

Providing an authentic experience of laboratory accreditation processes in a final year microbiology unit



Michael Phillips

School of Science and Health
Western Sydney University
Richmond Campus
NSW 2753, Australia
Tel: +61 2 4570 1315
Email:
m.phillips@westernsydney.edu.au



Julie Markham

School of Science and Health
Western Sydney University
Richmond Campus
NSW 2753, Australia

The value of gaining industry experience during undergraduate degrees is well recognised^{1,2} and there is much interest currently in the concept of work-integrated learning (WIL)^{3,4}. Industry experience equips graduates with job-ready skills, but university staff have reported that time, resources, and availability of industry places are obstacles in setting up placements for students^{3,5}. An alternative approach is to provide a 'real-world' learning experience within the university. In this paper we will describe an example of an 'authentic' learning experience that familiarises students with the procedures involved in laboratory accreditation, and enables students to develop skills that address issues identified by employers during recruitment. These issues include lack of team work, communication, understanding how industry 'does business', and lack of practical experience and laboratory skills^{2,6}. Laboratory Quality Management (LQM) is a final year unit at Western Sydney University that addresses some of these issues.

LQM is a laboratory based unit that has been running for over 25 years in cooperation with the National Association of Testing Authorities (NATA), initially with two cohorts, chemistry and microbiology, and more recently with a third, forensic science. Within each discipline, student groups of 6–10 set up a mock testing laboratory and choose one analysis to undertake. The most common tests chosen by students are for indicator organisms such as *E. coli* and specific pathogens in food, indicator organisms in water samples, sterility testing and bioassays of antimicrobials. Students then develop, document and operate a laboratory quality management

system for their testing method and for the organisation as a whole. The documentation is consolidated in a laboratory quality manual that conforms to the requirements of ISO 17025⁷ and the NATA guidelines for different types of testing laboratories⁸. This process requires effective team work, organisation, communication and higher order thinking relevant to the techniques and their primary purpose.

Apart from two introductory lectures, including one from NATA, the unit is run as laboratory sessions. The aim is to have the groups operate as autonomously as possible and to emphasise the need for critical thinking and problem solving within the group. The role of the laboratory supervisor is to facilitate the groups to organise and run themselves. In the first weeks the students are given ISO 17025, NATA resources and worksheets that aid in the preparation of the quality manual. The laboratory technique chosen needs to engage several students and be reasonably challenging; however, it does not need to be complex or technically difficult as NATA assesses the ability to complete the test as documented, not its degree of difficulty. Once the groups have decided on a test they are responsible for making their own media, solutions, buffers and determining how test material is handled and sampled. The process of perfecting the technical skills needed to complete one assay from start to finish, week to week, is a novelty, and challenging for some students. As the classes are held weekly, the group needs to organise how subcultures and analyses can be undertaken out of class time. This requires good planning and communication with both laboratory staff and each other. Normally the groups spend the first few weeks concentrating on the laboratory work and then, with the

supervisor's encouragement, begin to focus on quality management and the preparation of the manual. While supervisors provide encouragement and discuss the process, this can be a period of adjustment for some students as they adapt to the need for independent decision making. However, as the need to prepare a quality management system is addressed, the uncertainty dissipates.

A critical component of the unit is the involvement of NATA as an expert body on industry standards. The assessment of the manual and the assessor's audit of the student group follow a streamlined version of the actual procedures used by NATA when accrediting laboratories. The students recognise that this represents the 'real world' and it makes the whole experience more meaningful. The manual is submitted three weeks prior to the last lab session so that when the auditors, scientists who are employed by NATA to accredit laboratories, meet with each group, they can provide feedback on the document, as well as observing the groups' technical proficiency and ability to follow the documented test procedure (Figure 1). The assessor sends the group a list of corrective actions and the revised manual is then marked by NATA (40% of the unit mark). The remaining marks are individual and based on an oral exam, peer assessment and each student's contribution to the manual and group.

Most groups work harmoniously, but disagreements often occur. While this is monitored by supervisors, it is up to the group to resolve the issues and produce a manual on time; the supervisor only

intervenes if the disagreements become acrimonious. Interestingly, internal disagreement can lead to productive discussion within a group and these groups have often received high marks from NATA, while other groups lacking a critical dynamic have not performed as well as could be expected. Previously much conflict has arisen from poor communication and this seems to have diminished in recent years with the adoption of social networking as a means of communication within groups.

The fact that the procedures used by NATA follow their normal protocols means the students are confident that this is a real world experience and that they understand the documentation and levels of quality management expected when they enter the workforce. Students respond to this challenge and the unit typically scores well over 90% agreement in student feedback for questions such as 'I was able to see the relevance of this unit to my course' and 'I've had a satisfactory learning experience in this unit.' Similarly, when informally discussing the unit following the oral exam, many students say that this was the best unit they undertook in their degree. Typically students cite the benefits of self-directed activities and learning, freedom to choose the test system, relevance of the unit to the work environment, opportunity to do co-operative work in a meaningful way, and the clear goal-oriented nature of the class as reasons why they like this unit.

Anecdotal information received from past students indicates that this unit is recognised by employers as very desirable, with some students suggesting this was critical in successfully gaining a job. Several have reported subsequently being involved in updating manuals in their workplace or, in some cases, preparing laboratory quality manuals from scratch for their new employers. While most university subjects have little distinctive impact on prospective employers, IQM and its connection with NATA is readily identifiable as an indication that the students have the practical skills and knowledge necessary for working within a quality and standards based framework, and this facilitates transition to the workplace.



Figure 1. Lyndon Thomas from NATA assesses Microbiology students.

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Biographies

Dr Michael Phillips is a lecturer in the School of Science and Health at Western Sydney University. Since joining the teaching staff in 2007 he has taught a variety of microbiology units including Laboratory Quality Management. He has been the subject coordinator for the past four years.

Julie Markham is a lecturer and Academic Course Advisor for the Bachelor of Medical Science degree at Western Sydney University. She has taught microbiology at the tertiary level for more than 25 years and has extensive experience in curriculum design and course development.



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