

# Skills and Knowledge for Hire: Leeds *Source-IT*

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## ABSTRACT

We present a pilot for a student consultancy service offering students the opportunity to work with internal and external clients on real life projects to learn and enhance transferable skills. The pilot ran for 18 months with a pool of 20 to 24 students working on 8 projects.

We compare in detail two case study projects for external clients and described issues and lessons learned. Participating student consultants' feedback is presented and analysed, in the context of managed development of professional skills. Finally we discuss the initial challenges running a student consultancy service as an extra-curricular activity and comment on the value to the host university department.

## Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]: Computer science education, Curriculum, Information systems education, Literacy; K.6.1 [Project and People Management]: Management Techniques, Systems Development, Staffing

## General Terms

Management, Human Factors

## Keywords

Real-world student experiences, management, enterprise, education

## 1. INTRODUCTION

Opportunities for students to work on professional project assignments give experience that is recognized to be extremely valuable in differentiating graduates in the job market, providing confidence and improving focus for within academic work [5, 9]. At the same time, university Computing Schools often and regularly, receive internal and external enquiries for small scale, low level programming and

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web development work, which are not suitable to be serviced through any existing mechanisms (e.g. Academic consultancy, Knowledge Transfer Partnerships etc.).

Leeds Source-IT Consulting (Source-IT) was run as a pilot to take advantage of these opportunities, to provide students with some useful transferable skills and to develop a culture of enterprise within the School. A secondary, but not unimportant, driver was to provide students with earnings. Most students now need to work part time to supplement their income and course-related work within a safe environment is clearly preferable to other options.

Prior to setting up Source-IT, a number of issues had to be addressed. The major challenge was quality assurance, so that Source-IT could charge commercial rates sufficient to reach eventual financial sustainability. To address this, a robust project management system was devised and two experienced managers deployed to work part time (one at 20%, the other at 10%). In the second year, this changed to one person at 20% and two others at 5% each. The aim was to build the business to support one person at 50%, with limited support from the other two.

## 2. STUDENT ENTERPRISE WITHIN OTHER UNIVERSITIES

Other universities have provided opportunities for students to develop enterprise skills. Two examples were assessed at the outset and are described here. They are 'Kent IT Clinic' at the University of Kent [8] and 'Genesys Solutions' at the University of Sheffield with [6].

### 2.1 Kent IT Clinic

The Kent IT Clinic (KITC) was set up within the Computing Laboratory in 2004. KITC provide consulting services to local small to medium enterprises (SMEs) and individuals, to offer students first-hand experience of consultancy during their studies.

Students wishing to become consultants apply in their second or final year by selecting the relevant modules. The student is required to attend an interview prior to being accepted on to the module. KITC consultants work during university time and earn credit towards their final degree. There is also an option to earn cash by working in their spare time.

The type of consultancy offered by KITC include websites, programs for search engine optimisation and cutting edge mobile tracking software. Further information and annual reports are available on their website [8].

## 2.2 Genesys Solutions

Genesys Solutions is integrated with the Enterprise Computing degree programme at the University of Sheffield to provide graduates with business, technical, interpersonal and project skills. This credit bearing option offers the opportunity for students to take an active role in a student-run commercial IT company. Genesys is a division of epiGenesys and is run by students who are studying on masters degree programmes in the Department of Computer Science. Genesys Solutions use a wide range of leading tools and technologies and follow the extreme programming (XP) methodology [1], working closely between client and developer.

Similar to Kent IT Clinic, the students are responsible for all aspects of work within Genesys Solutions including sales and marketing, project management, software development and testing, and systems administration.

Both of these examples tried a cash based model initially and later chose to use a curriculum based enterprise model, in which students undertake real consultancy projects in return for credits within a dedicated module. The module marking scheme reflects the quality of their work, but they receive no payment. Both KITC and Genesys managers indicated that this was found to work better for a number of reasons: students retain motivation better, finish projects more successfully and provide higher quality of work.

Experience of both was that smaller and more manageable projects were far more successful. Genesys Solutions also restrict scope to non-critical projects, using a spin-off company, epiGenesys Ltd established in 2007, for larger critical projects.

## 3. LEEDS SOURCE-IT CONSULTING

Source-IT was established in September 2008 as a pilot software/IT consultancy business. Source-IT was advertised as 'providing bespoke software engineering solutions to companies, research groups and other external organisations (clients) in software development and specification, through short term contracts for defined tasks'. The planned typical contracts would be concluded by one or more students working part time over periods of between 2 weeks and 3 months. In addition to software development, a number of contracts have been delivered providing requirements specification or background solutions research as a pre-cursor to larger projects.

Skills offered include C#, Java, Python, PHP, Perl and frameworks offered included using Visual Studio (.NET) and Eclipse. It is worth noting that not all these skills are taught in the School curriculum and the undergraduate consultants selected arrived at Leeds with these skills or picked them up through extra-curricular activity. Python (with Django libraries) is recommended to clients as it offers a more cost effective solution as many clients were looking for Web application solutions (and in some cases Web 2.0 [7]).

Source-IT consultants were required to pass an induction process and were a mixture of second and third year undergraduates, postgraduates and some alumni.

### 3.1 Project Management Infrastructure

At the outset, it was clear that project management would be a major challenge. The School stipulated that students could only work an average of 5 hours per week and they were inexperienced at contract-driven work. A project management system was put in place, to track tasks/sub-tasks

against consultant hours. It also operated as a bug reporting system and for sharing of documents and information. The system was useful in allocation of tasks, but proved to have operational weaknesses for project monitoring, mainly because of limited adherence.

The content management system offered the client the facility to track the development of the project, upload documentation and add bug reports. Again, clients made little use of the system, which limited its value.

Another key feature was the repository, in which all codes and documentation are stored. This was a crucial part of the service offering, as clients needed to be assured of continuity of service after the individual student consultants had left. It was also important that student consultants introduced to a project at a later stage would be able to access the code and documentation and look at past revisions if necessary.

Source-IT used a mix of agile methodologies [4] depending on the size of the project team and the type of project. In all cases, each project team reported once a week for a fifteen minute session and reported what had been achieved since the last meeting, what each consultant was doing next and the status of the project overall. It was during this time that any other problems and issues were raised.

### 3.2 Consultancy Pool and Induction

During 2008-2009, from a total pool of 20, 11 consultants were employed by Source-IT. These were largely undergraduates (7), with 3 postgraduate students and one recent alumnus. All were offered the opportunity to remain in the consultancy pool. The consultancy pool for 2009-2010 contained 19 undergraduates (of which 8 previously worked for Source-IT), 5 postgraduates (4 of which were previously in the pool, 2 as undergraduates, 2 as postgraduates and one new) and 2 alumni (including one 2009 graduate). There was a formal application process to the consultancy pool and checks were done through the internal transcript system and with tutors.

Consultants were also required to attend a 2 hour induction session where they were given training on consultancy and Source-IT procedures. This was mandatory and the induction session provided the following:

- Project management
  - Project management in team software project
  - Source-IT infrastructure overview
  - Version control within Source-IT
  - Agile methodology
- Commercial issues
  - Commercial issues for an IT consultancy business
  - Person skills for entrepreneurship

### 3.3 Marketing, Sales and Business Link

In the second year, Source-IT aimed to increase the number of external clients and contact was made to local business resources Business Link and Yorkshire Forward. Business Link is a free business advice and support service, available online and through local advisers and Yorkshire Forward is the regional development agency for Yorkshire and Humber. A particular opportunity was the 'innovation voucher' scheme run by Business Link to provide companies with access to free university-provided consultancy up to the value of £3000. This suited the typical project size of 8-10 days.

## 3.4 Facts and Figures

### 3.4.1 Staff and Consultants

Source-IT, in its second year, had 26 consultants in the consultant pool. This was an increase of 6 due to increasing the undergraduates by 3, 3 postgraduates and 1 alumni who were final year consultants the previous year, with the loss of one postgraduate. In Table 1, the undergraduate pool increased to 19. For 2009-10, the final year students had three new students with 8 returning from the previous year. The table below presents the numbers in the pool and the number of students that were allocated to be consultants on the eight projects.

**Table 1: Number of staff, consultancy pool, and consultants on projects**

Consultants	2008-09		2009-10	
	Pool	Projects	Pool	Projects
2nd Year	9	2	8	1
Final Year	7	4	11 (8)	1
PG	3	3	5	5
Alumni	1	1	2	2
Staff	2		3	

While the staff increased by one in the second year, the staff time allocated (30%) for management remained the same with one staff at 20% and the other at 10% in the first year and in the second year, one person at 20% and two others at 5% each. The third staff member focused more on sales and communicated with Business Link

### 3.4.2 Projects

The number of consultants on each project (see Table 2) depended on the tasks and time available for project completion.

**Table 2: Number of consultants per project, consultant hours and staff management hours (NB. some consultants worked on more than one project).**

Project No.	Consultants	Consultant hrs
1	3	105
2	2	162
3	2	15
4	1	45
5	3	75
6	1	66.25
7	6	151
8	1	75
Total		694.25

From the eight projects listed above, five have successfully completed and three are still ongoing.

## 4. CASE STUDY

In this section, we present two projects highlighting different issues.

### 4.1 Case Study 1: Social e-Commerce Web Application (Project 7)

### Background

This was a large project with a number of milestones and an extensive requirements list for an external online start up company. The client aims to develop a social networking commercial website, with features similar to Facebook [10], including online classified advertising [2]. The client had an initial business model but had minimal technical skills and was looking for a low cost solution.

The initial phase required student consultants to work with the client and develop a technical specification based on the client's use cases. Two postgraduate consultants were recruited to the project and delivered a technical specification document to the client.

The first main development phase was to develop a basic social network web application as specified in the technical specification with the following functionality: User Profiles; Group Profiles; Advertising; Shopping and the communication infrastructure for commenting on user walls, messaging users and providing opinions to ads. For this set of functionality, the Django web framework [3] with Pinax was selected as it not only offered a number of suitable applications (apps), but also because the main teaching language for programming at the School of Computing, University of Leeds is Python.

### Project Team

Five student consultants were involved. An undergraduate intern worked intensively over the summer and two postgraduates continued the work from the start of term. Another postgraduate developed the e-commerce part of the application and a fifth consultant was employed for testing.

### Deliverable

The project team provided the following deliverables that were used with sign off and discussion meetings:

- Technical specification based on client meetings and story board
- Prototype code that can be run on a test server
- Documentation on deployment and application functionality

At the time of writing, this is still an ongoing project with the basic infrastructure phase taking 6 months and currently being prepared for handover.

### Issues

One major issue was a mismatch of expectation between the client and the student consultants, due to a lack of clarity in the specification. It is worth noting this was not the fault of the consultants who developed the original specification, as the client vision and scale of the original web application changed over time, while the consultants developed the functionality based on the technical specification. As the project continued, the mismatch grew larger and required a lot of negotiation to ensure the final result was as contracted.

### Lessons learned

This gap in expectations could have been avoided by ensuring that the milestones had smaller targets and each milestone was a smaller stand alone project.

## 4.2 Case Study 2: Embedded State-of-the-art Technology for a Website (Project 8)

### Background

A second project also involved a Web 2.0 start up company. In this project, the client wished to research new ideas on mobile technology to improve the user experience with the business website and to automate collection of valuable marketing data. The aim was to identify from a user requirements document a system to: (1) utilise SMS technology, (2) ensuring the client retrieves relevant marketing data, and (3) research potential state-of-art technology that fits the client business model.

### Project Team

This project was delivered by a recent alumnus, who worked directly with the client and was project managed by a member of staff.

### Deliverable

The four deliverables were:

- A user requirements document
- A research document presenting state-of-the-art technology in current use today and by the clients competitors
- A technical specification on the technology the client wished to pursue resulting from the results of the research document and resulting meetings.
- A prototype (work in progress)

At the time of writing, the consultant is currently implementing prototype applications using PHP to demonstrate functionality and for the client to embed within the business website. PHP was selected by the student consultant and client, to ensure easier integration with the current website.

### Issues

This project was run after Case Study 1 was started and some of the lessons learned there were applied. Specifically, the assignment was broken down into manageable stages and client communication was prioritised. A more experienced consultant was also assigned to it, as it was an external and critical project.

### Lessons learned

This project demonstrated a small size project with a task list easily managed by the consultant avoided many of the problems associated with Case Study 1 above. Each milestones had a small number of tasks and was done in the shortest amount of time possible. There was also a good level of communication and interaction between the consultant and the client.

## 5. DISCUSSION AND EVALUATION

### 5.1 Enterprise Education and Learning Outcomes

The main aim for Source-IT was to provide an opportunity for students to work on real projects with real clients. This

provided an opportunity to improve their skills and enhance their CV with examples that employers are looking for [5, 9] when looking at job applications.

Most of the projects involved working in teams and collaborating with the clients. Comments included:

... each of the projects in which I was involved required working in a team of people who I had never worked with before. Aside from the technology skill gained from each of the projects, a better sense of my role within a team and a better judgement of others' skills has been gained from this.

... that team working is essential and fulfilling on a large project

Working with real world clients was an issue for students, where clients had varying degrees of IT knowledge:

... that you cannot underestimate the knowledge of your client,

...gave me an insight into how software projects are run when there is an external stakeholder and a cash incentive in the mix

The consultants also commented on the learning curve, the type of work that was expected and the way they worked when being paid. As well as listing technologies and frameworks when asked what they needed to learn for a project. Comments included:

... the procedures in working in a software development environment.

The consultants were asked to comment on the quality of the work they produced and if they provided value for money. Some comments were:

... though someone more experienced would have probably crafted a better solution

... poor quality for the most part as work was rushed out

... I felt it was of adequate quality; could've been better, but could've been loads worse.

The consultants were also asked what they gained from Source-IT and the projects and what they learnt.

... some time ago I claimed to dislike web development without having done any in great detail. I now have the experience to justify why I don't like it.

... helped with job applications, and ultimately helped secure an offer of employment

We did not formally support student reflection and personal development gained from participation. There would certainly be opportunities to do this and no doubt further benefits, but this would imply a management cost outside of the remit of this pilot.

In the first year, we have learned a lot about project management for students where there is a limited time resource. Some projects have been straightforward, but two

have caused (and continue to cause) difficulties. These were resolved by closer management, with a consequent resource implication. From the outset, we were too broad with the skills offered which had management issues when projects had problems. For future projects we were more prescriptive about languages and frameworks to be supported and Source-IT focused on Python Django and PHP Drupal as the main skill sets.

The second main issue was the client expectation. In the beginning, management took a hands-off approach with the consultants and the specification for the deliverables. We now manage clients' expectations more closely to find any issues early in the project.

## 5.2 Financial Sustainability

Management of Source-IT during the pilot phase was undertaken by part time contributions from three staff, covering a range of skill areas (technical, financial and business development) and with support from the University's central administrative services for legal and contractual management. This resource requirement was built in to the financial model. During the pilot, management costs were not charged to Source-IT, but were monitored in the financial model. Actual figures are not very meaningful at this stage, but during year 1, the book loss was around 10% of turnover. During year 2, both time estimation and pricing were increased, without loss of interest from customers. Projected losses for successive years are therefore much lower, with break even forecast by the third year. Over time, there is the opportunity to improve efficiency and hence profitability, by building up libraries of code that could be re-used on different jobs and to build relationships with customers leading to repeat business.

We believe that, for a department the size of the University of Leeds School of Computing, there is sufficient market from both internal and external contracts to support a manager working half time. In year 1 we were able to generate sufficient work to fulfil management capacity by word of mouth. In year 2, we began to do some more proactive sales and marketing, using a telesales company and Business Link, leading to a significant increase in the sales enquiry pipeline.

With some institutional underwriting, this is therefore a viable model, but does require a time horizon of 2-3 years before the initiative can be relied on to cover its own costs. The main long term benefit would be in having a structure available to respond to opportunities, such as low level involvement with companies that might lead to more lucrative collaboration later, or as a vehicle to exploit student and staff ideas for software products.

## 6. CONCLUSIONS

The pilot showed that the model is workable, but requires a funded incubation period of at least two years. Within a department the size of the School of Computing in Leeds, it should be possible to sustain a half time management post and to provide work experience to up to 20 student consultants. The benefits to the students and the School include an improved learning experience, enhanced employability and the opportunity to build relationships with local companies and entrepreneurs. Some important lessons were learned and modifications should be made to the model described here. In particular, very detailed project specification to manage client expectations and monitor closely student ac-

tivities is essential.

Students benefited significantly from participation, gaining valuable teamworking, professional and entrepreneurial skills. This could be enhanced further by adding formal processes to facilitate reflection and personal learning.

## 7. ACKNOWLEDGMENTS

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