

A detailed illustration of the Nativity scene. The Virgin Mary is seated in the center, holding the infant Jesus who is surrounded by a bright, glowing halo. To the left, Joseph stands with a staff, and two shepherds are kneeling in prayer. To the right, two angels are also kneeling. In the foreground, two sheep are resting on the ground. The scene is set in a stable with a star visible in the sky above the manger. The artist's signature 'Zandini' is visible in the bottom left corner of the illustration.

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# Quality Systems Education within University Science

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## ABSTRACT

*Increasing emphasis on quality management in industries employing university science graduates necessitates integration of quality systems education into science curricula. This includes undergraduate, honours and postgraduate curricula. In the Australian academic system, the latter two focus almost exclusively on research, and comprise the numerical minority of overall university leavers. However, all graduates are likely to interact with quality systems during their career; hence effective general knowledge of such systems is desirable. Few academic programs offer quality systems-based education except where such education forms a required component of accredited programs (pharmacy, food technology, food safety, etc.) Hence, a large proportion of current practical quality systems education either occurs on-the-job, or via external quality training coursework and/or certification programs.*

*Many students misperceive quality systems (and hence employment) as "box-ticking." Additionally, the myriad real-world, often discipline-specific, regulatory and certification bodies can be daunting. In order to provide university graduates capability to "hit the ground running" regarding scope and utility of quality systems to utilisation of experienced, external quality systems guest lecturers and contextual placement of quality systems is recommended. Suggestions and challenges regarding bioanalytical and environmental quality systems content within selected university science curricula are presented.*

## CONTEMPORARY QUALITY SYSTEMS EDUCATION

Australian university graduates in most subject areas will eventually be required to interact with quality systems as part of their employment. This may occur in several ways; as product or service end-users, as employees whose tasks include quality assurance and/or control functions, or as quality system managers. This is particularly the case for university graduates in the technical sciences, such as natural resources, mathematics and life sciences. Such graduates may be employed in such critical areas as health care, laboratory services, food safety, environmental health/management, critical large-scale modelling, etc, in which quality management is a common and critical component. The

engineering disciplines should also be included here. However, for the purposes of this paper, discussion will be limited primarily to the life and natural resource sciences.

Despite an increasing emphasis on quality (and associated risk) management in both public and private sectors, as well as increasing employment opportunities in these areas, there are no common or widespread university quality systems curricula. Exceptions include externally-accredited degree programs leading to certified/licensed graduates that specifically require quality system curricula (food safety, food technology, pharmacy, medical technology, etc.) However, for the majority of technical science areas, quality systems education is commonly provided via post-graduation, non-university-based instruction in the form of short courses or on-the-job training. Given the variety of quality management system technical areas, and the frequent, often industry-, or site-specific, requirement for specialised training in each, such education is unlikely to be wholly replaced by university academic coursework. And given the largely limited real-world experience of most university science academics outside academia, such practical extra-university quality system training in critical risk areas may be warranted. However, as most quality systems managers and lead auditors recognise, knowledge of general quality management principles provides the foundation on which specific quality system and technical knowledge can be most effectively utilised. University would seem an ideal place to provide such a foundation. This paper presents the author's impressions on where quality systems education currently

sits within the current Australian university science educational environment, and presents a discussion of potential schemes to foster a broader understanding of such systems in graduates; some of whom will become future quality system managers.

### QUALITY SYSTEMS EDUCATION AT UNIVERSITY

A primary function of university science education is provision of "foundation" technical and critical thinking capabilities for subsequent study employment and/or study. Considering undergraduate students undertake studies progressively-focused on their respective technical areas from the second year onward, provision of education in quality systems in general, and optimally associated with the specific technical area, at this time would appear optimal. While perhaps obvious, a basic understanding of the Australian university academic environment can provide critical context for those considering integration of quality systems education into university curricula.

### PERCEPTIONS OF "QUALITY"

As many in quality management professionals recognise, the term "quality" is used what I might term "promiscuously." One such example was in transit in a SE Asian capital wherein I saw an establishment of somewhat dubious moral rectitude advertising, "Qualtee Entatanment". Several quality management system issues came to mind, including accreditation, QMP, SOPs, scope, and the technical assessors required. While those associated with quality management recognise the profligate use of a term which, to them, has a specific meaning, they also recognise the wide spectrum in what can be (and is) labelled "quality". Indeed, "quality" is often used as a synonym and brand label of "excellence". Give me \$5 and an hour in an Australian CBD and I will purchase something labelled "quality" that lacks either excellence or quality. At a higher level, anyone unfortunate enough to deal negatively with ISO9000-accredited-company outsourced customer support knows what I'm talking about. It is within this context we should first consider perceptions of quality of university students.

My experience is students perceive the term "quality" as described above; as a label or adjective/adverb rather than the end-goal of a systematic approach to assuring safety and/or consistency and/or performance. Additionally, many science students respectively associate the terms

"quality assurance"/"quality control" and "audit" with either, a) humourless, clipboard-wielding drones of severe-constitution whose objective is creation of annoying busy-work, or b) something negative associated with taxation authorities. In my experience, exceptions are often students with employment experience in supermarkets (largely food safety and stock QA) or production facilities. However, the majority of students have only a vague knowledge of quality systems in the real world, and less regarding their breadth of application, operation, scope and utility.

For those actively involved in quality systems and their management it is worthwhile to step-back and recall the cumulative amount of knowledge required to become skilled in a particular system. Students of even one quality management system are frequently faced with a daunting alphabet soup of abbreviations, acronyms, agencies, regulations and stakeholders, to say nothing of jargon and standard quality system terminology. Many find even the distinction between quality control and assurance conceptually difficult. This is not assisted by the frequent perception of quality management as on-par with accounting for excitement. Overcoming these factors is crucial to stimulating interest in quality issue and management. I suggest presentation of specific quality management system terminology is essential. However, regulatory agencies, certification authorities and associated regulations may be best presented in gradually where possible, and optimally in an applied context.

One approach I have used to stimulate interest concerns career advancement. Many life science undergraduates obtain employment as laboratory technicians or assistants directly out of university. I suggest quality assurance as a route to advancement within such laboratories and development of generic quality management skills as helpful for career progression within a variety of industries.

### UNIVERSITY STUDENT DIVERSITY

Australian university students comprise two basic cohorts, undergraduates (BSc and Honours) and postgraduates (MSc and PhD). A variety of other degree options such as graduate diplomas (GradDip) exist as well. Undergraduate (BSc, typically 3 years) studies focus on development of technical and theoretical capabilities within the chosen discipline/degree. A majority of Australian university BSc graduates do not subsequently pursue science-related careers. Honours (one year) and postgraduate studies (MSc 1-2 years, PhD 3 years) focus almost exclusively on laboratory and/or literature research, and a larger proportion subsequently



pursue technical science careers and employment. Disciplines may include biotechnology, environmental science, medical science, pharmacy, biochemistry, geology, microbiology, chemistry, mathematical sciences, ecology, physics, etc. and combine disciplines as co-majors within conferred BSc degrees. This diversity reflects that of potential fields of employment, in which industry-specific quality management system knowledge will be required. Thus, it may prove most effective for education regarding associated quality systems to be incorporated as discipline-specific educational components or modules rather than specific quality system units and/or courses. An environmental science graduate starting out at an ISO14001-accredited hazardous waste management facility does not require the in-depth knowledge of Good Manufacturing Practices (GMP) of a biochemistry graduate at a cosmetics production facility and visa versa. Perhaps most effective within BSc programs is description of associated quality systems during presentation of real-world discipline application to provide context.

Additional education is warranted as part of postgraduate research programs. As an example, running of experimental controls is commonly confused with overall quality assurance. It is not uncommon for those working in quality management who have completed research-based postgraduate science degrees to reflect critically on quality assurance during their postgraduate work. As Australian honours and postgraduate students do not generally take classroom-based coursework, this necessitates delivery of specific quality-system-and-assurance-based content to these cohorts. This may be most effectively presented in the form of short courses, workshops or modules.

#### **UNIVERSITY STAFF**

In order to provide instruction in a way most effective for promoting real-world practical skills development, academic staff capabilities should reflect such skills. Where such practical experience is limited, employment of skilled internal or external professional staff, or generation/review of teaching materials by same is recommended. Student engagement with those working with the specific quality management system related to the area of study demonstrates not only direct application of theory, but also the nature of employment in quality management.

Considering the expanding use of emerging electronic modes of delivery of educational materials, and potential time-constraints between external and academic schedules, creation of recorded and/or web-based media content is also suggested.

#### **UNIVERSITY QUALITY SYSTEMS EDUCATION GOALS**

Provision of effective quality systems knowledge to assist university science students to place their sub-discipline and its subsequent practical application in a quality management context is desirable. Optimally, this will counter the negative “bean counter” stereotype indicated above, and foster an appreciation of the benefits of quality management.

Graduate capabilities should include:

- a basic knowledge of quality systems in technology-based industries
- a basic understanding of risk management in a quality management context
- identification of major respective industry stakeholders and regulatory and/or certification authorities
- the ability to recognise, and effectively integrate within, existing quality systems

Put simply, graduates should be capable of recognising quality systems and their utility in the workplace, whether production or research. They should be able to integrate quality assurance principles in their day to day work, and potentially manage quality systems when appropriate.

#### **CONCLUDING REMARKS**

It is my impression that knowledge of quality assurance principles and management adds generic value to university graduates in the applied technical sciences. Such capabilities present a valuable set of skills which often transcend discipline-specific boundaries. As such they may provide science graduates with a greater opportunity for career mobility both within and without science-based employment. Both technology-, and non-technology-based businesses need such skilled employees.

It will also hopefully foster a healthy sense of the place of quality systems in general, and the critical role they play in an increasingly integrated and technologically-advanced global environment.

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