A Collaborative Model for Developing Future Continuing Education and Training in Mining

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ABSTRACT

The Certificate in Mining Studies program at the University of British Columbia, Vancouver, Canada is a collaborative initiative between mining schools and industry to provide accessible, cost-effective, accredited continuing education and training, designed to address the future needs of the global mining community. Content is provided by industry specialists and delivered through an integration of online learning, short courses and interactive webcasts. Accreditation is provided by a network of mining schools. In 2011, the program will deliver close to 100 short courses and interactive webcasts and provide 24/7 access to more than 130 online courses in six mining streams, to participants from as far afield as Tanzania, Argentina and Mongolia. The program is proving adaptable to corporate and mine site engineer-in-training and graduate-development programs, as well as providing accessible professional development opportunities for individuals. It also provides opportunities for cross-training from other disciplines and integration with mining school curricula.

INTRODUCTION

There is a growing need for accessible, cost-effective, accredited continuing education and training (CE/T), designed to address the future needs of the global mining community. This is illustrated by forecasts of employment requirements for the Canadian mining industry (Table 1) (Mining Industry Human Resources Council (MiHR), 2010), the growth in worldwide job statistics (Figure 1), the scarcity of job candidates with appropriate mining qualifications, skills and experience, and the demand for cross-training from personnel in other industry sectors wishing to enter the mining sector (Houlding, 2008).

Mining companies are searching for accredited CE/T components that can be integrated within project training programs. At the level of the individual, it is now widely accepted that CE/T is part of the life-long learning experience. The mining industry imposes its own unique restrictions on the viability of any CE/T solution because of the sparsely distributed audience and the restrictions on travel and time away from the job.

Mining schools are hard-pressed to provide a viable solution because of the scarcity of resources and the fact that it is difficult to justify development of courses on specialised topics for classroom-sized audiences.

A COLLABORATIVE MODEL

The Certificate in Mining Studies (CMS) is a CE/T initiative that attempts to addresses many of these requirements and restrictions. The CMS was conceived by the Norman B Kievel Institute of Mining Engineering at the University of British Columbia and EduMine, the Professional Development Division of InfoMine Inc. It is a program of accredited short courses, webcasts and online courses for life-long learning in mining, developed and supported by collaboration between a network of mining schools and providers of courses on mining topics. The CMS is designed for those seeking professional development, career advancement, cross training in different disciplines, or just an introduction to mining. It is also designed to the requirements of the global mining community.

TABLE 1

<table>
<thead>
<tr>
<th>Region</th>
<th>Year</th>
<th>Change in employment</th>
<th>Replacement requirements</th>
<th>Cumulative hiring requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Retirement</td>
<td>Non-retirement</td>
</tr>
<tr>
<td>Canada</td>
<td>2010</td>
<td>-1000</td>
<td>3710</td>
<td>3980</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>3400</td>
<td>13 580</td>
<td>12 100</td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>-3500</td>
<td>32 600</td>
<td>24 050</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>-8600</td>
<td>65 290</td>
<td>43 300</td>
</tr>
</tbody>
</table>

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It minimises the need for travel and time away from the job and allows participants to complete the program in their own time.

The CMS is a blended learning program of online courses, short courses and interactive webcasts delivered by industry specialists. Participants can structure their own CMS program from a range of courses and providers to suit their career objectives and availability. So far the CMS is receiving an enthusiastic reception from the global mining community.

Certificate in Mining Studies Network
The CMS is supported by a dynamic collaborative network of course providers administered by mining schools. Current members include the following:

- The Norman B Keevil Institute of Mining Engineering at the University of British Columbia (UBC) in Vancouver BC is a founder and administrator of the CMS network. The Institute collaborates with EduMine on provision of qualifying short courses and webcasts on a broad range of mining topics. CMS certificates are awarded by the UBC Department of Continuing Education.

- The Lowell Institute for Mineral Resources at the University of Arizona in Tucson AZ is an administrator of the CMS network, and a provider of qualifying short courses and webcasts on mining topics. The Institute awards Professional Certificates from the University of Arizona.

- The Sauder School of Business at the University of British Columbia in Vancouver BC is a provider of qualifying short courses on business and management topics.

- The Learning Strategies Group at Simon Fraser University in Vancouver BC is a provider of qualifying short courses on business topics.

- EduMine is the primary provider of qualifying online courses for the CMS on a broad range of mining topics, and collaborates with UBC on provision of qualifying short courses and interactive webcasts.

Mining schools and course providers are being actively sought to join the CMS network. The primary objectives are to increase the geographical accessibility of the program to the global mining community, and to increase the number of courses and topics offered.

Certificate in Mining Studies Resources
Qualifying online courses, short courses and webcasts developed by industry specialists are available in six mining streams:

1. exploration – geology – reserves,
2. geotechnics – rock mechanics – hydrology,
3. environment – social issues – health and safety,
4. mining methods – mine planning,
5. management – risk – financial, and
6. mineralogy – mineral processing.

A CMS participant can structure their own CMS program from a range of courses within these streams, and from different providers, to suit career objectives, CMS requirements (see CMS Requirements below) and accessibility considerations. A personal CMS program may include courses from several streams and several providers.

For 2011, the CMS program includes more than 50 short courses and webcasts, and more than 130 online courses.

Certificate in Mining Studies Delivery
All study is completed remotely except for short course attendance. These are delivered by industry specialists in a number of locations, limited at the time of writing to North
American venues and mining projects like Oyu Tolgoi in Mongolia.

To increase the accessibility of the program to the global mining community, a growing number of short courses are presented in an interactive (synchronous) webcast format. Questions from the audience are delivered either verbally or in text format and responded to immediately. Webcasts are delivered as two to three-hour components on consecutive days to minimise disruption to the workplace and to increase their accessibility in different time zones.

Online courses are delivered within a low-bandwidth, browser-compatible template. The courses are based on a self-learning model that allows participants to study in their own time from any convenient location with an Internet connection. The template includes built-in online certification methodology that is accredited by both mining schools and professional associations (Houlding, 2005).

The CMS has a flexible timetable. Studying for the Certificate while continuing to meet full time job requirements will take the average participant 1 - 2 years. Some participants choose to take all of their courses in one summer allowing them to then complete the CMS within a condensed time period.

Certificate in Mining Studies Requirements
A participant must apply for registration for the CMS program with one of the collaborating mining schools. An application must include:

- current and past experiences in the mining industry,
- reasons for participating in the Certificate Program,
- perceived benefits to participant’s career and the mining industry, and
- the expected time duration to complete the program.

A participant must study and satisfactorily complete the requirements for certification in qualifying online courses totalling at least 160 hours of study content. Some of these courses will be prescribed eLearning for the selected short courses and webcasts. A participant must attend qualifying short courses and/or webcasts totalling at least nine days and satisfactorily complete the associated take-away projects.

On submission of all online course certificates, attendance certificates and project grades the participant will be awarded the CMS by the mining school with which they first registered. The total cost of the CMS, excluding travel and accommodation costs, is approximately CAD$10 000 depending on a participant’s selection of courses.

Certificate in Mining Studies Performance
In the four years since the program was initiated, 124 individuals have registered for the CMS and eight have completed the program and received certificates. The geographical spread of participants is global with 60 per cent from North America.

The following is an analysis of 42 CMS participants who enrolled in the CMS in the last 12 months. As illustrated by the case examples below, participants can be separated into three categories according to their stated objectives for joining the program:

- cross-training: individuals from other disciplines who wish to improve their career prospects within the mining industry (20/42 = 47.6 per cent),
- mining: individuals within the mining industry who wish to upgrade their current knowledge/skill levels (12/42 = 28.5 per cent), and
- finance: individuals in finance and investment who wish to improve their understanding of the mining industry (10/42 = 23.8 per cent).

The number of cross-training participants is indicative of the current shortage of mining personnel and the robust health of the mining industry relative to other industry sectors.

CASE EXAMPLES OF CAREER ADVANCEMENT IN MINING
The quotes below are from the CMS case files of individuals within the mining industry who wish to upgrade their current knowledge and skill levels. They are included to demonstrate both a need for this type of program within the mining community and how the program is being applied within this context.

Case #1 – Canada
FLL has specialised in mineral processing for the past seven years, working in gold and base metal mines, and is currently employed as a Metallurgical Engineer.

I feel that the UBC Mining Certificate could help increase my knowledge base in mineral processing, in particular with regards to mineralogy and process mineralogy. Furthermore, the finance aspect of the certificate would help me with project management and to help me to have a greater understanding of the mining industry, allowing more depth to my career portfolio and a more diverse employee for the company.

Case #2 – Australia
TN has been actively involved in the mining industry for around 16 years, holding various roles in mineral processing and extractive metallurgy.

At this stage of my career I would like to broaden my knowledge of related fields such as geology, mining engineering, and finance. My work increasingly requires an understanding of these other disciplines and I believe this course would help me understand the various factors that make for a successful mining project.

Case #3 – Canada
GB’s present position is that of ‘maintenance department shift team-leader’. With what appears to be substantial opportunity for advancement within the company and other industry players in his field of work.

The position I hold, is the beginning of what I plan to use as a continued ascent to a department head position in the maintenance field.

My goal to participate in your program is to engage in a range of studies that will provide me with an improved understanding of the various planning and operational procedures of mining that affect my work in the maintenance field. Personally, I hope to grow an understanding and empathy for my co-workers needs being brought to the table with respect to their individual departments.

Case #4 – Brazil
As a professional Mining Engineer, WL has already experienced almost every field of work in the mining industry, including Mining Supervisor, Process Engineer, Laboratory Supervisor, Quality Control and Programming Supervisor,
and Mine Planner. He is currently Technical Director of a consulting company.

After carefully browsing for adequate courses in Mining subjects, all related to continuous professional improvement, I decided to apply for the Certificate of Mining Studies at University of British Columbia.

There are some reasons why choosing this innovative approach of NBK Institute of Mining Engineering, all they clear to me.

The first one and most important to me is the flexibility. Since I live and work in Brazil, having the opportunity of online learning, using my available time to study is essential. As a Technical Director and co-owner of one of the most traditional mining consulting companies in the state of Minas Gerais, Brazil, I really do not have time to waste, and the solution presented by the CMS fits my needs like a glove.

Case #5 – Tanzania
EP has been working in the mining industry for the past six years as a mine surveyor, of which five and half years has been spent working in open pit mining and six months working in underground mining.

Study of the certificate course in mining methods – mine planning is vital because it will give me more insights about underground mining which will enable to work confidently as underground surveyor, also stand at better position to contribute on how to improve production by employing/suggesting the best mining practices.

CASE EXAMPLES OF CROSS-TRAINING FOR MINING
The quotes below are from the CMS case files of individuals from other disciplines who wish to improve their career prospects within the mining industry. They are included to demonstrate both a need for this type of program within the mining community and how the program is being applied within this context.

Case #6 – Canada
IM is a graduate of the UBC Metals and Materials Engineering program. After completion of a degree, IM worked in the manufacturing industry for almost ten years.

I have recently transitioned into the mining industry and am working at a mine as a metallurgist.

I would like to fast track my knowledge of all areas of the mining industry – starting with coursework that touches immediately upon my current work in the process plant (mostly the grinding and crushing coursework).

Case #7 – Canada
From 2006 - 2009, SB worked for a First Nation (Aboriginal) group primarily leading their community review of the permits for a mine, as well as interacting with exploration companies and government on exploration projects on traditional lands.

I enjoyed the interactions with the mining industry that I had in my last position and the people that I met and have decided to focus my career in that area. I believe my values and work ethic more closely match industry than some of the other organisations I have worked for. I believe the certificate program would help me in this endeavour.

Case #8 – Canada
TS's career to this point has exposed him to various stages of mining and the different challenges they bring from an environmental perspective. This experience has supplemented his education, a BSc in Environmental Engineering, quite well as it has touched on many different areas of engineering that he has studied.

As my interest in the environmental and social challenges of mining deepens, I find that my degree limits my knowledge of the complete cycle as well as niche areas. For example, my degree limits my area of study in the topics of geology and geochemistry, which is fundamental in the understanding of tailings treatment and rehabilitation of tailings waste. Aside from enrolling in a graduate degree, a path not practical at this point in time, I am looking for a program that allows me the flexibility to target my area of focus, work at my own pace, and ultimately complement my degree. I believe that the Certificate of Mining Studies meets this criteria.

Case #9 – Mozambique
RD has been working in mineral exploration for nine years and is now moving into a mine planning role.

Grade control is an essential part in the mineral extraction and recovery process. Understanding the process as a whole is the key for success. This course offers integrated and structured tools for an improved grade control system.

By acquiring improved more sophisticated knowledge I can be able to establish a better system for the benefit of my company. Mining industry is new in my country. Few professionals are in this area, with either lower qualifications or experience or both. Short term courses, business oriented constitute better options for those lacking time for further studying.

CASE EXAMPLES FROM MINING FINANCE AND INVESTMENT
The quotes below are from the CMS case files of individuals in finance and investment who wish to improve their understanding of the mining industry. They are included to demonstrate both a need for this type of program within the mining community and how the program is being applied within this context.

Case #10 – Canada
Over the last six years, TG's work has been focused in the resource sector, analysing companies for potential investment.

I would like to participate in the certificate program to enhance my overall knowledge of the mining sector; in particular I would like to gain further expertise in exploration and mining geology, and mining financial valuation. I feel the knowledge I will gain from the program will help build on the mining fundamentals I currently possess, and will aid in the valuations and investments in mining companies. I feel my studies will benefit the mining industry by being an engaged and knowledgeable investor in the industry, this I feel will play a role in enabling high quality and economically feasible projects to be financed in the future.
Case #11 – USA
MH has worked at a mining company in the position of Chief Financial Officer since May 2008. Developing a career in the mining industry has given him the opportunity to travel to different locations around the world and establish working relationships with a diverse group of professionals and people from different backgrounds, professions and cultures.

I am a certified public accountant by profession so my current technical knowledge in mining was mostly gained from work experience. I am attracted to the Certificate Program as it will enhance my knowledge of practices, standards, procedures and methods related to the mining industry in general and therefore help me excel in my career in the mining industry as a chief financial officer and in the future as either executive officer, mining entrepreneur and director of publicly listed mining companies. With appropriate technical knowledge and work experience I will be able to provide more value to our company, our management team, our investors, be a mentor to my subordinates and provide more value to the mining industry in general when interacting with my peers.

CERTIFICATE IN MINING STUDIES INTEGRATION WITH PROJECT TRAINING
The CMS is being integrated with training requirements on the giant Oyu Tolgoi project in Mongolia. The fact that CMS components of this training are accredited by recognised mining schools is an added benefit for project personnel. The following are extracts from the work of Caulfield (2011) that describe this integration.

The first students have begun to enrol in Canadian-developed online mining courses at the Mongolian University of Science and Technology (MUST). The online courses are part of an advanced education program that was established to provide applied training and skills development to professionals in Mongolia’s rapidly growing mining industry.

The program is a joint offering of the University of British Columbia’s Norman B Keevil Institute of Mining Engineering, Vancouver-based EduMine and MUST. The program is expected to educate hundreds of Mongolian mining professionals over the next few years. Many of them will work at the giant Oyu Tolgoi copper-gold project in the southern Gobi Desert, once the world’s largest undeveloped copper-gold porphyry project is in operation. At the end of October 2010, virtual campuses accessible through Oyu Tolgoi’s human resources department and MUST’s mining department were up and running.

EduMine, a developer and distributor of educational material for mining professionals, is a division of InfoMine Inc., an online provider of mining research and know-how.

MUST is a multidisciplinary centre of education, training and scientific research, with campuses in Ulan Bator, Mongolia’s capital, and Erdenet, a mining community. Approximately two-thirds of university-educated Mongolians have graduated from MUST.

The UBC-MUST-EduMine program has five different streams: Surface mining, underground mining, mineral processing, mining and the environment and communities and mine management and economics.

The CMS program has two parts: 160 hours of online courses that will be provided by EduMine and nine days of short courses that will be delivered primarily by UBC faculty, either at the Oyu Tolgoi site or at MUST’s campus in Ulan Bator (Figure 2).
The program allows significant flexibility regarding selection of courses. Some introductory online courses have been translated to Mongolian and translators are used for the short courses as necessary. There is a strong incentive for Mongolians to speak English and engage the rest of the world.

The cost of the program is approximately $10 000 per student. From start to finish, the course will take each student approximately eight months to complete. The first short courses are being offered in August 2011 and the first graduates are expected in the fall of 2012.

CONCLUSIONS
The CMS provides a cost-effective, innovative response to the need for CE/T in the mining industry. It has received an enthusiastic and growing reception from individuals as well as corporations within the industry, and is currently being integrated within project training programs.

It provides a platform for capture and dissemination of knowledge from a graying and shrinking generation of mining specialists. The CMS must expand its network and its course offerings in order to increase its accessibility to the global mining community and become a viable long-term solution.

REFERENCES
Mining Industry Human Resources Council (MIHR), 2010. Canadian mining industry employment and hiring forecasts 2010, MiHR report, Kanata, Canada.