

3.4. TRUCK AND SHOVEL MODULE

This module contains a library of resources pertaining to truck and shovel operations. The first part acts as a virtual tour of several truck and shovel operations. It contains 23 photographic 360-degree panoramas, 2 aerial photographs, 6 interviews with personnel, 3 full resolution 360° panoramic videos, 15 assorted videos, and almost 400 still photographs. Students are able to combine these resources into virtual workspaces, grouping related information together. Students can also navigate, in 3D, a full digital terrain map of an open cut mining operation at the Hunter Valley, NSW, Australia.

The second part of the module is a 3D representation of a sample equipment selection software simulation. Students are presented with an open cut mine and the option to run the simulation using 3, 4 or 5 trucks.

The simulation can then be viewed at up to 16x real time speed, from any number of angles, and paused, resumed and restarted. Students are also presented with an overlay displaying the elapsed time, the idle time for the loader and the amount hauled for each truck. With the help of this section of the module, students can visualise in this virtual environment the importance of choosing the correct number of trucks for each shovel. This module also shows the capability of this system to link with other software packages. This technology is currently being undertaken in another project which will be discussed later in this paper. Figure 4 provides a screenshot of the equipment selection simulation that the students can observe in this environment.

3.5. LONGWALL TOP COAL CAVING (LTCC) MODULE

This module contains a virtual representation of a LTCC operation (Fig. 5) consisting of 55

face shields, a shearer, and the coal face. It allows students to view all the steps involved in the LTCC cycle. Students can also view the steps of the caving cycle on a single face shield in isolation. Both modes allow the student to freely navigate around the environment. Finally, students can also access a video library containing PowerPoint screen captures outlining the complete LTCC process at one of the mines in NSW which operates this method of mining. This module is quite useful in teaching as not many operations in Australia have this method of mining.

Explaining this mining system through the use of this technology is very helpful as students can go underneath these virtual shields and visualise the process.

4. A RECENT DEVELOPMENT - 4D INTERACTIVE LEARNING SYSTEM APPROACH - VIMINE

In the world of digital entertainment, four-dimensional (4D) interactive environments incorporating multiple simulations are common. 4D VR simulations can take participants through time to view the future outcomes of a decision – combining 3D representations of physical situations with other forms of data presentation. Increasingly, integrated simulations are being brought into professional education. The SIMPLE project in the UK [26] has developed integrated simulations for law and related disciplines. There are currently no 4D simulations that integrate professional technical simulation tools with socio-economic models for mining engineering education. ViMINE is a tool that has been developed for mining engineering students to experience various aspects of a mining operation working together, integrating several types of simulation into one environment. In scenario-based learning activities run through the ViMINE environment, students can access information from different simulations and make decisions



Fig. 4. Equipment selection simulation observed in the Truck and Shovel module.



Fig. 5. Screenshot from the Longwall Top Coal Caving module