Essay

Asia-Pacific Journal of Cooperative Education

Student and Employer Reflections of an International Science and Technology Work Placement

Stuart Beard
Department of Chemistry, The University of Surrey, Guildford, Surrey GU2 5XH, United Kingdom

Richard K. Coll*
Cooperative Education Unit, School of Science and Technology, The University of Waikato, Private Bag 3105, Hamilton, New Zealand

Jon Harris
Environmental Section, RJ Hill Laboratories Private Bag 3201, Hamilton, New Zealand

Received 15 April 2001; accepted 2 May 2001

In this paper we describe student and employer reflections of an English student's work placement at a New Zealand analytical chemistry laboratory. The reflections are presented in the form of narratives in which the authors examine student and employer perceptions of the critical factors that they believe led to a successful international placement. The paper seeks to establish what led to this success and to examine what makes for a credible employer of international students; that is, an employer that provides an environment in which the student achieves personal and professional growth. The authors propose that enhancement of professional and personal growth for the student occurred as a result of student-employer negotiated placement objectives and on-going support during the placement. The principal benefit for the employer was found to be access to a continuing supply of local graduates as a result of employer support for the University's cooperative education program *(Asia-Pacific Journal of Cooperative Education, 2001, 2(1), 6-10)*.

Keywords: placement purpose; placement objectives; professional growth; personal growth; credible employer

The context for this paper is an exchange arrangement between the University of Surrey in Guildford, England and the University of Waikato in Hamilton, New Zealand. The placement experience reported refers to a Surrey student's (the second author) BSc(Hons) placement in New Zealand, working at New Zealand's premier analytical service laboratory, RJ Hill Laboratories. The BSc(Hons) program at Surrey comprises a four-year sandwich degree in which students complete a single 12-month sandwich placement between the second and fourth years of the degree (Figure 1). The placement began in June 2000 and represented a significant challenge for the student, as it was the first time he had been overseas other than for vacations in Europe. However, the experience also afforded the opportunity for personal and professional growth. In this paper we report the second author's reflections of his placement along with the employer's (the third author) views on advantages of this exchange arrangement. The perceptions are reported in the form of narratives in the first person. In this paper the authors describe their understanding of what measures they believe aided the student's personal and professional growth during his placement, and seek to develop an understanding of what employer actions led to its success: in other words what factors result in a credible employer of international students.

Context of the Placement

RJ Hill Laboratories is a privately owned commercial organization that consists of a modern analytical service laboratory situated in Hamilton, New Zealand. The Company is owned and managed by its senior analytical staff and was established in 1984 to serve the needs of local agricultural and horticultural industries. Hamilton is an important agricultural area, being the New Zealand center for the dairying industry. Hill Laboratories began with limited resources, other than staff expertise.

*Author for correspondence: *Dr Richard K. Coll*, email r.coll@waikao.ac.nz

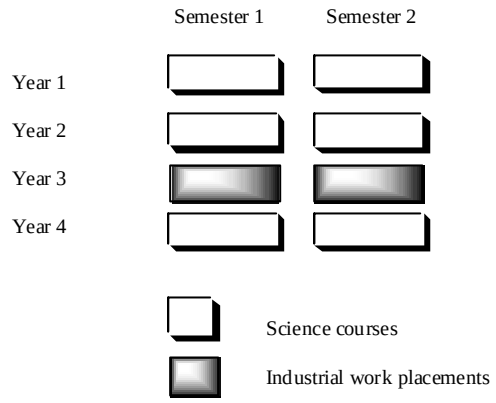

Figure 1
The structure of the BSc(Hons) degree at the University of Surrey

The Company experienced rapid growth in the late 1980s and through the 1990s. This growth was due to a number of factors, one being the implementation of environmental legislation; specifically, the New Zealand Resource Management Act (1991). This legislation requires organizations to conduct their business in an environmentally responsible manner and there are severe penalties to those who fail to satisfy the Act. This coupled with considerable investment in state of the art analytical instrumentation and a strong customer focus resulted in a rapid expansion. The Laboratory now employs close to 100 staff and hosts a variety of sophisticated instruments. Most staff, other than administrative staff, hold tertiary science or chemistry qualifications, with senior staff typically qualified to the doctoral level. The Company also employs a fulltime computer programmer and quality control manager.

Hill Laboratories principal function is to provide high quality analytical data to clients in as short a time as possible. In many cases, rapid turn-around of samples is more important than the cost of the service. The Company provides a purely testing service, and does not, for example, become involved in consultancy, or the interpretation of analytical data. Hill's provides service for clients all over New Zealand, Australia and throughout the Pacific Islands. Clients include, Regional and District Councils (i.e., local government authorities), commercial organizations, agricultural and horticultural consultants, fertilizer companies and members of the public.

The Company seeks to ensure the integrity of the data outputs. Senior staff monitor all analytical data, and the analytical procedures routinely involve the use of a variety of control standards, the details of which vary depending on the sample matrix and particular technique. This is no trivial task, since commonly the analyst does not know, other than in a general sense, what the actual value of the analytical result should be. This problem is particularly important for environmental samples, which routinely involve analyses at the parts per million (ppm) and parts per billion (ppb) levels. The Laboratory holds New Zealand accreditation and consequently is required to have an extensive system of checks and balances and appropriate documentation covering all aspects of their operation. The majority of the testing procedures conform to the *US Environmental Protection Agency* and *American Public Health Organization Guidelines* as set out in the *Standard Methods for the Treatment of Water and Waste Water*. Quality control also means that Hill's have *Standard Operating Procedures* (SOP) for every test that they perform; these procedures are documented in manuals that must be read and used by all staff that conduct the tests and the procedures are updated regularly.

The Company management structure is based on eight main sections; *Administration*, *Sample Reception*, *Trace Elements*, *Environmental (General)*, *Organics*, *Food & Industrial*, *Soil & Plant*, and *Non-Routine*. The placement occurred in the Environmental Section, under the guidance of the Section Manager (the third author).

Placement Purpose and Employer Expectations

In this section, the second author describes the employer's work requirements, and in subsequent sections describes the setting of placement objectives and reflects on his professional and personal growth. The specific tasks associated with the placement are detailed in Table 1

My involvement in the Environmental Section clearly involved a multitude of tasks, of varying levels of difficulty/complexity. It is important to remember that Hills is a commercial organization with commitments to customer service. Naturally, the student must come up to speed with

Table 1
Tasks required for the work placement at RJ Hill Laboratories

1	Operation of Flow Injection Analyser (FIA) including reagent preparation, work sheet preparation, sample preparation, data work up, and preparation of standards
2	Operation of Ion Chromatography (IC)
3	Equipment maintenance
4	Total phosphorus analysis
5	Hexavalent chromium analysis
6	Cyanide testing
7	Biological Oxygen Demand (BOD) both total, and carbonaceous BOD
8	Sample storage and monitoring
9	Turbidity determination
10	Special project work, e.g., ensuring current testing procedures meet compliance standards

these tasks quickly. Tasks 1, 2 and 3 (Table 1) comprised the use of leading-edge analytical techniques; FIA in particular, being a continuous process that ensures rapid turn-around of samples. The remaining tasks constitute more conventional 'wet bench' chemistry techniques. These tasks represented employer expectations for my placement at Hills and I was expected to show proficiency in all tasks.

Negotiation of Placement Objectives

The exchange program offers many potential benefits to the student. From the students' perspective the primary aim is to provide 12 months of industrial training, something deemed to enhance employment prospects upon graduation. However, the employer has clear expectations for the placement; in this instance the completion of the tasks detailed in Table 1. As a student in a cooperative education program I sought to gain technical and soft skills that would be desired by employers. Previous research has established that employers seek 'hard' practical skills, but in addition, communication and interpersonal skills; what are sometimes referred to as 'soft' skills (Birkett, 1993; Burchell, Hodges, & Rainsbury, 1999; Rainsbury, Burchell, & Hodges, 2000).

As a consequence, I negotiated with Hill's a series of objectives for my placement (Table 2). Since these objectives were negotiated with my employer; they represent a synthesis of employer (i.e., as detailed in Table 1) and student objectives for the work placement. Other student objectives included the opportunity to gain financial remuneration, and non-work related benefits such as gaining knowledge of a different country and culture.

Reflection and Self-Assessment of Placement Objectives

From my work at Hill's I gained expertise in two modern analytical chemistry techniques, namely, FIA and IC as detailed above. These techniques are widely used in industry and thus are important skills for me to gain. It took me some time to understand and gain competency in these methods of analysis, but after nine months I now feel confident in my work and can work unsupervised. I also gained detailed knowledge of general laboratory skills and, specifically, gained an appreciation of the awareness for accuracy and self-assessment/criticism of my own work. It has become clear to me the importance of the use of SOPs for analytical chemistry techniques. Lack of adherence to SOPs (e.g., taking short cuts to save time, mixing up samples) can lead to spurious results causing additional cost to the Company and potential harm to customers.

Training at Hill's is rigorous and the Company expects students, like other staff, to perform analytical procedures independently. Once trained, I was afforded the freedom of performing complex tasks on my own, and quickly learned to be critical of my own work; inspecting my data, and assessing the veracity of the analytical results I produced. The key skill gained was knowing when to exercise my own initiative, and knowing when I needed to seek expert advice and help.

The visit to me whilst on placement by my University Supervisors provided an opportunity to describe my work in a formal setting to an expert and critical audience. Whilst for me personally this represented a daunting prospect, it enabled me to continually monitor and conduct a self-assessment of my own progress and performance with regard to communication skills. There will be further opportunities of this nature and I expect to continue to improve in this regard. In addition, I was expected to interact with a variety of staff in the laboratory, and to initiate communication when required. Staff at Hill's work in a highly collaborative environment, and this has been a most pleasing aspect of the placement, further enhancing my interpersonal skills.

Partaking in an international placement is very different to staying at home, in a familiar, non-threatening, environment. Indeed, it is a case of the student entering into the unknown: I left England, traveled across the World, joined a skilled labor force in an internationally accredited analytical chemistry laboratory. This represented a formidable challenge for me, but I feel that the fact that I undertook an international placement greatly increased my self-confidence. My employer has found my work to be of an acceptable standard, and I have made new friends and entered into a different environment and culture to my own. This has led to significant personal growth for me in these areas. Having faced many challenges, I now feel confident about risk taking, knowing that I can meet and overcome a variety of challenges.

Table 2
Placement objectives identified at the beginning of the placement

Enhancement of Technical Skills	
1.	Gain experience in conventional 'wet bench' chemistry procedures
2.	Gain experience in instrumental methods of analysis, specifically Flow Injection Analysis (FIA) and Ion Chromatography (IC)
3.	Development of knowledge of the analytical chemical industry
Enhancement of Soft Skills	
1.	Enhance interpersonal communication skills
2.	Career clarification
3.	Development of independent working habits
4.	Enhancement of self confidence

The work placement also enabled me to 'test the waters' in the career path for which I am embarking. Prior to this I had little idea of what was involved in becoming a career analytical chemist. Working in a modern analytical chemistry laboratory, alongside professionals and experts, provided me with an excellent overview of this career. This will enable me to make an educated choice regarding my future career options. Although the work undertaken at Hill Laboratories is specific to the analytical chemistry industry, the technical tasks undertaken on a daily basis are wide ranging, and applicable to a variety of other commercial organizations. As a result of my placement experience, I have learned traditional chemistry techniques and become competent in the operation, including maintenance, of instruments, data work up, and general operating procedures. This experience means I now feel I can convince prospective employers that I have useful skills.

As well as setting and achieving placement objectives described above, there were several purely logistical factors (both good and bad) that I found influenced the placement success; these related to timing of placements and some issues relating to student support while on placement. The starting date for English students at Hills has over a number of years gradually crept back earlier and earlier, so that there is now little time for preparation prior to departure for New Zealand. In my case, this resulted in being left with some 10 days between examinations and departure. Clearly this places some stress on the individual as there are many issues needing attention in a comparatively short space of time. A further complication is that the arrival date no longer coincides with the beginning of the New Zealand academic year. This makes securing appropriate rental accommodation more problematic.

Being met at the airport was much appreciated and did much to reduce the stress of arriving in a new country a long way from home. It would also be beneficial if on the day of arrival the previous/current Surrey student could be freed up from work to help settling in. It was useful to go directly to the Company and to meet co-workers, but waiting for staff to finish the days work before helping out was not ideal.

The Employers' Views of the International Placement Exchange Program

In this section the third author offers his reflections of the benefits of the international exchange program from the Company's point of view.

There are a number of important reasons why Hill Laboratories has been an enthusiastic participant in the student placement program between Waikato and Surrey Universities. An overlying consideration is the relationship or alliance with Waikato University: this is an important factor for our company, both through the supply of well trained staff and the availability of a tertiary research center close to the laboratory. It is to the Company's benefit to participate in student placements as it contributes to the training of chemistry students and provides them with the requisite practical work experience. If commercial organizations fail to take on students, the University would not be able to continue with the cooperative education program, closing off a potential source of staff recruitment. This issue is of considerable concern given the recent drop-off in numbers of science students in New Zealand and worldwide (Coll, 1996).

Involvement in cooperative education programs gives the Company the opportunity to be closely involved in the training of potential new staff. Clearly, for the international exchange program described here, the last reason does not apply (although Surrey students potentially can secure New Zealand residency and subsequently work for the Company). There are, however, other advantages. First, international placements enable permanent local staff to interact with someone from a different cultural background. This is seen as a valuable part of the personal development of the staff, which is seen as part of the responsibility of the Company. It also puts the responsibility on the staff to receive and socially support the lonely immigrant from across the world.

From a purely pragmatic point of view, the employment of international students enables the Company to fill employment needs at a time of year that it is traditionally difficult to find staff. These students become full staff members; albeit for a fixed amount of time. They are expected to perform, and the Company was instrumental in the setting of placement objectives detailed in Table 1 and 2. We expect international students to meet these objectives and quickly develop specific technical skills in the use of analytical procedures and in instrumental methods.

Increasing globalization brings New Zealand into close contact with the rest of the World. Participating in this program has helped prepare the Company to face the challenges of global markets, with regard to recruitment as well as new product and customer opportunities. Our experience with students from the University of Surrey has been very good. They are well trained, fast learning and very committed to perform. Considering the position they are placed in, a totally new environment with different values and views, they have performed very well. They have made a valuable contribution to the laboratory as skilled technicians; they have worked hard, sometimes under considerable stress. However, they have continued to produce high quality analytical data and have proven flexible and willing to help out colleagues in busy times.

Finally, the student's placement report provides an opportunity to look at the Company from a different viewpoint. Consequently, the placement objectives detailed above serve to satisfy the needs of both employer and student. It is this holistic approach to employment adopted by Hill Laboratories, along with the setting of clear placement objectives, that we believe contributes to the success of the international exchange arrangement.

Implications for other Practitioners

This paper has examined student and employer reflections of an international cooperative education exchange arrangement between a New Zealand and an English university. A previous large-scale study focused on practical issues of importance to international cooperative

education programs (Coll, 1998; Coll & Chapman, 1999, in press). It identified several factors that cause students most stress. Chief amongst those were matters relating to immigration; for example, securing a work permit in time. Other issues included the importance of rapid enculturation into work and social environments. These practical steps do much to smooth the placement process and reduce complications due to, for example, homesickness. However, they do not necessarily lead to a successful placement, especially from the students' perspective. The authors believe that the negotiation and mutual agreement on placement objectives early in the placement is crucial. This is a major contribution the employer can make, and what ultimately results in a credible employer; an employer that provides an environment in which the student achieves professional and personal growth. The present paper contributes to the literature by providing a deeper understanding of the challenges students may confront when they are on placements outside their own country. Whilst these issues are specific to the context in which the placement was conducted, the study provides an insight into the sorts of problems students may encounter in these settings. The employer had clear expectations and motives for the placement; namely, the successful completion of specific tasks, development of specific skills in procedures or use of specific instrumentation. In addition, the employer expected to see a rapid increase of skill in the use of instrumentation, and to see this skill result in an independent worker. Refinement was necessary as the needs of the employer changed due to, for example, commercial pressures. Furthermore, the employer had an expectation that the student would be able to interact appropriately with a wide variety of staff and quickly develop good interpersonal skills. As the student developed skills in some areas, experience and reflection revealed other areas requiring improvement, which were then targeted for remedial action. This process of setting objectives, and constructive, timely feedback, proved to be the key to personal and professional growth, and ultimately a highly successful international placement.

References

Birkett, W.P. (1993). *Competency based standards for professional accountants in Australia and New Zealand*. Sydney: Australian Society of Certified Practicing Accountants.

Burchell, N., Hodges, D., & Rainsbury, L. (1999). What competencies does the workplace expect for business graduates? Some perspectives of the top 50 companies in New Zealand. In D. Hodges & C. Eames (Eds.), *Proceedings of the Third Annual Conference of the New Zealand Association for Cooperative Education* (pp. 1-12). Rotorua, New Zealand: New Zealand Association for Cooperative Education.

Coll, R.K. (1996). The BSc(Technology) degree: Responding to the challenges of the education marketplace. *Journal of Cooperative Education, 32*(1), 29-35.

Coll, R.K. (1998). International cooperative education placements: Benefits and barriers. *Proceedings of the Fourth Asia-Pacific Conference on Cooperative Education* (pp. 8). Hong Kong: World Association for Cooperative Education.

Coll, R.K., & Chapman, R. (1999, July). *International cooperative education placements: Benefits and barriers*. Paper presented at the 11th world conference on cooperative education. Washington, DC.

Coll, R.K., & Chapman, R. (in press). Advantages and disadvantages of international co-op placements: The students' perspective. *Journal of Cooperative Education*.

New Zealand Resource Management Act (1991). Wellington, New Zealand: Government Printer.

Rainsbury E., Burchell, N., & Hodges, D. (2000). Workplace requirements in the third millennium: Business students and graduates' perspectives on the desirable competencies. In L. Finch (Ed.), *Proceedings of the Second Annual Conference of the New Zealand Association for Cooperative Education* (pp. 13-22). Rotorua, New Zealand: New Zealand Association for Cooperative Education.