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In 2006 the Wellington Summer of Code was brought to life engaging ICT undergraduates with innovative Wellington employers, it has developed into a thriving talent pipeline engaging all levels of tertiary students and industry in the Wellington region. Summer of Code engages students during term time through industry led learning and a summer seminar and workshop series that are open to all. It has worked with the NZCS to integrate the Evening with Industry where undergraduates see young IT professionals starting their careers discussing the move from academia to the real world. Through Summer of Code ~70% of students are retained in full or part time employment and ICT career opportunities explored. In 2010 Summer of Code evolved to the Summer of Technology by incorporating engineering, design and business analysis and the scheme provides a template for other centres in New Zealand. This paper explores the success of Summer of Code, its engagement models, curriculum aspects and the potential for the future.

Keywords | *Information and computing technology, ICT, undergraduates, work experience, employers, New Zealand, Information technology, IT professionals.*

Introduction

In 2005 the Wellington Summer of Code was brought to life engaging ICT undergraduates with innovative Wellington employers. Since then it has developed into a thriving talent pipeline engaging all levels of tertiary students and providers in the Wellington region with over 150 students contending to be part of the Summer of Code working with over a score of innovative companies in a cooperative internship scheme.

Summer of Code engages the students during term time through industry led learning delivered through the year and a summer seminar and workshop series that are open to all. It has also worked with the NZCS to develop the Evening with Industry where undergraduates see young IT professionals starting their careers and discuss the move from academia to the real world using professional tools such as the Skills Framework for the Information Age (SFIA+, 2010). The programme has achieved success with around 70% of students retained in full or part time employment, new products have been developed and ICT career opportunities have been explored.

The Summer of Code evolved to the Summer of Technology in 2010 incorporating more than just code development and the Internet industry segments by including engineering, design and business analysis. The scheme provides a template for other centres in New Zealand and a model for future growth and innovation that is essential for the development of the ICT industry. This paper explores the success of Summer of Code, its evolution to Summer of Technology, its engagement models, which includes bootcamps, seminars and workshops, and finally the potential for the future.

The paper is structured as follows: a brief history is provided followed by a discussion of the engagement model with industry; the integration of Summer of Technology into the curriculum is explored in the larger context of professional practice in the Bachelor of Engineering; the paper then explores the future direction for Summer of Technology.

A short history: from Summer of Code to Summer of Technology

The Summer of Code and now Summer of Technology is predominantly a cooperative scheme based largely on voluntary contributions from many people in industry and academia (Summer of Code, 2010). Along side these there are contributions from the regional development agency Grow Wellington (predominantly Cath Randall, Ruth McDavitt) and from TechNZ/FRST (Joseph Stuart). The prime industry mover has been John Clegg of ProjectX who has lead a cooperative set of companies in Wellington to develop the model of cooperative internships. Contributors from industry have been many including Paul Gold and Peter Torr-Smith, to name just two. Over the years more than 60 companies have been involved in the Summer of Code, either taking on student interns, sponsoring activities or contributing to industry led teaching and seminars or workshops.

Essentially the proposition for Summer of Code was 'Education and business working together to build capability' in the ICT industry, the focus being the development of the students in tertiary education and of the Wellington ICT industry. Larger businesses already had links with universities and tertiary institutions to plug into the talent pipeline, typically at graduation and thereafter through some graduate development programme. However smaller industry players did not have the capability to effectively plug into the talent pipeline and did not have the scale to develop a graduate development programme. Furthermore larger industry could engage with the students earlier diverting key talent. Bringing together smaller industry players cooperatively allows engagement. By engaging with students early in their development, say at second year, it provides a more effective talent pipeline development with the additional benefits of enhancing the student learning experience through industry led teaching, industrial work experience and for some students industry based capstone projects.

A brief overview of industry-academia engagement in New Zealand

Engineering programmes have traditionally engaged with industry, they have a requirement for undergraduate engineers to have at least 800 hours of practical experience in industry in order for the degree to be accredited under the Washington Accord. There are various examples of how this can be achieved – typically in New Zealand this is through 2 or 3 summer work placements or internships. Internationally there are various models, such as a thick sandwich course, where the students spend a year in industry, through to flexible cooperative schemes, typically found in the USA, where students can spend almost any trimester in industry. These coop schemes require the institution to provide a very flexible schedule of course/modules that the students can take in-between industry engagement. Other areas within ICT have also taken on board the concept of work experience to create more rounded graduates that have a better appreciation of their industry. One such degree was the BIT at Victoria University of Wellington (VUW) that began in 2002, which merged into the Bachelor of Engineering programme at VUW in 2007-8. The BIT was the primary source of students for the Summer of Code initially, a discussion of its efficacy is found in (Pauling, 2006).

Within New Zealand there have been a number of initiatives to engage industry and academia, a number are discussed here. A further discussion including IT internships can be found in Wempe, (2010). As mentioned engineering degrees require work experience and Waikato University (Waikato, 2010) and Victoria University of Wellington (Victoria, 2010) provide some details of their engagement. The University of Auckland, created the Centre for Software Innovation (CSI Academy, 2010) in 2004, funded through the Tertiary Education Commission (TEC), to link ICT researchers at the University of Auckland with the ICT industry. At the inception of Summer of Code the CSI Academy was probably the top NZ internship programme in the ICT area as they provided a managed internship programme (Academy, 2010). It is led by the University of Auckland, accommodated at the University of Auckland and usually requires fully costed funding. The CSI Academy employ a project manager to manage the summer internship projects and those students are located at the CSI Academy.

There were a number of issues with the CSI Academy model from the Summer of Code perspective. The cost base was high, with the cost of accommodation, infrastructure and a project manager, so to develop a similar programme was seen as prohibitive. Furthermore the industry and student experience was more limited, with the prospective employer held at arms length and the student not exposed to the full employer engagement. The talent pipeline enablement was not deemed as effective as it could be, although there would be some employers who would prefer an arms length engagement with a university led facility. By placing students in industry and providing training, learning and working aspects we could develop a more effective solution, within the context of central Wellington which is a relatively compact central business district (CBD).

In 2008 and 2009 there was a move to try and create a national engagement opportunity which brought together most of the universities, the CSI Academy, Summer of Code and a representative from Dunedin regional development, who wanted to replicate the Summer of Code within their environment. A single national engagement structure was not feasible with different needs geographically, different engagement strategies and delivery models. Accelerating Aotearoa (Accelerating Aotearoa, 2010) began a similar programme in Auckland and the Dunedin ICT Business Cluster developed the Dunedin IT Wave in 2008 which runs alongside the Dunedin ICT Cluster's regular internship program (thedistiller, 2010).

In addition, starting in the summer 2009-10, Government grants through the Tertiary Education Commission (TEC) were provided for summer interns at universities. In 2010 the proposition from the TEC is that the Government provides NZ$3500 per student, with around 100+ grants per university. To gain the funding for a summer intern requires matching funding from industry or the university, an industry and university supervisor and an appropriate student. The internship is university based and supervised, with industrial engagement, furthermore the programme is not limited to ICT or engineering.

Additionally there are other schemes, for example a Polytechnic programme (incorporating the Institutes of Technology) in conjunction with ManufacturingNZ has recently started. This offers an engagement aimed to accelerate product development,

improve operational processes and increase organizational capabilities (innovatingNZ, 2010). This scheme is to be extended to the other polytechnics in 2011.

A brief history of Summer of Code/Summer of Technology

The development of Summer of Code began in 2006, based around the technology incubator CreativeHQ. It was developed as a not-for-profit premium internship programme connecting smart students with Wellington technology companies.

Over the summer of 2006-7 we developed the initial internships, feeling our way, based at CreativeHQ a technology incubator in central Wellington. Seven companies were engaged in taking on students and Summer of Code engaged with Victoria University of Wellington and Massey University. Around 30 students applied, they were interviewed, selected and eventually 17 were employed. TechNZ sponsored most projects/interns in their companies. A summer seminar series and social events were organised to help develop the student experience. The Summer of Code was a success all round and based on our learning from the initial engagement the second Summer of Code was planned. During 2007 we ramped-up Summer of Code to get more companies and students involved for the summer of 2007-8. From our experience the previous year we developed Bootcamps in order to provide some industry led training. The experience over the summer with the first cohort of students showed that they had little knowledge or perspective on the industry, they were not using communication skills well, with poor CV's. There was also a missing curriculum, that is a more industry focused set of skills or knowledge. Also some of the coverage at university was too theoretical. Therefore Summer of Code companies developed a number of bootcamps to introduce certain topics and provide a pointer to further learning material for student self study. These covered communications and writing a better CV, web aspects such as html and PHP programming, Microsoft development using Visual Studio, an introduction to databases and SQL. These bootcamps developed through the next few years as different industry partners engaged, so for example Ruby was used as an example of a web development scripting language in subsequent years as its use became more significant within the companies represented. The introduction to Visual Studio was popular with students as the majority of university teaching was in Java or C/C++ in a Unix environment, whereas the predominant industry requirement was for Microsoft based operating systems and development tools.

Another key aspect in 2007 was the engagement with more tertiary institutions, through the Wellington Tertiary IT Network (WTIN). These were predominantly the polytechnics in the greater Wellington region (Weltec, Whitireia, and the Open Polytechnic). This introduced more students to Summer of Code with a greater variety of backgrounds, for example the polytechnics often employed more Microsoft development tools in their courses. This year also saw the first students from Massey University in Palmerston North make the 90km trip to the capital to take part.

Testing of the students was extended in order to pick the best students; this is a requirement for TechNZ to prove that students are worthy of financial support, but also the companies as well. Over 100 students applied, and the students meet industry in a social event and at the NZCS Evening with Industry which was then followed by a speed dating event where students had 10 minute interviews with the key industry players. Students were allocated to the companies through a combination of industry preferences and student preferences, with key students having a large number of interviews. To cover costs for social events the companies were asked to contribute to cover the costs, as CreativeHQ was not the core for Summer of Code seminars moved to a central city university venue. Additionally a social contract between students and companies began to be developed, such as a minimum wage (well above the official minimum wage), the contract also indicated the development needs of the students that the companies should provide, such as mentoring, see Summer of Tech (2010). A few companies were not happy with the social contract and so withdrew from Summer of Code, however the summer of 2007-8 saw a more extensive seminar series, workshops and social events for the selected students and industry partners. The seminars covered a variety of technical subjects, personal development and an introduction to various industry segments, plus longer workshops, for example scalable database design for the web industry.

The key lessons from 2007-8 were many fold: better systems to test, mark and select students, the need to work more smoothly

with TechNZ to get funding for companies in a timely fashion. Also the key need to have more administrative help to survive was realized, although some admin help was provided by Victoria University and TechNZ paperwork was predominantly organised by Grow Wellington, it was far from enough to sufficiently organise such a set of events and number of students.

In 2008-9 Summer of Code was nearing saturation within the context of the Wellington area. We engaged funding bodies to further develop Summer of Code beyond its original ICT niche and to also include other cities. However funding bids to extend the scope and to extend SoC to centres beyond Wellington all failed, the feedback from applications indicated that for one source there was a lack of funding available and the other indicated that we did not have sufficient industry support outside Wellington. However in Wellington SoC had over 150 students apply, with 27 employers taking on 35 students at the end of the process. A more significant company contribution was set in order to provide for some part-time administrative support. The success generated issues in providing enough space at bootcamps to accommodate students wanting to take part in the training and learning experience that were offered. Furthermore two part time administrative assistants were engaged over the summer as the management of Summer of Code needed support to avoid impact on the small businesses that provided the key volunteers.

For 2009-10 we developed a diversification of the Summer of Code formula based around the greater need for work experience through the provision of Engineering at Victoria University, but also through the Bachelor of Business and Information Systems (BBIS). The majority of effort was placed into the traditional Summer of Code although that was largely saturated (with employers/students). The new needs in engineering required an engagement with more diverse industries covering electronics, mechatronics and network engineering especially. However we had also seen a need from the softer end of the ICT market emerging in 2008-9 and so more opportunities developed in the areas of business analysis etc. in 2009-10. In addition Grow Wellington were developing more design and manufacturing business links. These would develop the Digital Design area and manufacturing which engaged with a number of other industry sectors. Through the combination of university outreach and Grow Wellington business development we saw linkages with local engineering industries: the birth of Summer of Engineering. Several aspects of this expansion cause concern, we no longer have an integrated programme – we were widely geographically dispersed as manufacturing and electronics/ mechatronics industries were not CBD located and that there was a much more wider range of students so the seminar series needed adjustment. Additionally the summer seminar series was opened to all students in the Wellington region rather than limited only to those directly participating in the programme.

Following on from the developments in 2009-10 the key changes in 2010-11 were around the consolidation of new directions. The Summer of Code was renamed to Summer of Technology (Summer of Tech) which incorporated a number of initiatives: Summer of Code, Summer of Business Analysis, Summer of Engineering and Summer of Design. Through this the number of companies and students involved has almost doubled. Table 1 shows the participation statistics, for final number of companies and students involved.

Figure 1 Students and companies engaged in Summer of Code/ Summer of Technology

YEAR	COMPANIES	STUDENTS
2006	7	17
2007	17	27
2008	27	35
2009	30	42
2010	35	62

The key partners in Summer of tech are shown in Figure 1, with significant inputs from Xero and ProjectX, with industry interfacing both directly to previous Summer of Code industry partners but also through the regional development agency Grow Wellington and nationally through TechNZ. Xero in particular sponsors the Summer Seminar Series. The seminar series includes personal development, technical, business and industry perspectives, including for example how to start-up your own business, or how to be a games developer. In addition from a professional development perspective the students learn how to develop as a self learner, for example 'expanding your help horizons' is about how to plug into

support communities beyond the workplace (Summer of Code Blog, 2010).

Figure 1: Key partners in Summer of Technology 2010

The financial aspects of the Summer of Technology are highlighted in Figure 2. Many companies apply to receive TechNZ funding which provides $16 per hour for up to 400 hours to cover the majority of the student pay. The companies pay a participation fee and a per student fee to Summer of Technology – which is a not-for-profit organization. In turn Summer of Technology and Grow Wellington facilitate the interfaces with the student body, the tertiary organizations, provide learning and teaching for students and help develop the funding applications to TechNZ. There is no guarantee of project/student funding, however TechNZ has invested over NZ$500K in Wellington Summer of Code projects from 2006-2009. To receive funding requires a suitable company with a suitable R&D project, these are matched to a suitably qualified student that would benefit from the industry project.

Increased demand and re-focused priorities in the TechNZ funding programme in 2010 (TechNZ, 2010) have led to the exploration of other funding models, such as the local government-supported programme in Dunedin, which has a wider remit for funding support for interns, not just working on R&D projects. In 2010 TechNZ's undergraduate internship fund was significantly over-subscribed, with increased demand from businesses throughout New Zealand. Unfortunately, the focus of investment in R&D funding moved more

toward large and established companies, this meant that the traditional Summer of Technology host companies (predominantly medium and emerging businesses) have not been supported in 2010 as much as in previous years. Other factors including the uncertainty of funding approval and the timing notification of grant allocations (during end-of-year exams in November, when intern recruitment starts in March) added to the need to find other sources of funding. Additionally other partners such as the young IT networking organization Unlimited Potential (UP) and the technology incubators provide entrepreneurial development opportunities, with the summer seminar series includes various entrepreneurial components. Through such inputs Summer of Code has developed several start-ups, for example Code to Customer specializing in Ruby development.

Figure 2: Typical cash flow in Summer of Technology

Integrating the industry and the academic experiences

The Summer of Code/Summer of Technology value statement is to: 'Accelerate student learning and their industry experiences through bootcamps, internships, seminars and workshops.' The key aspects of bootcamps, internships and seminars/workshops were introduced in the previous section. Additionally Summer of Code has had an effect on the university curriculum with for example the inclusion of scripting at second year in Victoria University, to give the students a fuller experience of programming. It has also led to the development of a set of more extensive professional development courses, these are discussed in the next section. However the development cycle in academia is relatively slow with at least a year's lag in developing changes to courses, potentially longer in terms of the development of new courses.

The net benefits from Summer of Code include the education system (student and tertiary institutions) and the ICT industry. Students are exposed to significantly more industry presence than before Summer of Code. Their appreciation of what the ICT industry includes and what career opportunities they can find is significantly enhanced. Certainly within the New Zealand context the majority of ICT companies are small businesses and they often require their employees to be more rounded individuals that can contribute across a number of areas, not just programming or testing. This can excite a student as they see a variety of challenges ahead of them in the industry.

A key enablement from Summer of Technology has been the talent pipeline from the tertiary system to the ICT industry in the Wellington region. Around 70% of students that are provided with internships through Summer of Code have been pipelined into the ICT industry. As of March 2010 90 jobs have been created and 121 internships had been completed, in the order of 40 man years in total. Additionally approximately NZ$500K of funding from TechNZ has been provided since 2006. As a whole the Wellington regions ICT industry has gained valuable resources to help develop products and services.

In the future of course we hope for more and better outcomes, but much relies on the support of the various players/stakeholders. From TechNZ and Grow Wellington, to the companies that want to develop the talent within the Wellington region through to the tertiary providers. Most important of course has been meeting the need to the students and exciting them to develop within the ICT industry. Now with the extension of Summer of Technology, into other areas there is an expectation that the benefits gained by industry and tertiary providers in the ICT areas will be seen in engineering, design and the applications of ICT to business.

There is much research and development in the area of professional practice. The professional bodies have been active in bringing professional accreditation and career development within their industry segments. The British Computer Society (BCS) and Institute of Engineering Technology (IET) have developed the Skills Framework for the Information Age, a framework identifying a common reference model across ICT and engineering that identifies skills and competency levels across a large number of job titles and functions (SFIA+, 2010). The New Zealand Computer Society (NZCS) have brought ICT professional certification to New Zealand in 2009 with the ITCP (Information Technology Certified Professional) based on SFIA+ and international developments in IFIP, BCS and the ACS. ITCP is aimed at accrediting ICT professionals that have gained key competencies and skills typically after five to seven years in professional practice, giving graduates from the tertiary sector a goal for further development.

Likewise the tertiary sector has been active in developing industry linkages, bringing industry speakers into the classroom as well as developing the professional ethos in students. This has been expressed as a range of courses covering ethics, professionalism and the learning from industry successes and disasters. Additionally ICT career fairs and the milkround are seen as key to bringing students and industry together. One of the key providers of student – industry activities in the New Zealand context is the New Zealand Computer Society. The Evening with Industry has encompassed the Summer of Code and working together they now provide a young persons focus towards bridging academia and industry. Additionally the Wellington NZCS region provide other opportunities for students to meet industry with a social event in trimester one and a student final year project competition in trimester two.

Curriculum for developing professional practice

Victoria University was at the heart of developing Summer of Code and has integrated it into the development of their engineering and ICT work experience programs. This has culminated in the creation of courses aimed at developing the student towards employment through an understanding of industry, jobs and functions, communication skills and developing self learning through reflection on their learning. Three courses are developed: ENGR291, ENGR391 and ENGR491 in conjunction with the students work experience, see the material available from Victoria University, (2010).

In addition, because these are engineering oriented, these courses include specific requirements such as NZQA health and safety as well as aspects such as SFIA+. These also incorporate elements of the Victoria University victoriaPlus programme run by the careers service which provides an additional certificate to employers showing that a student has achieved across a number of areas including service and leadership (victoriaPlus, 2010). These courses run in conjunction with Summer of Technology activities. Bootcamps, start in trimester 1, providing a perspective on the ICT industry in particular plus communication skills and CV creation. These continue through the first half of trimester two with more technical content, such as Microsoft development, web development, an introduction to databases and so on. These are aimed primarily at second year students who have not perhaps gained a breadth of coverage over their first three trimesters.

Through the combination of Summer of Technology and the courses provided through the School of Engineering and Computer Science at Victoria University, the student is able to prepare a suitable CV aimed at industry and job needs, gain an understanding of the ICT and engineering industry, move on to engagement though interviews usually culminating in job offers an industry experience either as part of Summer of Technology or through other employers.

The future for Summer of Technology

Summer of Code, now Summer of Technology, provides a low cost base, cooperative, value added, internship programme which should continue for many years. It began based on industry volunteers providing time and effort to give back and this is still key to the heart of Summer of Technology. Through its growth since 2006 the programme has become a serious contributor to the growth within the Wellington ICT industry, developing a key talent pipeline and providing an enhanced student experience.

Summer of Technologies goals are to remain NZ's leading industry-driven skills development and summer internship service for technology businesses, as we have grown we have seen that host companies want interns with a broader set of skills and career aspirations. In order to build a sustainable, self-sufficient programme, we are seeking to expand to serve a wider range of employers. There is also demand from employers in regions outside of Wellington, so we are talking to partner organizations throughout New Zealand to help establish the model in other areas.

Talent and foster connections between the education, research and business In 2010, Summer of Technology was established as an Incorporated Society, so the future will include serving our membership, being a strong voice for industry in the bridge between education and the workplace. Continuing to build partnerships with the NZCS and other related industry organizations will be a key criteria for success, along with further developing our ongoing partnerships with tertiary institutions and partner organizations. Critically we must share the vision for industry-led professional development, and recognize that in order to grow our industry and economy, we need to invest in local communities.

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