on-campus and off-campus students in the Bachelor of Engineering, Bachelor of Engineering Technology and Master of Technology. This course extends the basic course, Engineering Materials, to explore the variety of material properties and behaviours and their impact on engineering activities. Its objectives are:

1. Appraise the characteristic properties, applications and behaviours (including strengthening mechanisms) during processing, fabrication and service of a wide range of engineering materials
2. Systematically specify and justify suitable material(s) for a given application
3. Evaluate the effects of fatigue, creep, corrosion and wear on materials
4. Examine forms and effects of corrosion in metals and review the main methods of corrosion prevention

5. Assess the effects of welding on the properties of a welded component and the methods used to ensure a sound weld
6. Apply basic procedures used in the failure analysis of a component and in the selection of a material for a given component.

A traditional non-compulsory lecture and tutorial format had been employed for the majority of the course and assessment consisted of:

- Assignment 1 - ten short answer questions (5%)
- Assignment 2 - eight short answer questions (10%)
- Assignment 3 - six questions for six items demonstrating material selection processes (15%)
- Final examination (70%).

Twenty-nine on-campus students were enrolled in the course (with fifteen regularly attending lectures and tutorials) and fifty-two students were enrolled off-campus. On average, nine students chose to attend the case study session series held in the Library.

Information literacy

Information literacy has been defined in a variety of ways (Australian and New Zealand Institute for Information Literacy, 2004, American Library Association, 2000, SCONUL, n.d.) but at the heart of these discussions is the ability to:

- Analyse one's information need/s
- Identify which sources are most likely to meet those needs through the provision of relevant and quality information
- Find that information efficiently
- Incorporate the information into one's existing knowledge base so that it can be used effectively and in an ethical manner.

Information literacy learning is at its most powerful when embedded into discipline learning.

In the Bachelor of Engineering and Bachelor of Engineering Technology information literacy has been addressed, with support of the Library, on an ad hoc basis. Examiner's attempts to address information literacy autonomously have also been limited and ad hoc in nature. As a result, most undergraduate third year students possess limited research skills and are, at best, naïve evaluators of the relevance and quality of information that they find.

Our students are not alone. Numerous studies have revealed similar limitations across a range of disciplines, universities and countries. These studies (e.g., Armstrong, Fenton, Lonsdale, Stoker, Thomas, and Urquhart, 2001, Banwell and Gannon-Leary, 2000, Brophy, Fisher, Griffiths and Markland, 2003, Callinan, 2005, Gannon-Leary, Banwell, Childs, 2001, Price, 2004, Smith and Oliver 2005, Urquhart, Thomas, Armstrong, Fenton, Lonsdale, Spink and Yeoman, 2003, Waldman, 2003) typically report common student attitudes and experiences such as:

- The right information is information that can be acquired quickly rather than information that is reliable and relevant to the question/problem
- The large numbers of results (regardless of their relevance) of Internet searches are more desirable than the smaller number of focused search results retrieved by traditional databases
- Finding the right information is not part of "study"
- Website information is trustworthy
- Lack of awareness of scholarly and professional sources, and their differences
- Lack of preparedness to practice and develop information seeking and utilisation skills
- Lack of appropriate encouragement by academics
- Inappropriate training and/or education provided by librarians
- Familiarity with Internet search engines and websites as they are embedded in everyday life.

Leading up to the case study sessions

Prior to conducting the case study session series, on-campus students attended a Library session related to the value of Engineering and Materials handbooks to Materials knowledge building

generally, and to Assignment 2 in particular (off-campus students used a comparable online tutorial). We recognised that students would not overturn entrenched information seeking and evaluation habits after this fifty minute session but aimed to challenge that entrenched thinking and behaviour. Students clearly enjoyed the session and their Assignment 2 submissions demonstrated that they had begun to incorporate the ASM Handbooks into their source repertoire.

This positive experience and subsequent student expressions of dissatisfaction with the standard lecture-tutorial format, convinced the course examiner to replace the lecture-tutorial format with a failure analysis and materials selection case study to be analysed, researched and reported.

Case study – failure analysis sessions

We came into the failure analysis sessions with five things on our minds. We knew that students had enjoyed their handbooks session and that, most particularly, they had come to recognise the relevance of the ASM Handbooks to Materials questions. We also recognised that the previous fifty minute session did not provide an opportunity to overturn entrenched Wikipedia and Google reliance. However, the ASM Handbooks uptake gave us confidence that, given the right learning environment, students were open to using professional sources. Although a true transformation (Mezirow, 1991) in information seeking and use was highly desirable, we recognised that this could not be achieved through one course. We did, though, suspect that we could help students come to understand the value that professional sources bring to Engineering practice.

Working with these considerations led to an activity consisting of:

- Group analysis of the failure analysis issues embedded in the case study
- An introduction to Engineers Australia's Stage 1 competencies (n.d.) related to information literacy and industry relevance (eg. legal liability issues) so that students could situate their research activities within the context of professional identity
- A creation of individual student awareness of the process of synthesizing existing knowledge with found information to create new knowledge
- Guidelines to sources of information (eg. which information needs tend to be best met by conference papers, handbooks, etc)
- Searches (by individual students) for information to use to help fill knowledge gaps
- Sharing of research findings and failure resolution suggestions
- Group failure analysis decision.

During this process, we saw students develop their information literacy skills and develop their Materials knowledge. With their research under way, students focused on developing a consciousness (though tentative) they had not previously experienced in their research work. They considered what they already knew about the problem and what they did not know. As they researched to fill identified knowledge gaps, they asked themselves new questions and began to delve more deeply into their problem, and their research took new and interesting turns.

This conscious process of ongoing analysis and research led students to seek information from sources that they had not previously considered. They were surprised by the sources held in the Library and began to take a level of pride in their ability to find and use these sources. Working through this process in a social setting was important for students' learning. As individuals investigated several different lines, they shared their thinking and their successes and failures, and told each other of valuable online and print materials located. The environment that they created was collegial and truly inquiring and was a pleasure for the examiner and librarian to experience.

The group report-back on failure identification continued in a similar vein - what do we know about this problem, what else do we need to know, how will we find this out, does this lead us to another issue requiring investigation, etc. Students volunteered the sources that they had used, including the full and correct citation details. They appeared eager to demonstrate that they could find a variety of relevant sources and that they had considered the professional credibility of each source. As referencing and information evaluation skills are skills that we regularly bemoan as lacking in our students, we were astonished by their initiative.

Case study – materials selection session

With this very positive experience behind us, we moved on to the materials selection section of the case study. Materials were to be selected to overcome the failures identified in the previous sessions. As we prepared for these two sessions, we kept several factors in the back of our minds. We knew that despite their significant achievement, students were operating outside their comfort zones and would not have fully consolidated information literacy thinking and skills into their technical thinking. As a result, the materials selection work would provide an opportunity to consolidate their information literacy knowledge base and skill levels and increase perceptions of self-efficacy (Kurbanoglu, 2003). We also hoped that conducting more research work in this authentic learning setting would help reinforce a newly discovered aspect of professional identity - professional lifelong learning as part of everyday engineering practice.

The group divided itself to cover the aspects of the materials selection problem including:

- Selection methodology
- Design factors
- Life versus cost
- Sustainability
- Innovation.

Individuals continued with a conscious application of existing knowledge and identification of knowledge gaps which they sort to fill and then synthesize with their existing knowledge.

Most students continued to explore sources other than websites and few relied solely on Google for searching. Surprisingly, in the group-report back and problem resolution segment, students had to be prompted to provide source details and seemed a little flummoxed by questions regarding source credibility and reliability. This contrasted sharply with the "source pride" that appeared evident in the failure analysis reporting. Most students continued to seek out handbooks and similar material but no-one moved on to explore journal articles even though they were the source most suited to the question of innovative solutions.

What we have learnt

… From our own reflections

In the materials selection session, students' enthusiasm to "get on with the job" overtook their identification of the most likely sources for each research task. We had not expected this but, on reflection, it seems perfectly reasonable that the previous 100 minutes work would not be sufficient to overturn entrenched information seeking activity behaviours that mitigate against preparation work. In future we will be very careful that analysis and preparation scaffolding is reinforced at all relevant points throughout the session series.

We were also surprised that students did not continue with the previously demonstrated source evaluation work. Once again, though, it was unrealistic to expect students to continue evaluating sources without appropriate support being embedded into the research sessions. We also wonder how much evaluation depth should be introduced in a series of sessions totaling 200 minutes. In our authentic learning situation, information literacy and discipline learning are occurring simultaneously and organically. Information evaluation creates a layer of complexity and relies on a reasonable degree of discipline competency to be truly meaningful.

We wonder whether information evaluation needs to be substantially addressed before this point so that basic skills are bedded down and can be synthesized and applied in the case study. This would also allow us to pursue a constructivist pedagogy (Collins and O'Brien, 2003) consistent with the rest of the case study learning. In this experiment information evaluation was addressed in quite a behaviourist manner (Collins and O'Brien, 2003). That third year students aren't competent evaluators and "referencers" of information, despite continual instructions from academics to be both, indicates that continuing with a behaviourist pedagogy will not result in a change of thinking and acting.

… From student evaluation responses

On completion of the sessions, we conducted an evaluation addressing learning styles preferences and information literacy outcomes. Although we cannot claim that responses are representative of the entire MEC3203 cohort, they provided interesting input into our post-session reflections. Eight of the nine respondents found the case study learning environment challenging and enjoyable and all students saw its relevance to their future professional practice. Most also indicated that they appreciated a combination of "being told" in lectures and study materials with "finding out for themselves" through case study research activities. Pleasingly, all respondents reported that the case study activities helped them synthesize existing knowledge with the new information (found through their research) and that they had learnt more about the subject.

On the information literacy front, responses indicated that, as we expected, this was not a transformational experience (Mezirow, 1991). It was, as we planned, a learning experience that challenged entrenched thinking and behaviours dominated by Google and Wikipedia. Exposure to professional sources and the professional thinking processes embedded in case study research, did help students understand their importance to the quality of a growing professional knowledge base.

Students also indicated that they were becoming more discerning users of websites and other information sources and that they were now more able to find those resources (than they were in the past). All respondents indicated that conducting the sessions in the Library encouraged them to use resources other than free websites. Eight of the nine respondents also said that they expected that their future research activities would be conducted in a more systematic and methodical manner.

Conclusion

Our experiment to embed information literacy into an authentic learning situation was, we consider, a success. In around 200 minutes of work, students touched (to varying degrees) on a number of Stage 1 Competencies: PE 1.2.f, 2.1.a, 2.1.b, 2.3.d, 2.4.c (fourth dot point), 2.5.b, 3.2.a, 3.2.b, 3.3.d, 3.4.c, 3.5.c, 3.6 and 3.7.c (Engineers Australia, n.d.) and reported enjoyment and learning from the activity. Our critical reflections, however, showed us that our enthusiasm for the task (as it evolved during the early sessions) led us to overly high expectations in some cases and that we had unwittingly incorporated a behaviourist pedagogy already proven to be unsuccessful. The reflections also confirmed our initial analysis that student information literacy will only be achieved through a strategic approach delivered across an entire program. A greater consciousness in our understanding of the experiment, provided by this reflective activity, will now be used to create a new assessment item (a literature review) with carefully scaffolded information literacy support for both on-campus and off-campus students.

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