

Self-Learning Interactive Website Mining Engineering Education for the Australian Environment

Najdat I Aziz, Stuart Chambers, Ernest Baafi and Richard Caladine

*University of Wollongong, Faculty of Engineering- Mining Engineering, Australia
Ph: +61 2 42213449, Fax: +61 2 42213238, e-mail: naj_aziz@uow.edu.au*

Abstract: The mining engineering course at the University of Wollongong is in the process of continuing restructuring to meet the challenges and changing demands on mining engineering education in Australia. An on-line interactive student resource on longwall mining has been developed at the University of Wollongong to serve as a supplement to formal teaching of mining engineering students enrolled in the subject of Underground Coal Mining Methods. The on-line interactive website allows students to gain a deeper understanding of longwall mining in their own time and at their own pace. Incorporated into the website is a self-assessment component to allow an informal on line interaction between students and lecturers. A student survey of the website has indicated a general desire for website learning as it represented a new approach to effective method of engineering education deliberation.

Keywords: Longwall mining website, flexible delivery.

1. Introduction

All mining engineering institutions worldwide including those in Australia teach core mining methods subjects to undergraduate students. The techniques of mining are best demonstrated when formal lectures are supported by field visits and hands-on practical experience. Where active mine sites are in close proximity to tertiary institutions, this is not normally a problem. Unfortunately, most mine sites nowadays are remotely located from universities and educational institutions offering mining programs, and in recent years access to local mines has been discouraged. This makes the learning of certain mining methods a difficult task for the students. Conventional teaching methods are to use static overheads and sometimes videos to explain simple operations to students and concept of equipment sizes and three-dimensional visualisation of unit mining operations are not always easily grasped by students. As a consequence, an on-line student resource has been developed to:

- serve as a supplement to formal teaching of longwall mining to students enrolled in the subject of underground coal mining methods
- gain a better understanding of longwall mining in student's own time and own pace
- allow informal on-line interaction between students and lecturers by incorporation of a self-assessment component into the package
- keep a breast of latest information and technologies used in Australian mines as the website is maintained dynamic with regular updating
- gain access to various statutory mining legislation's and laws as the website is interlinked to various government organisations and legislative bodies websites.

2. Project Development

A research assistant with mining engineering qualifications was recruited to develop the site. Reliance on a trained mining engineer was necessary in view of the nature of underground mining operations not being easily understood and visualised by others not trained in the discipline. Developing the website in-house provided an opportunity to master skills for future development of other sites as well as regular upgrading of the existing website. The initial introduction is to describe and illustrate the basic elements of longwall mining commencing with a basic definition of longwall mining and expanding to more complex issues related to the operation and problem solving associated with longwall mining. Accordingly, the structure of the developed web site on longwall mining falls into the following components:

- a) General introduction to longwall mining
- b) General design and layout of longwall mining

- c) Longwall mining machinery and equipment
- d) Ventilation and environmental aspects of longwall mining
- e) Geomechanics and ground control in longwall mining
- f) Longwall change over techniques
- g) Glossary of longwall mining terms and references, and
- h) Self-assessment, which includes student and staff interaction.

The web site was written in the standard html format that is used on the web. Access to the site is via any standard internet web browser (ie Netscape Navigator or Internet Explorer) and the address of the development site is <http://www.uow.edu.au/~sselby/stu/equipment>. One of the aims of this project is to present the information to the students in a user friendly and technically attractive style. The subject that this was designed for is a very descriptive subject and students previously undertaking this subject have found it difficult to comprehend and imagine in comparison to a real field situation. The incorporation of various video footage on actual coal winning and equipment functioning have contributed significantly to students better understanding of the subject.

3. Website Content

The technical content of the website is based on class lecture notes of the academics involved in teaching the various longwall mining subject components. This is further supplemented with technical material from industry personnel in the field as well as specialist mining consultants. The reported case studies and the future ones to be incorporated will be supplied from mining personnel and expert industry consultants. Although the website is interlinked to various national and international websites it will not be used to actively promote any company, product or alike. The website's primary function will be for educational purposes only, both for students and for knowledge upgrading of the mining industry personnel. The inclusion of a self-assessment component is vital to the credibility and acceptability of the site. A method of determining the competencies of persons and their knowledge of the topics is becoming more critical in view of the mining legislation direction for future training of mine personnel working at the longwall face in Australia. Another section needs to be developed for the number of instances for the recovery of longwalls from disturbances of ground or inadequate maintenance of equipment or incorrect operation of the equipment. There is a lot of case history in Australia and overseas which has allowed innovative techniques to be developed and would also save many millions of dollars to the mining industry.

To make it easier for students to use the site a standard/template was developed and this structure was incorporated onto every web page. A general view of the front page of the website can be viewed in figure 1. The structure used for this website was as follows:

i) Universal Navigation System : This system allows the users to move around the web site with ease. The agreed system consists of a simple menu bar that is located in a column on the left-hand side of every page. At the top of the menu bar is the Mining Engineering logo of the University of Wollongong. Below the logo is a list of pages/modules that could be accessed from that particular page. To the left of each of the menu buttons is a mining icon (the well-known hammer and pick crossed) used to indicate which page the user of the site is on by making the mining icon turn green. Located at the bottom of the menu bar on every page are four 'global' navigation buttons:

- HOME: Returns the user to the front page of the web site.
- GLOSSARY: Takes the user to a comprehensive list of terms and their definitions that are associated with longwall mining.
- REFERENCES: This button takes the user to a list of references that are associated with longwall mining, enabling the students using the web site to further research longwall mining from these particular references. The students can also check the University of Wollongong's on-line library catalogue to see if the references listed are available at the library.
- TOP: This button allows the user to immediately return to the top of the viewed web page when they have scrolled down to the bottom of it.

ii) Content: The content of the web page takes up the remaining space left from that used by the navigation system. The content is presented in such a manner as to allow the student to read about a particular topic and then view a graphical diagram of that topic. The lecture material incorporated into the web site is well researched to accurately portray current longwall operations in Australia.



Fig. 1. Front Page of the Longwall Mining Web Site

When the user accesses the site the index page in figure 1 is displayed on their computer screen. A banner is incorporated at the top of the index page that says “Coal Mining Methods, Longwall Mining”. Beneath the banner is a photograph of a modern longwall face from a current Australian Longwall face operation. In the navigation bar of the index page there is a series of menu buttons for the various learning modules that are available to the viewer. The topics incorporated into this site are:

- a) **History and Methods:** This module provides an introduction into longwall mining in Australia and throughout the world. It incorporates a short introduction into the basic concepts of longwall mining and the various methods that can be used to extract coal by longwall mining. A unique feature of this module is that it contains details of every currently operating longwall face in Australia including;
 - longwall production figures for the last calendar year,
 - equipment used at each longwall mine site,
 - layout plan of each longwall site,
 - coal seam mined,
 - coal transportation,
 - method of underground access,
 - contact details of the sites,
 - geographical location,
 - Date of commencement of longwall mining operations.
- b) **Equipment Overview:** A thorough description of longwall face equipment is described throughout longwall faces. These include
 - *Coal Shearer:* This machine extracts the coal from the coal seam
 - *Coal Plough:* The coal plough is an alternative machine to the coal shearer and is not favoured in Australia.

- *Powered Supports*: Powered supports provide support to overlying strata as the coal is being extracted from the longwall face.
 - *Armoured Face Conveyor*: The armoured face conveyor carries the extracted coal from the longwall face to the beam stage loader at the end of the face.
 - *Pantehnicor*: The pantehnicor is made up of a series of sleds that supply the electrical and hydraulic power supply to equipment on the longwall face.
 - *Beam Stage Loader*: The beam stage loader transfers the extracted coal from the armoured face conveyor to the belt conveyor.
 - *Communications*: Communications that are used throughout longwall mines in Australia
 - *Environmental*: This page covers various aspects that can affect the quality of the mine atmosphere such as airborne dust, heat, humidity and methane gas.
- c) **Ground Control**: An important aspect of longwall mine design is to understand how the surrounding ground stratification react when a tunnel is driven through it.
- d) **Ventilation**: The design of a ventilation system for a longwall mine is dependent upon the geological and atmospheric conditions found at each individual mine site. Many factors have to be considered to determine the most suitable system of ventilation.
- e) **Longwall Change-over**: Once a longwall panel has been fully extracted the longwall equipment is dismantled and moved to a new panel. This operation is called a longwall change-over.

4. Website Survey

During development of the site a student evaluation was conducted to gather their input and ideas for further development on the website. The students navigated through the website for approximately half an hour and were then asked a series of question at the conclusion of the session. Some of their responses are given below:

“It is great because you actually get coloured pictures, movies etc right where your information is so you visualise what your reading”

“Yes, very helpful. I wish we had it for our sessions work.”

“It helped my understanding of longwall mining by a great deal due to the videos and diagrams.”

“It helped a lot, doing a 2nd year subject it is the 1st time you are exposed to anything mining related and the concepts can sometimes be confusing but here they are set out logically.”

5. Conclusion

The website on longwall mining is developed primarily as a tool for effective teaching in tertiary education. The website will be placed into the public domain to assist in upgrading and training of mining industry personnel as well as raising awareness of the mining operation to the public in general. The website would be a valuable source and a useful library for those interested bodies in remote regions and rural areas of Australia. Although the website is interlinked to various national and international websites, it will not be used to actively promote any company or product, or alike. It is purely an educational website that in due course will also be a website for advanced training in various aspects of mining engineering which will cover more complex issues for improved safety in mining operations.

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