The Impact of the Bologna Model on Mineral Processing Education: Good, Bad or Indifferent

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Introduction

The Bologna Process started in 1999 with a declaration signed by ministers from mostly the European countries. Contrary to the belief, the Process was not an EU Commission or EU Parliament initiative, it had stemmed from the countries themselves who noted the competitiveness of European universities falling behind that of the United States of America (Charlier and Croché 2008). As of 2012, the Bologna Process has 47 participating countries (EHEA 2012).

The purpose of the Process was to create a more open and uniform system and to allow movement of students between countries. It was expected that this would lead to more employability of graduates and a more competitive Europe.

Alexandre et al. (2008) point to the reasons it as to why moving to the Anglo-Saxon three tier system of Bachelors, Masters and PhD would be an improvement over the analogous continental system: graduates would enter the work force earlier, less damage from a poor first choice and more flexible progression, etc.

The need for common quality standards was always envisaged as part of the process but this aspect still requires much work (Charlier and Croché 2008). There is currently considerable criticism of the variability of standards, for example the same unit taught in one country might be

taught in far fewer contact hours. The realities are however that this is a minor point compared with the way higher education is changing as modernization of both content and learning proceeds (Caddick 2008). The days of staff/student ratios of 5.9 (in Hungary in 1990) are long gone (Pusztai and Szabó 2008).

Progress with the Bologna Process

It is clear that much progress has happened (Huisman and Van der Wende 2004) and continues but with significant challenges in some countries, see for example the progress report on Germany by Wex (2007). What is clear however is that the benefits are starting to be seen (for example, see Particio 2010).

Most importantly, there is ample evidence that students prefer Bologna Process degrees with their greater flexibility and shorter times to reach a first qualification (Portela *et al.* 2009). Despite the student preference for the Bologna Process degrees at this stage in some countries (for example, Germany), the international mobility of students was slow to increase (Finger 2007) and still remains low in some countries (Schomburg and Teissler 2011).

What is clear to date is that many benefits have been realized from the Bologna Process and that students in particular prefer the greater flexibility. This is also the anecdotal evidence of this from outside of Europe, for example Australia, where Melbourne University has adopted a similar scheme and others (for example, University of West Australia) are now following. As in Latin America and Turkey, such major changes do not come without challenges that must be overcome (Vukasovic 2011).

Impact on Mineral Processing

A survey was undertaken amongst members of the International Mineral Processing Council's Commission on Education (IMPC 2012). A letter was circulated inviting comments on how education has changed, particularly in light of the Bologna Process. There were 20 responses ranging from

summary points to several pages. The responses are available at (Mitchell 2012) and represent an excellent summary of mineral processing education in a wide range of countries.

What is clear from the responses is as Finch (2003) also noted at the XXII IMPC, that "developed countries are in the midst of re-structuring education in minerals-related disciplines". This was much in response to falling numbers for 10–15 years and the need to diversify courses to make them more attractive to students. Results in Canada and Australia reflect this trend. To this extent then, many countries that are not in fact part of the Bologna Process are indeed following the model or already had a system of bachelor, master and PhD degrees and hence notice no difference.

Similarly, countries that have changed to the Bologna model, for example, Sweden and Hungary, find little difference as they were already into five year courses and at one level have merely changed from a 2+3 to a 3+2 year system.

The recent strong growth in the industry has highlighted the shortage of mineral processing engineers and other professionals for the mining industry. Pallson (2006), who also responded to the survey, noted prophetically that in changing the mineral processing course to attract more students, the changes were effective (as in Canada), but that a major problem remains that the production and recruitment of graduates are out of sync.

One response to the out of sync demand for engineers for the industry has been the introduction of graduate training programs, either in the University as a master's degree or in some cases, largely on the job, like the part time MBA courses that have been popular for many years. Certainly at Melbourne University one finds that some of the specialist master's courses are heavily oversubscribed and have no difficulty in attracting full fee paying students.

From the survey we can then conclude that in many countries, the fall off in demand for places has driven universities to make more flexible offerings in much the same way as what is happening as a result of the Bologna

Process. Consequently, we can comment that while the roll out of the Bologna Process is seen in higher education circles as a very significant change, for mineral processing, falling student numbers over many years forced changes which just happen to fit broadly with the Bologna Process.

Conclusions

Overall, the Bologna Process has demonstrably changed higher education in many countries to allow for considerably more flexibility in course offerings.

The falling demand for places in mineral processing courses over many years however has driven changes that would have happened in any case. They are co-incident with what one is seeing in the Bologna Process in other disciplines.

Finally, while student interest has picked up in many countries, the current shortages seen in many countries (for example, Australia, China and Canada) remind us that the industry demand and the production of graduates have long been out of sync.

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Appendix

Selected comments from a range of countries

These comments reflect directions from the submissions but do not cover the depth and detail. The reader is referred to Mitchell (2012) for the wealth of detail available in the submissions.

Australia
- After years of falling numbers, demand an increase in number
- More flexible course offerings but not as comprehensive

Belgium
- Relatively few students
- Bologna simply changed a 2+3 into a 3+2 offering

Brazil
- Course structure set by State, comprehensive
- MERCOSUL area introducing its own “Bologna”
- Academic themes of some PhDs seen as limiting

Bulgaria
- Steady (small) number of graduates
- No particular changes noted

Canada
- More flexible offerings now in place in response to years of low numbers
- Still not clear if mineral processing is better in undergraduate or masters level
- French Canada with emphasis on engagement/experience with industry

China
- Pressing demand for graduates
- Particular technological demands in China (for example, grade and recovery)
- Further education needed to update knowledge of practitioners

Greece
- July 2011 directives will force changes, not clear as to extent
- Expect courses to shorten in line with Bologna

Hungary
- Mineral processing embedded in wider courses
- Implemented Bologna type system

India
- The industry not seen as attractive to students, hence low entrance levels
- Recent improvement in student numbers
- Overhaul of course curricula seen as needed

Norway
- Still on a five year masters, but this is similar to Bologna 3+2
- Student numbers again increasing

Poland
- Implemented Bologna system
- Significant numbers of students and wide ranging curricula

Russia
- Several universities teaching mineral processing
- Generally negative view of the Bologna Process but greater exposure of the students to industry seen as a benefit

Sweden
- Student numbers now increasing
- Still on a five year masters, but this is similar to Bologna 3+2

Turkey
- Mineral processing taught at masters level
- Strong demand for graduates

USA
- Traditional four year course still going strong
- Research funding harder to find so links between research and teaching more tenuous