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CAPTURING THE TECHNICAL HERITAGE OF EXPERTS

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ABSTRACT

The current shortage of experience and skills in the metallurgical world requires that we take special care to pass on the technical heritage of experts in the field. Some suggestions for how this can be done include online repositories of publications and lecture material, as well as audio and video recording of presentations. Where possible, short courses should be presented that provide a good summary of a particular topic that can be recorded too.

INTRODUCTION

Plato's writing about the teachings of Socrates (469 – 399 BC) provides us with one of the earliest recorded examples of someone specifically capturing and passing on the expertise of another. We can be very grateful that Plato did this; otherwise the Socratic method of teaching might have remained unknown to us. The influence of this approach is seen today in the scientific method.

Much of the knowledge of the ancient Greeks was captured in papyrus scrolls in the Library of Alexandria in Egypt from around 280 BC until a few hundred years later when it was sadly destroyed. During its existence, the Library of Alexandria was the largest library in the world. Perhaps it could be argued that its leading position came about because Alexandria dominated papyrus production – the required technology of the time. In addition to collecting ancient works, the library also hosted numerous international scholars, paid for by the Egyptian rulers. This allowed the Library of Alexandria to work towards the fulfilment of its mandate of collecting all the world's knowledge at the time. Scholars such as Euclid and Archimedes are said to have studied, written, and experimented at Alexandria.

Along with the exponential growth in the world's population in modern times, there has been an even greater exponential growth in the world's accumulated knowledge. The advent of the Internet, the World Wide Web, and search engines such as Google has made it easy to find information on almost any topic. This would have been almost unimaginable as little as twenty years ago. Open access to information is invaluable and taken for granted by many.

SKILLS SHORTAGE

Despite the rapid expansion of knowledge, there exists a shortage of skills in some important areas. In the case of the minerals or metals industry, it takes a long time to train engineers to a high degree of proficiency. At least four years of university training is typically followed by five to ten years of working experience before people are regarded as being able to contribute fully and independently to their field.

Unfortunately, the metals industry is cyclical in nature. It is common for boom times in the industry to attract students, only for them to find themselves in the midst of a depressed period by the time they are able to participate fully. People are lost to the industry during difficult times, and this makes the industry appear unattractive to prospective students.

Over a few decades, this has resulted in a situation where there is a bimodal age distribution in the industry. There are currently numerous inexperienced graduates, and many experienced people on the verge of retirement. This leaves a large gap in the intermediate age category, which is where the people should be who can pass on knowledge and skills to the next generation.

This makes it imperative to find methods of capturing and disseminating the technical heritage of experts.

HOW CAN KNOWLEDGE BE CAPTURED?

The present generation has a responsibility to pass on information of value to future generations. Individuals and organizations have a range of ways to accomplish this.

Individual

Most researchers maintain a list of references to their published papers. Newer papers are almost certainly available in electronic form, and it is fairly straightforward to get these into a standard format that is widely supported. The most widely adopted standard is the Portable Document Format (PDF). This is able to include a graphically accurate rendition of the printed page, as well as searchable text. Older papers are perhaps available only in printed form. Fortunately, it is easy to have these papers scanned into PDF files, and to subject these to Optical Character Recognition (OCR) so that searchable text can be embedded in the PDF files, thereby allowing the contents of these documents to be found by search engines such as Google.

My strong recommendation is that every technical expert should have an online list of their publications, with links to the documents themselves. This can be supplemented, as required, with additional material, such as lecture notes, presentation files, drawings, or photographs.

This does not need to wait until the end of one's career. If done early on, there can be additional benefits along the way where other researchers can find the publications online, perhaps leading to fruitful collaborations. Two examples where lists of references have been done (or are in progress) are provided in the references[1,2].

Companies

As in the case of individuals, companies can assemble the publications of their staff in electronic form and place these on the company website. This provides not only an online library, but provides a showcase for the company's work. An example of this can be seen in the website of Mintek's Pyrometallurgy Division[3] where this has been in existence since 1996.

Technical Societies

Some technical societies (including the oldest of these – the Royal Society) have made their journals available online via open access[4,5]. This makes valuable knowledge available to anyone with an Internet connection – even those in the poorest countries of the world, or those who are unemployed. Some governments now insist that the results of any state-funded research work are made available via open access publishing. For technical societies that have not outsourced the printing of their journals or who are not subject to restrictive publishing agreements, it is a simple matter to make their journal papers available on their own websites or via compilations such as OneMine.org[6].

The Southern African Institute of Mining and Metallurgy (SAIMM)[7] made their journal papers available via open access in 2007. During 2012 and 2013, the oldest of the printed journals (dating back as far as 1894) were digitised in PDF form with searchable text embedded, with the assistance of the South African Bibliographic Network (Sabinet) and a grant from the Carnegie Foundation that is intended to make a wide range of African journals available via open access.

Conference proceedings can also be made available online. This has been done by SAIMM[7], without any noticeable decrease in conference attendance. Old editions of long-running international conference series, *e.g.*, the International Ferro-Alloys Congress (Infacon)[8], or Molten Slags, would be very valuable to have as on online resource.

Technical societies also have the ability to hold short courses where a particular topic can be covered in great depth by one or more expert presenters. Written course materials can be made

available online after completion of the course. Short courses provide an ideal opportunity to further capture something of the character and personality of the presenter, if the course is recorded on video. A recent example of this was a short course by Ken Mills[9] on slag properties, arranged by SAIMM, where course notes, a spreadsheet, and video recordings are available.

Universities

Universities have traditionally presented their courses by means of lectures where the lecturers and students were physically present in the same room. Increasingly, distance education is being used to extend access to further education to a wider range of people. For example, the Massachusetts Institute of Technology (MIT) has course material for many of its courses available online free of charge[10].

It can be useful to record a course of lectures given by an experienced lecturer. This material can be prepared very inexpensively, and with little effort, simply by combining presentation slides with an audio recording. Alternatively, video recording can be done. Either way, the lecture material can be used by students in future, and can also provide a basis for the preparation of lectures by academic staff less experienced in that particular field.

CONCLUSIONS

We are living in a time when knowledge is expanding rapidly. However, it is also true that there is a shortage of skills in some key areas (pyrometallurgy, for example). Fortunately, there are readily available tools for capturing the knowledge of experts, and widely disseminating this technical heritage.

Individual professionals should be encouraged to maintain an online searchable collection of their publications. It is also beneficial for companies to have an online collection of papers written by their staff. Technical societies can make their journals and conference proceedings available via open access. The digitisation of old journals and conference proceedings is a valuable service that can be provided. Short courses by recognised experts should be held and recorded for posterity. Universities can also play their part by recording lecture materials and making these available online.

Many individuals, companies, technical societies, and universities are already actively contributing to capturing the technical heritage of experts.

REFERENCES

1. A selection of Danie Krige's publications over half a century, Compilation for APCOM 2003, SAIMM website, 2010.
   http://www.saimm.co.za/Conferences/DanieKrige/

2. Publications by David Robertson, 2013.
   http://www.pyrometallurgy.co.za/DavidRobertson/Publications.htm

3. Mintek, 2013. Pyrometallurgy Division – Technical papers and Patents.
   http://www.mintek.co.za/Pyromet/

4. Royal Society, 2011. Royal Society journal archive made permanently free to access, 26 October 2011.
   http://royalsociety.org/news/Royal-Society-journal-archive-made-permanently-free-to-access/

5. Royal Society, 2012. Royal Society Publishing, Open Access publishing, Accessed on 16 May 2012.
   http://royalsocietypublishing.org/site/authors/EXiS.xhtml

6. OneMine, 2012. OneMine – The online global mining and minerals library.
   http://www.onemine.org

7. SAIMM, 2013. Southern African Institute of Mining and Metallurgy.
   http://www.saimm.co.za

8. Infacon, 2010-2013. INFACON: International Ferro-Alloys Congress.
   http://www.pyrometallurgy.co.za/Infacon/

9. Ken Mills – Slag modelling, Misty Hills, South Africa, 7 March 2011.
   http://www.pyrometallurgy.co.za/KenMills/

10. Massachusetts Institute of Technology, MIT OpenCourseWare.
    http://ocw.mit.edu