On-line discussion forum to support undergraduate mining student independent learning

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CONTEXT
Discussion modules are generally limited to student-to-student peer learning, with guided moderation by tutors and lecturers. This paper aims to establish that there can be valuable additional learning by using a similar approach, but involving industry professionals to provide mentoring and responses to students' questions in specific subject and/or topical areas. A real advantage of this approach is the translation of theory and technical knowledge into real world problems. The industry-based forum used in this trial resulted in students re-calibrating what they are being taught and what awaits them in the real world and was also invaluable to lecturers as it alerted them to the relevance of what is being taught during lectures/tutorials. Mining engineering was chosen as the focus for this study for two reasons. One was the background of the authors and the subjects they teach. The other is that, unlike most other engineering disciplines, mining engineering professionals are mainly located in regional and remote areas, which limits the ability for students to gain face-to-face access to these professionals across a wide range of commodities or processes.

PURPOSE
The advantages of student-industry professional on-line discussion forums can to assist undergraduate mining students translate classroom theory and technical knowledge into real world mining problems was evaluated using two subjects, covering Surface Mining and Mineral Processing.

APPROACH
Mining industry professionals from a diverse range of commodities and companies were invited to take part in a trial on-line discussion forums, to assist students in two subjects. The invitations were issued through both professional and industry associations. The professionals came from both production and technical services, as well as consultants. They had expertise in drilling/blasting/explosives, draglines, truck and shovel, excavators, related mobile equipment, mine planning and logistics and diverse processing techniques, as well as environmental/rehabilitation issues. The students either asked questions individually, or formed discussion groups to ask questions, or raise issues, related to lecture, practical, tutorial and project topics. The industry professionals provided advice on-line, or answered questions that students raised.

RESULTS
Feedback from industry professionals demonstrated that they also highly valued the on-line discussion experience. In many cases, student questions elicited a range of responses and the industry professionals were able to compare their own responses to those from colleagues in other companies. The professionals highlighted that this significantly developed their own knowledge about possible problem solutions. Another highly valuable outcome from the on-line trial has been that often the industry professionals' responses re-enforced or enhanced material that the lecturer had presented and this added to the lecturer and subject credibility.

CONCLUSIONS
The subject assessment results demonstrated that the students found the inclusion of industry-based professionals in their discussion groups to be highly beneficial and they strongly recommended that the trial should be extended to all mining subjects. The trial developed strong linkages between the theory and technical knowledge gained from the university program and the real world problems faced by industry-based mining industry professionals. The exercise drew students' awareness to what they would be likely to experience in the real world.

KEYWORDS
Discussion forum, mentoring, on-line discussion.

Introduction

Increasingly, University of Wollongong (UOW) students are gaining value from using UOW eLearning sites, particularly on-line discussion modules for each of their individual subjects. Discussion modules are generally limited to student-to-student peer learning, with guided moderation by tutors and lecturers. This paper aims to show that there can be valuable additional learning by using a similar approach, but involving industry professionals to provide mentoring and responses to students' questions in specific subject and/or topical areas. A real advantage of this approach is the translation of theory and technical knowledge into real world problems. The industry-based forum used in this trial resulted in students re-calibrating what they are being taught and what awaits them in the real world and was also invaluable to lecturers, as it alerted them to the relevance and currency of what is being taught during lectures/tutorials.

The University of Wollongong's mining engineering program is in the unique position of being the only full Australian mining engineering degree offered entirely in a mining region. Increasingly, this is enabling UOW students to interact with the industry and professional bodies, such as the Illawarra Branch of the Australasian Institute of Mining and Metallurgy, (AusIMM), achieving a broader, more comprehensive education. This paper discusses an educational project (Baafi, Tolhurst and Marston, 2015) aimed to build on mining engineering students' positive experiences from using the University of Wollongong (UOW) eLearning Moodle site, particularly the Discussion Forum module for individual subjects, by using an approach similar to an on-line discussion forum blog, involving industry-based professionals across two single semester subjects, *MINE211* and *MINE324* covering surface mining and mineral processing, respectively The significance of the approach was that it re-enforced the strong linkages between UOW mining engineering and the mining industry and also created additional independence in student learning.

On successful completion of the *MINE211 Surface Mining Methods* subject, students should be able to:

- be familiar with the design and operations of various mining systems including bench mining, strip mining, alluvial mining and their associated mining equipment (shovels, hydraulic excavators, wheeled loaders, trucks, draglines, scrapers and bucket wheel excavators)
- be familiar with different material handling systems for surface mine operations, and
- acquire the skills in designing blasting patterns for different mining conditions.

On successful completion of the *MINE324 Mineral Processing* subject, students should be able to:

- understand the theoretical limitations of physics and dynamics when applied to real-life processing units and maximise their efficiency using engineering judgment and design alterations;
- design the optimum flow sheets and perform the appropriate mass balancing computations for a given circuit operation, and
- recognise the major environmental problems associated with tailings disposal and understand appropriate technologies that can contribute towards waste reduction and re-use.

Approach

The project built on a post-constructionist approach (refer to Figure 1), where students were enabled to "construct" some of their learning, based on adding to, or clarifying, what they already know. It is based on the success of two similar related approaches:

- the UOW eLearning discussion forum for each subject, and
- the TAFE Illawarra on-line Quarry Management Diploma approach of using the expertise of industry-based mentors (Tolhurst, 2002).

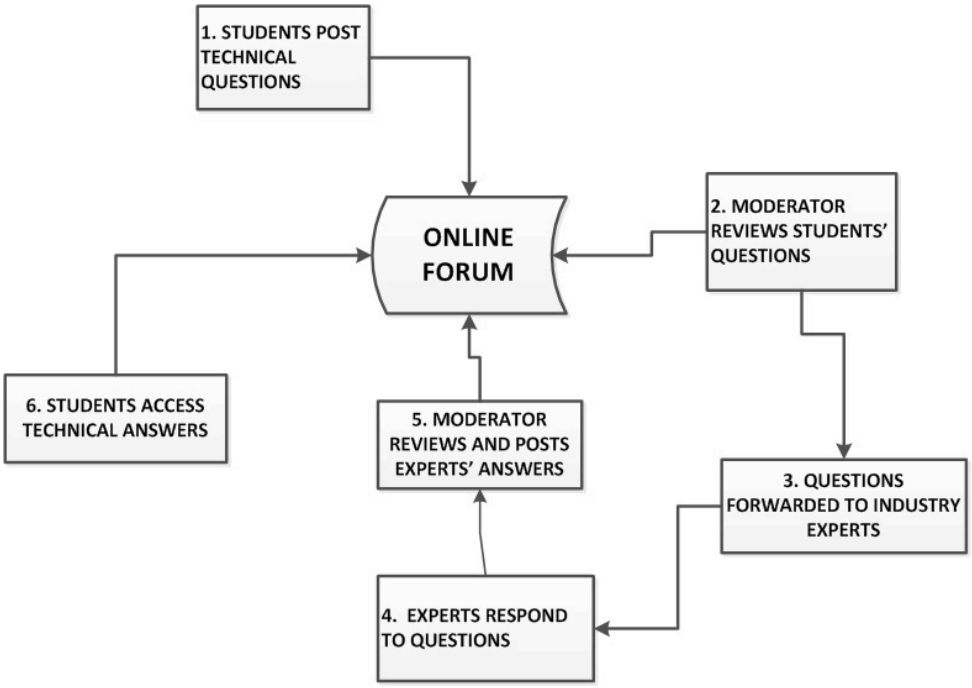

Figure 1: Industry-based online ask expert forum

The TAFE Illawarra program had been successful in gaining Quarry Management Diplomas and Licences for students throughout Australia and New Zealand.

Mining industry professionals from a diverse range of commodities and companies were invited to take part in a trial on-line discussion forums, to assist students in the two subjects, covering surface mining methods and mineral processing techniques. The invitations were issued through both professional and industry associations. The professionals came from both production and technical services, as well as consultants. They had expertise in drilling/blasting/explosives, draglines, truck and shovel, excavators, related mobile equipment, mine planning and logistics and diverse mineral processing techniques, as well as environmental/rehabilitation issues. The advantages for mining industry professionals taking part in this project were:

- Gaining experience in mentoring personnel about to enter the mining industry;
- Obtaining Continuing Professional Development (CPD) credit points for maintaining consultancy/chartered engineer status;
- Providing advice and suggestions that could enhance their technical understanding on mining related issues;
- Considering issues from different perspectives than may normally happen within a particular company;
- Recognition of involvement may be added to their resume.

The registration of industry experts was through the student's Moodle site to give industry partners access to the eLearning sites. It was difficult to obtain registrations and access for industry-based professionals as this is not the normal UOW IT practice. While the project approval expected a total of 10 industry-based professionals across both subjects to take part, due to greater interest, 18 were registered for *MINE211 Surface Mining Methods* and 12 for *MINE324 Mineral Processing*, all gaining access to the respective eLearning Moodle site*s.*

The students either asked questions individually, or formed discussion groups to ask questions, or raise issues, related to lecture, practical, tutorial and project topics. The students' questions were moderated to ensure that UOW's reputation was protected. The industry professionals provided advice on-line, or answered questions that students raised. In total over 160 questions were asked by students in the two subjects, with only one inappropriate request, which was quickly removed from the online forum by the moderators. (The student had asked for a job). An example of the type of questions asked by students was:

> *"What considerations are made when matching trucks with a loading unit? What other factors would later influence this match?"*

The industry professional's response was:

> *"In most surface operations truck haulage accounts for the largest single cost, making the match between trucks and loading units integral to the entire operation. It is important to note that there are many different options which can be used but the optimal one should provide the lowest unit cost (i.e. which option has the lowest $/bcm). Optimising a truck and shovel fleet involves the consideration of all factors affecting cost and productivity. The main factors which I would identify relate to productivity including machine availability, operating efficiency, bucket fill factors, both truck and loading unit size (as a rule of thumb 3-4 loader passes per truck), haul distances, haul times, material properties and then also the actual cost of the machinery. It is common to use various software including Talpac and Deswik to analyse different scenarios to choose the best option."*

Another question posed by one student was:

> *"I was just curious about what are some typical numbers for downtime of machines and regular maintenance?"*

The industry professional's response was:

> *"Depending on the machine some weekly and some quarterly. For a primary piece of equipment like a mill you would like it to have an up time as high as possible. Most plant budget is about 95% up time for the concentrator. They also usually have a quarterly shut to do essential preventive maintenance this can last for 12 hr -24 hrs depending what is required. Other maintenance is done on the run e.g. like pumps as they usually there are stand by spare pumps to kick in if one breaks down."*

Results

Feedback from industry professionals demonstrated that they also highly valued the on-line discussion experience. In many cases, student questions elicited a range of responses and the industry professionals were able to compare their own responses to those from colleagues in other companies. The professionals highlighted that this significantly developed their own knowledge about possible problem solutions. Another highly valuable outcome from the on-line trial has been that often the industry professionals' responses re-enforced or enhanced material that the lecturer had presented and this added to the lecturer and subject credibility and relevance.

The effectiveness of the trial for student learning was assessed for both subjects. The assessments demonstrated that the students found the inclusion of industry-based professionals in their discussion groups to be highly beneficial and they recommended that the trial should be extended to all mining subjects (Refer to Figure 2). The subject failure rates were found to be lower compared to the previous years. The industry professionals

were also surveyed and their feedback was also highly positive and they were most impressed that UOW staff opened up their presentations to students to being evaluated by industry-based personnel. Unedited comments by a group of students were:

> "*An effective and excellent way of contacting people working in the industry. Responses were fast and efficient";*
>
> *"It's a good place to ask question and gain general feedback from professionals on different topics that surround surface mining".*

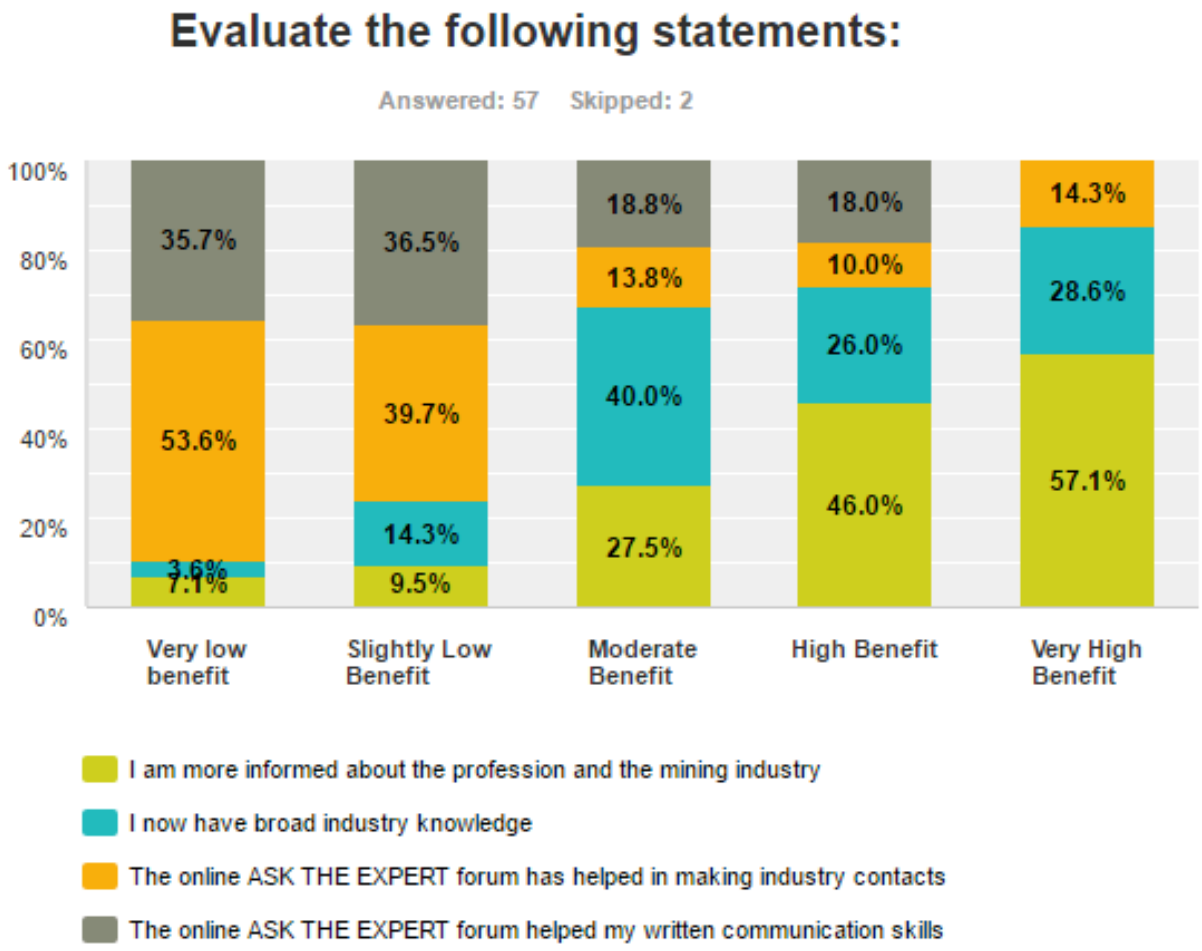

Figure 2: Students' assessment of the benefits gained from the participation of industry-based professionals in the on-line discussion trials.

Conclusions

The subject assessment results demonstrated that the students found the inclusion of industry-based professionals in their discussion groups to be highly beneficial and they strongly recommended that the trial should be extended to all mining subjects. The industry professionals were also surveyed and their feedback was also highly positive and they were most impressed that the mining staff opened up eLearning presentations to students to be evaluated by industry-based personnel. The trial developed strong linkages between the theory and technical knowledge gained from the university program and the real world problems faced by industry-based mining industry professionals. The exercise drew students' awareness to what they would be likely to experience in the real world. Although the study focussed on the mining discipline mainly because of the background of the authors, the approach may easily be applied in other engineering disciplines.

The online discussion forum increased industry-relevant learning by students, improved achievement of UOW Graduate Attributes and offered a greater mutual respect between the mining industry and UOW. The advantages of student-industry professional on-line discussion forums can assist undergraduate mining students translate classroom theory and technical knowledge into real world mining problems was evaluated using two single semester subjects, covering surface mining methods and mineral processing techniques.

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