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48F. ICT education: bridging with the Industry

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Abstract

This paper presents the practical forms of university/industry co-operation which we have developed over the years at the Department of Information Systems and Operations Management (ISOM) at the University of Auckland, New Zealand. Most of these practices are well known but we think that the ISOM Department set up a comprehensive policy in this area.

Key words

ICT education, IT internship, IT projects,

1. Introduction

As long as universities have existed, the academics have been accused of creating "ivory towers" of the knowledge, or that their teachings are not representing a set of skills needed in the professional life. The source of these statements is based on the fact that university education is not aimed at providing, "job training" but rather to create a broader mechanisms of understanding issues of a given discipline. Quite often comparisons are made between university and polytechnic education and opinions are formulated that (contrary to the Polytechnics' programmes) Universities are not preparing their graduates well to function properly in the real work environment. University staff usually denies these claims but nevertheless quite often contacts between academia and relevant industry are sporadic.

Generally speaking, tertiary institutions are aware of this problem and are placing considerable efforts in maintaining close relations with the ICT industry to make their offer relevant to the job market as much as possible. These efforts usually have a form of:

- Formal and informal contacts with business organisation,
- Industry-originated guest speakers,
- Special student practices/projects.

This paper presents the practical forms of university/industry co-operation which we have developed over the years at the Department of Information Systems and Operations Management (ISOM) at the University of Auckland, New Zealand. Most of these practices are well known but we think that the ISOM Department set up a comprehensive policy in this area.

2. Formal and informal contacts with business organisations, speakers

It is a widely used university tradition to invite to the classes recognised authorities in the given field to discuss subjects related to their mastery skills. For example if the subject of a class presentation is computer forensic it would be quite obvious to invite a leading expert in this field.

Some variant of that is to invite a representative of a company which is a leader in the give field. It could be quite obvious to invite a representative of a company occupying the majority position on the ISP market.

At first, after receiving acceptance from the potential speaker, a session between him/her and a lecturer is arranged to discuss the date, content of the presentation and a form of the hand-outs. We try to arrange the presentations when it is logical to have them but some flexibility must exist as a guest speaker may not be available at the most appropriate time. Before the presentation students are briefed as to whom they will see and the topic of the presentation.

The format of the lecture/presentation varies, depending on the topic. It could be a plain lecture (and we rather try to avoid that) or a live demonstration of some sort. One of the most interesting ones (which is a permanent feature of a course on Data Security) is a demonstration of eavesdropping techniques: real hearing "bugs" are shown and equipment to trace them plus methods of monitoring pagers and mobile phones discussed. A significant portion of time is always left for the question and answer session.

A delicate problem is the question of remuneration for guest speakers. Most of them are not looking for financial rewards but on the other hand are forced to spend a considerable amount of time in preparation for the presentation and in some way should be rewarded for that effort. Direct payment in most of the cases could be difficult. Many business organisations forbid their employees to have extra earnings without their consent. To avoid these problems we introduced the presentation to guest speakers of book tokens which could be redeemed in any major bookstore in the country. This system of "tokens of appreciation" works very well. Overall surveys carried out after each semester show that students highly regard these presentations. Interestingly enough these presentations are also valued by the guest speakers themselves. We have noticed that many of the guest speakers introduced into their CVs a statement like: "frequent University of Auckland guest speaker".

3. Issues with student practices/projects

To better prepare students to professional life in the field of information technology every university is offering a course usually named "Information System Project". The basic goal of such a course is development of a working application. The course arrangements may vary but the conditions usually include:

- The topic of the project is generated by the university staff or by associated company,
- Work is done in teams,
- Supervision is limited to progress reporting to the university staff and the sponsoring company.

Such conditions present a number of problems:

- *Importance of group work*

Each university grants diplomas on the basis of a candidate's individual performance and achievements during their stay at the university. It is the norm that part of the studies would be carried out through some sort of group work. This could be in the form of workshop groups, working parties, or (the University is not usually very happy about this) informal syndicate work on home assignments. The real life situation is one where most individuals do not exhibit a thorough knowledge of each aspect of a problem. At present few information projects are the sole work and responsibility of one designer from the very beginning until the end. This situation may be exacerbated through group work by allocating

tasks so the degree of repetition for individuals is significantly reduced (spread of tasks during a system analysis phase etc.). On the other hand team work is a good vehicle to develop in students skills of working in groups (mainly psychological and social), e.g. responsibility for and to a group, leadership skills, understanding someone else's problems, punctuality, etc. These skills are extremely important in a future professional career in systems development and systems management. Therefore universities should train their students in group activities. But the question is how to place group work within the university curriculum? The typical solution is to have a regulation limiting the weight of a group project to a specific small value (like 20%) of the overall course grade.

- *How to assess a group work?*

A basic question then arises - how to mark the group if the whole work was done in a group? Assessment may be arranged on a group performance basis, when each member of the group receives the same mark or on an individual basis. Both methods have their advantages and disadvantages. The first may be called "product oriented", whereby the University would not be interested in the individual contribution to the end results. This approach may help "easy riders" to get the credit but it emphasises the role of a group's goal. The second approach eliminates the problem of ghost members but makes the final product of little importance, and does not emphasise the role of group work.

- *Skill set to complete the project*

As it was said before, in the real life situation most individuals do not exhibit a thorough knowledge of each aspect of a problem. Each student (at least theoretically) should acquire the same set of skills (if studying the same programme), but in the real life most of them usually concentrate on specific subjects trying only to pass the other courses. Also few information projects are the sole work and responsibility of one designer from the very beginning until the end. Hence during the project work quite naturally students participate in all the activities but like to concentrate on part of the projects they are especially interested in. On the other hand there are some skills required, which students should be familiar with, but usually not being part of their courses of studies. The best example could be the group dynamic skills. Good practical knowledge of the group mechanics is essential for successful completion of a group project. Practically every university offers courses on this subject but very few students outside the psychology department would be inclined to take such a course (or even the university regulation could prevent it if the student is not part of the given faculty).

- *Knowledge of business environment*

University curricula include variety of courses but among them there is not presentation of "Business skills", i.e. knowledge how to operate in a real life working environment. Employers are aware of this issue and this is usually expressed by asking the candidate: "What is your business experience?"

4. Environment for Information System Project

Over the last 25 years the Department of Information Systems and Operations Management (ISOM) at the University of Auckland has been offering a paper "Information System Project" which we consider to be a good example of a group project providing answers to the questions discussed above.

Before we give a description of this group project we firstly provide basic information about the studies framework at the Department. The mission of the Department is to teach and conduct research in four interrelated discipline. They are:

- *Information Systems*
Application of information technology solutions to business problems.
- *Data Communications and Networking*
Presentation of telecommunication technologies that is increasingly important in today's world. It is a specialisation available as part of an Information Systems major. The data communications and computer network courses are integrated with the Cisco Networking Academy Programme giving students the opportunity to prepare for the CCNA professional networking certification.
- *Operations and Supply Chain Management*
Application of methods to solving business problems related to the delivery of products and services from the manufacturer or provider to the end customer.
- *Operation Research*
Theory and application of mathematical and computer models for complex decision problems encountered by management.

The ISOM Department offers both undergraduate and graduate studies leading respectively to Bachelor of Commerce and Masters of Commerce degrees.

5. Information System Project course

5.1. The Goal

An information systems project has to allow the student to apply theoretical knowledge to a practical problem in the business world. The overall goal is to develop an information system which, at the end of the project, meets the requirements of the user who sponsored the project.

Also, we like our students:

- To learn to work in a team with a minimum of outside supervision,
- To interact with end-users and successfully identify and satisfy their information requirements,
- To carry out an information system development project from its initial conception to the implementation and the user acceptance,
- To integrate the course work in several disciplines realising its significance to information system development,
- To gain practical experience in information system development.

5.2. Organisation

This is the only course of the School worth four times more than a "regular" course and lasting two semesters. Project teams consist of 2-3-4 students (Stage III, Bachelor of Commerce), a staff member of the ISOM Department as supervisor, and a sponsor contact person.

The supervisor meets regularly with the team throughout the year. The supervisor doesn't act as team leader, but he or she does monitor progress and advises as problems arise. Only as a last resort, will he/she intervene between students and the client. 4 times during two semesters all teams must present a progress report to the class and to exchange experiences.

A requirement is that the team and client agree early in the schedule on the domain of the project and on the criteria by which its success will be judged by the client. Each team organises their work itself, but it is required that each member contributes, in an identifiable way, to each of the stages of the system's specification, development, and implementation cycle.

5.3. Workload/timetable

The project size does not usually exceeds around 400 hours per student. Practically, each student should spend one day per week working on the project plus some time during the school breaks.

All projects start at the beginning of March and terminate at the mid October. Students should meet the several deadlines:

DATE	DELIVERY OF THE PROJECT
End of March	Timetable
End of May	Specification
End of September	Working system and documentation

Please note that our academic year starts in March and terminates in November

5.4. Assessment, Payments and Rights

The following table presents the assessment schedule:

Activity type	Value	Number	Total
Class presentations	5	4	20
Schedule documentation	5	1	5
Specification documentation	15	1	15
Customer satisfaction	35	1	35
Technical content	10	1	10
Project Exhibition	5	1	5
Supervisors assessment	10	1	10
		Total	100

The System Project course is a part of an Information Systems programme in our Department. Although it is expected to create business information systems in a "real-world" situation, it is not a commercial operation. No payments are made to the project team or supervising staff. The sponsor does, however, provide the necessary hardware and software environment for the project and is expected to reimburse any travel expenses in relation to the project work.

The information systems developed by the project team become the property of the sponsor organisation. The project team members and the Department ISOM, however, do have the right to use the developed information systems for educational or reference purposes.

Due to many different activities carried during the course of two semesters, the delivery of the course is quite expensive. To recover these costs we ask our sponsors for a donation, in the range between \$3.5 and \$10K NZD (approx: \$1NZD = \$0.80USD). The donation is truly voluntary but most sponsors pay it.

5.5. Course Organisation

The course organisation is divided into four parts:

- The preparations (before the beginning of the academic year),
- The initial stage (up to groups formation and projects allocation),
- Organization of the course work,
- The social part of the course,

Preparations

The preparation for the course usually starts in January each year. It includes:

- Detailed briefing of all the staff involved in the course (most likely 3 persons, depending of the number of students),
- Preparation and distribution of project requests to potential sponsors. Every year we run between 6 and 15 projects.

Through this document we offer development of a professional quality system. We ask the sponsors to provide adequate technical and office support for the students. Also we ask each sponsoring organization company to offer us a donation, if satisfied with the final product.

During preparation time we are vetting all the students who applied for admission to the course. The admission procedure is the following: Apart from predefined prerequisite courses, all students need to have good average marks. The students are exposed to the real companies and a possible failure of a project team should be avoided at any costs as would create extremely bad impression of the course (and the university!!). Besides, from our experience we have noticed that mediocre or C- average students usually are unable to cope with the loads the course is presenting, Due to this restrictions the course is not obligatory for all the IS students. It is customary that many students with border grades are called in for an interview.

Initial stage

At the first class meeting we outline all the course regulations, limitations, duties and students' privileges. The process is formalised and each students receives a very detailed program of the course and all the rules. There is number of issues which are worth to comment about these course regulations:

- As we ask sponsors to treat students as their own employees, all the students are invited to sign a confidentiality form asking them not to reveal the content of their project and other company information outside the class. This form was approved by the University of Auckland Executive Officer.
- Each student is graded individually, but the base of his/her mark is determined by the overall team performance. The team assessment is published for the whole class after each assessed activities. This increases in the significant way rivalry between teams and leads to the better overall final results. However, to be able to publish these results and to follow the requirement of the New Zealand Privacy Act 1993, we ask every student to sign a declaration allowing us to do so. It was our experience that fair marks can be given by

considering both, the direct individual contribution to the project, and the support given to the group. This is very much in line with "real world" projects, where, on a similar basis, team members are remunerated individually. Most of the teams showed genuine interest in the results of their work. The following example is perhaps the best illustration of this attitude: Towards the end of the designing stage one student was taken to hospital. Arrangements were made to allow the other team members to terminate the work in abbreviated form. Despite these arrangements, the student was later able to increase his involvement to an extent which allowed full completion of the project!

- Managing complex course arrangements require receiving on time information from the students. We had introduced so called "Required Action" (RA) activity. The RA is always not a time absorbing activity but it is essential to get timely response to the course supervisor. For instance we may suggest change of the day for particular class activity and to do this we need to have reply from every student. RAs are announced through internet and include information about specific time window for the answers. Answers before the start of the defined time slot are ignored, received after the defined slot incur penalty of 0.5p deducted from the final grade. Only documented major disasters (health or family problems) may justify the delayed response. This arrangement works extremely well in the class. Never-the-less, each year there are few students having their (usually very good grades) decreased due to collection of RAs penalty points

After the initial brief we enter a phase of informing students who the sponsors are and what projects they offer. This phase will include:

- Distributing written information about sponsoring organization and the project,
- Each sponsor makes 15 min presentation about his/her company and the project,
- Evening Sponsor's Forum is arranged where over pizzas and soft drinks students may directly ask the sponsors about their projects, working conditions, company itself, etc.

Soon after, the class is taken to a three day, live-in workshop, outside Auckland, where they are taught:

- Group dynamic skill,
- Art of public speaking,
- Business behaviour,

The programme of the workshop includes a number of activities starting from very simple exercises for 2 to 5 people to complex activities requiring planning, managing and controlling of the whole group. It is an outdoor course but not of the "Rambo" style. All the exercises require minimal physical fitness but eventual success depends upon proper planning of the exercises before, participation of all members of a team and efficient and flexible management. All exercises are set-up in a very realistic way. For example the planning session is based on developing a plan of building the next major bridge in Auckland spanning Northern and Southern parts of the city. The plan is based on the real documents issued by the Auckland's City Council.

All exercises contain four stages:

- Initial brief- when each team receives (usually in writing) the scenario and the rules of the game,
- Planning session; when teams decide which way they would go to accomplish the planned objectives,
- Execution: where the real action is, and finally,
- The closing debrief.

Involvement of instructors is substantial only in the last. Earlier, an instructor only observes the activities and intervenes in the case of a safety violation or other emergencies. Students may also ask some questions related to the interpretation of the rules (but not related to how to do the exercise). It is interesting to notice that many teams after reading the initial brief impose on themselves limitations which were not specified. For instance one of the most common trends is to only use the equipment provided by the instructors only.

During the workshop students' behaviour are also assessed and commented upon to assist them in forming optimal project teams. However we are not putting any pressure on the team content.

The workshop is run by a company specialising in outdoor activities. Before attending the workshop each student receives a detailed brief about the workshop location, necessary preparations and the content. There are costs to the students associated with this workshop but it is heavily subsidised from the donations received from the previous year's appreciative sponsors.

By the workshop's end students must form the project teams and develop a prioritised (but not binding) list of their preferred projects. This list is published to allow students having better prioritising their choices. Very often, some projects are extremely popular and besieged by the applications.

After the workshop a number of lectures are offered on topics related to the project work:

- Time management,
- Management of real ICT projects,
- Interview skills.

To enhance their relevance and to emphasise the practical aspects of these areas, these lectures are presented by working ICT consultants rather than by academics.

One week after the Group Dynamic Workshop all groups are asked to deliver their first documentation: their Project Bid.

As in the real life, projects will not allocate arbitrarily or blindly to the teams. Rather, each project team will get the opportunity to prepare their official bid stating which project they would like to take and the compelling grounds on which any particular project should be allocated to them. This is an emulation of a real life bidding process.

Only after this step and the consequent project allocations will each project team be introduced to their sponsors to commence the INFOSYS 342 project. This initial stage lasts around one month.

Coursework phase

From the end of March until mid October student teams will work on their project at the sponsors' sites. During this time they will receive guidance and supervision in the following forms:

- Four times during two semesters formal class presentations are arranged. "Formal" has a meaning of "like in the real life". Preparations for these presentations always include "dry

runs”: non-assessed presentation in the front of their supervisor, to smooth later the assessed delivery. The class presentations are recorded on a camcorder and each team gets the set of all presentations, for future reference. Students assess (anonymously) the presenters and this forms the base for the mark, after adjustments introduced by the supervisors’ team.

- Every month each team deliver a written monthly report which outlines what they did, which problems they faced and their plans for the next month.
- Each supervisor meets his/her teams every fortnight to discuss the progress of the individual projects and the grades.
- During the year students deliver two documents:
 - Project Schedule being general information what is the business problem, essence of the project and how to develop the final solution,
 - Project Specification: detailed information what they plan to do.
- 8 times during the year class newsletter is published informing the class about the results, changes in the regulations, important news and commentaries.
- Four times during two semesters each student deliver confidential report on how he/she rates contribution member of his/her team. These surveys form the base of the individual assessments.
- Just after the first semester students starts intense design work. This is usually a source of mounting tensions within the project teams. To ease up these tensions a special one day Workshop is organized. During the workshop students are able to exchange their experience and discuss the problems they faced, both internally within teams as with the sponsors. Also a more formal guidance on conflict resolutions will be offered.

Towards the end of the project work, a public exhibition of the projects is set up. This exhibition is always advertised around the university and ICT community plus mass media. Settings of the exhibition are the same as for real exhibitions of ICT applications. Each stand bears the name of the sponsor of the project and companies usually help the teams to arrange the stand.

Final stage of the work is the official handover meeting, at the company premises. Objective of the meeting is to present formally the final product and hand over the software and accompanied documentation.

Social activities of the course

In the real life business organizations set up various social actives aimed on creation bonds between employees, to relax and reduce tensions. The same concept is plied for the course and includes:

- Skit session during the Group Dynamic workshop. Students are encouraged to prepare a 20 minutes (per team) humorous performance.
- After each class presentation we organize a social gathering. It has either a “Bring Your Own” party at the University grounds or going together to a restaurant. Participation in these events is entirely voluntary and, depending of the time of the year, between 50% and 100% of the class is attending.
- The best two teams at the end of the year are getting Departmental Diplomas and gift vouchers (between \$50 and \$150 per person, depending of the year and the team place). Special plaques are prepared for each sponsoring organization commemorating their contribution to the University (signed by the Dean of the School). All these diplomas, plaques and final team results are announced at the formal dinner.

- Email distribution list is maintained and all the course graduates are encouraged to sign this list. List is used to exchange personal information and also to communicate with the former students.
- Every second year a reunion of the class is organized. All former students and lectures are invited. The next reunion is planned during 2008.
- All graduates who would end up with grade at least A- are entitled for a written reference from both the supervisor and sponsor. These references letter are highly valued among students as it strengthens their chances of securing an interesting and good paid work.
- Practically we are running an employment agency, directing students to organizations who approached us with a request for employees.

6. Results

The Information System Project course is a part in our Information System Programme. Despite the fact that students have to work very hard to succeed in this paper, the projects are very popular with our students. The ultimate value of the project work results from the opportunity to apply classroom knowledge to real life IS problems, gaining experience by:

- Exposure to the constraints and pressures of analyst/programmers life,
- Development of interpersonal skills,
- Appreciation of the value and importance of planning, scheduling of activities, foreseeing of difficulties,
- Discovery of the price to be paid for failure, or earned for success.

Every year students' survey brings many statements of the type: "It was the most difficult and in the same time rewards course I took at this University". This year ALL students gave 100% to two vital questions given to them in the end year survey:

- *I had a clear idea of what was expected of me in this course*
- *Overall, I was satisfied with the quality of this course.*

Because the students were required to exercise their intellect in responding to unstructured situations, the project was clearly an educational venture. The project sponsors are full of praise for the students. We are receiving from many of them unsolicited letters expressing their satisfaction, both with the scheme and the contribution the students had made.

The local press every year publish at least one report on one of our projects. These projects are always substantial and our sponsors are usually well known companies. We completed projects for such institutions like Hewlett-Packard, Microsoft, Cap-Gemini, RNZ Navy, District Health Board, etc.

Reputation of the course is such that all the course graduates are securing without any difficulties very interesting and good jobs.

References

Most of the texts related to content of this paper, like

- *Initial brief for sponsors*
- *Initial brief for students, etc*

are the internal ISOM Department documents. These texts are available on request.

Also see:

ISOM Department mission statement: <http://www.business.auckland.ac.nz/Departments/ISOM>.

INFOSYS 342 course outline: The University of Auckland 2008 Calendar, INFOSYS 342 p432.

Newspaper report about the course: Ulrika Hedquist, *Students Build Network Portfolio System*, Computerworld, 30 January 2006