Educating future IS professionals through real-world integration

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Abstract: We report on teaching Information Systems Analysis (ISA) in a way that takes the classroom into the real world to enrich students' understanding of the broader role of being an IS professional. Through exposure to less controllable and more uncomfortable issues (e.g., client deadlines; unclear scope; client expectations; unhelpful colleagues, complexity about what is the problem never mind the solution) we aim to better prepare students to respond to the complex issues surrounding deployment of systems analysis methodologies in the real world. In this paper we provide enough detail on what these classes involve to allow a reader to replicate appealing elements in their own teaching. This paper is a reflection on integrating in the real world when teaching ISA – a reflection from the standpoint of students who face an unstructured and complex world and of lecturers who aim to prepare students to hit the floor running when they encounter that world.

Keywords: clients; experiential learning; industry; systems analysis; teaching case.

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1 Introduction

In the past the teaching of ISA may have been regarded as a rather bland affair even by the most enthusiastic proponent as the structured logic behind core methods can sometimes dry up the most exciting of examples. However, recently a raft of case studies have been published which aim to enthuse students (e.g., see a special issue by Hackney et al. (2003)). In attempting to brighten the learning experience we have gone beyond case studies to bring ISA alive for students by immersing them in the complexity of organisational problems while adding elements of: political considerations; client difficulties; project manager relationship problems; questioning their very professionalism; the looming threat of self-designed sanctions for below standard performance. We call the approach '*real-world integration*'.

What we describe in this paper is a different approach to teaching ISA to undergraduates which was developed simultaneously (but without collaboration) in New Zealand and the UK. Relying on prior taught knowledge of core SA techniques, our classes provide undergraduate students with an opportunity to consolidate technical knowledge while experiencing the raft of process-related issues involved in deploying these techniques as part of a Systems Development Lifecycle (SDLC) group project lasting between 11–26 weeks – a constructivist approach to education (Connolly and Begg, 2006; Tetard and Patokorpi, 2005).

In the classes we aim to prepare students to hit the ground running and listening when they enter employment. We take the view that technical competence is a necessary beginning, but the skills which an IS professional relies upon are much broader (Hoxmeier and Lenk, 2003). Client management, working with a project manager, accumulating data and processing it into a format in which it can be analysed, deciding what is the client specification and designing a programme of work to meet that, working against (self-imposed) deadlines, defending a proposal against considerable pressure from paymasters, and working with a team in which skills and capabilities differ all characterise the systems development process and are addressed in different ways in our classes. We realise that others might take more radical approaches to teaching systems analysis and, through this paper, we hope to stimulate discussion on good practice and teaching innovations which bring ISA alive.

This paper reports on taking the classroom into the 'real' industrial world in different ways in three systems analysis classes. We begin by discussing our viewpoint of the need for developing process awareness in students as well as technical skills. We then introduce the three classes we lead, covering their: aims; organisation; mode of assessment; interesting features which differentiate each class from the other classes reviewed here. The discussion reflects on the classes from a variety of perspectives, for example: the real world as a classroom; the role of university staff; preparing students to have immediate impact in industry; client relations; assessment; the quid pro quo for clients.

2 Viewpoint underpinning our approach

Balancing technical capabilities and process awareness

Although useful for structuring our thinking, many methodologies for systems development (e.g., the SDLC, the waterfall model, the spiral approach) tend to reduce the process to a series of technical steps that require only analytical skills without appreciating the systemic elements and interaction of process, technology and people (Checkland and Holwell, 1997). In their description of these methodologies, textbooks often offer a raft of techniques which support analysis at each stage without equally rich discussion of the process in which they are couched. This may promote a view of systems development that only requires technical competence to succeed. It could suggest that deployment of the various techniques in a suitably rigorous and competent manner should lead to a feasible solution which may have the desired effect when implemented (assuming implementation will naturally follow design and development). Even worse, to some students it might even imply that a technical solution will have impact irrespective of the process in which is it couched. To those whose teaching is underpinned by this philosophy, we would say that systems development is never as simple as a series of technical challenges and that such a philosophy may result in a technically excellent system never getting as far as implementation due to the lack of attention given to process-related issues. From their writings, we believe we are joined in this view by others, for example, Checkland (2002), Checkland and Scholes (1999), Checkland and Holwell (1997), Ellen and West (2003), Hoxmeier and Lenk (2003), Silva and McFadden (2005) and Connolly and Begg (2006).

Many systems developments are made more problematic by process issues which require close management (Checkland, 1999), for example, a client who does not understand the basic technical issues, or a client organisation that has unrealistic expectations, or a resistant organisation which is unready for significant leaps of faith into radical systems, or a project manager who cares little for the direction and success of the project. We realise that only a few issues can be covered in depth in a single textbook, but technical competence is only part of the competence required by an IS professional – strong awareness of the process issues and a competence in their management are critical factors.

Perhaps one reason why textbooks tend to focus on techniques is that they are simpler to communicate on paper than process-related issues which require contextualising and extensive rich explanation to communicate subtle issues (not all of which can ever hope to be shared). It is even difficult to verbally provide sufficiently rich insight to some

process-related issues in a way that students can fully grasp and through which they can understand the raft of implications (Hinds et al., 2001). This difficulty led us, separately, to providing students with a class which focuses (almost exclusively) on them managing the process for themselves. Underpinning this was a philosophy that experiencing the process was a valuable way of building knowledge about it (Keeton, 1976; Kolb and Allen, 1984) – and, through lecturers influencing the environment in which the process was experienced, we can cultivate scenarios which IS professionals would encounter in the real-world thus requiring students to respond as they would if they were an IS professional. Furthermore, in creating an environment we should create a more extreme environment where assistance from a Mentor (not 'project manager' as their remit is more overseeing than management of the process) is limited, the client is less helpful than ideal, the client organisation has high demands, the complexity of the situation can only realistically be partially understood in the time available and tough choices need to be made in order to meet the deadlines. This is somewhat in contrast to the approach recommended by Keys that "sufficient instructor support is crucial to ensuring that the scope of the project is appropriate and that students make satisfactory progress" (Keys, 2002, p.49). Instead we aim for a more realistic environment where students are more independent from their instructors, risk is managed by students and balanced with benefit, technical competence is assumed to exist, and process management is fraught with complexities. We also aim to build an environment where critical thinking is developed (called higher-order thinking by Mukherjee (2004)) and reflective learning is encouraged (Brockbank and McGill, 1998), aiming to develop reflective practitioners (Schoen, 1990). This aims to build student's capacity for critically appraising options, understanding what they have done, thinking through what went well, and what they might do differently next time.

Our viewpoint is that technical knowledge alone is an unrealistic portrayal of the competencies required to deploy of systems analysis methodologies and, more widely, of the role of a systems analysis professional. If our degree programmes are to incubate the next generation of practitioners, then they should focus on the process as well as the technical content of systems development, for strength in each is demanded in the production of feasible solutions which can be potentially implemented. We believe that process management can effectively be learned experientially and that an environment can be cultivated to provide students with the richness of complexity that demands effective process management.

3 Examples of the real-world integration

3.1 Class 1: systems analysis project

This class is targeted at students in their second year of the Business Computing and Information Technology degree. The degree is business-focused and so most students do not have extensive programming skills and are likely to follow a general management career path. In an earlier 100 hours class they have been taught, and examined on, techniques for analysing systems and now they have an opportunity to put these into practice in a 11 week project (another 100 learning hours). This class, and their project, is not aimed at the production of a fully working computer system, but it is focused on the analysis and specification of a business system fitting the needs of the client.

Thus they are instructed to integrate whatever techniques they chose in what they think is the most appropriate combination in order to satisfactorily design a system for a client.

The aims of the class are:

- *technique selection and deployment*: to employ and consolidate knowledge gained in the prerequisite class in the design of an information system
- *the development process*: to gain experience of thinking holistically about a systems analysis problem – specifically the sharing and synthesis of knowledge, and the in-depth consideration of the interaction of individual elements of the problem
- *the project management process*: to give direct experience of project management and working with a project management Mentor.

The students' remit is to advise the top management team of their chosen organisation on the definition and selection of a suite of new management information systems, which will significantly improve their management of operations. This is not a case study in that they are being provided with unstructured information to analyse. Instead it a case where the students have to source the information themselves without all the structure and boundaries which invariably surround a case study (Cappel and Schwager, 2003).

3.1.1 Organisation of the class

Students work in pre-selected groups of 4–6 'Consultants' as real consultants often work in teams they do not previously know. Their role is that of a systems analysis consultant: to discover their own route to fulfilling the aims of the project to the client's satisfaction. They nominate their client and are encouraged to contact the real organisation to request information which might help them in their requirements analysis and in understanding what existing systems exist.

They have a Mentor who they meet for up to 20 minutes per week and who sometimes provides thin advice, but whose role is more to be a sounding board on whom to test ideas and think through implications of decisions. The Mentor explicitly tells students that they "will guide and help [the consultants] to decide what to do, but will not tell [them] what to do". In the first meeting the only advice from the Mentor is

> "decide on the organisation you are working for and then start your analyses. Remember the importance of methodology, and the importance of convincing others of the merits of your methodology."

The Mentor offers to groups that throughout the project they can prepare short, final versions of documents to gain additional feedback.

Their first 'group bonding' task is to rapidly agree: what company they wish to take as their client organisation; who will be the first point of contact with the Mentor; what are their 'Terms of Engagement' for the project i.e., expected levels of performance and sanctions for failing to meet these. They then have to organise themselves to agree the scope of work and then proceed to conduct the work against self-imposed deadlines.

3.1.2 Mode of assessment

The class is continually assessed through coursework. Within the first two weeks each group must submit a statement of work (Valacich et al., 2005) (10% of the marks) which

outlines their understanding of the project activities and timescales. A group viva is conducted in Week 7–8 during which the management team of the client organisation quiz the consultants on what they have done, why they have done it that way, and what they intend to do in the near future. During this viva 10% of the marks are awarded to consultants for a 15 minute presentation to the management team, 10% are awarded to the management team for their 25 minutes questioning of the consultants, and 10% are awarded to the consultants for their answering of the questions from the management team. A formal management report (no more than 25 pages) detailing all the work and findings of interest to the client accounts for the remaining 60% of the marks.

3.1.3 Differentiating features

The rules of engagement and the group viva are unusual and worthy of explanation.

- *Rules of engagement.* These are designed and agreed by each group (sometimes with guidance) and form an explicit contract against which a student's input is assessed. Inputs are often measured against the likes of: attendance; delivering on time; active participation; forewarning of absence. Penalties are often designed to be very precise and normally focus on reducing marks according to the severity and regularity of the offence e.g., a sliding scale of percentage loss depending on how many meetings are missed without 24 hours advanced notice (except through illness). Measures of output (e.g., sufficient quality) are normally not included as differences across students makes this hard to police. In a project which relies on 100% group assessment, we have found it useful if students decide their own rules up-front. The Mentor is the enforcer of agreed penalties.
- *Group viva.* We adopt a philosophy that real consultant/client meetings can often be challenging, hostile and quite unpleasant causing consultants to only want to escape unscathed and with their proposals intact. The viva aims to be a formative experience for how to react in similar meetings as well as giving feedback to help the groups to realise how they might spend their final weeks of the project. Three groups attend each viva and they are arranged to remove the ease of groups forming pre-viva alliances. Each session of vivas take about 2 hours (3×40 mins). A few weeks before the viva, students are given the following brief:
    - The group asking the questions represents the top management team and lead the viva. Their job is to intensively and extensively question the consultants to get their money's worth, refocus the consultants, and correct misunderstandings.
    - In previous years the management team have often entered the viva with prepared questions and have slavishly read these from a piece of paper. This is poor practice which shows little imagination and lack of effective preparation.
    - Any swapping of documents between groups can be negotiated. Negotiation skills will ensure that you are not worse off during the viva.

- Marks are awarded to the management team based on the overall impression given. Impression is formed, partly from: clarity of questioning; suitability of phraseology; probing questions; range of questions; working as a team in asking questions; whether bluffing answers are blindly accepted or further probed; releasing consultants off particular questions when they clearly cannot answer.
- Marks are awarded to the consultants based on the overall impression given. Impression is formed, partly from: reliance on the full set of consultants; answering questions in a co-ordinated fashion; how convincing is the defence.

The importance of very hard (but fair) questioning and crisp, pointed answers is reinforced at every opportunity in the weeks before the viva.

3.2 Class 2: information systems development project

This class is targeted at final year undergraduate students as part of an Information Science degree. It is mainly a practical group project and is a major component of their year in being a 26 weeks class across two semesters (180 learning hours). The first semester is devoted to requirements gathering, analysis and design of a system prototype. The second semester focuses on implementation of the prototype itself as well as class assessment.

The class centres on the completion of a small project for an organisation outside the university (an approach similar to Hoxmeier and Lenk (2003)). Theoretical lectures in the first six weeks form the basis of the practical skills that may be used during the project work, covering project management, project planning, user interface design, measurement and metrics, and testing. The project also starts in Week 1 and requires groups to build a fully functioning working prototype for a real client. This serves to cement knowledge gained throughout the students' degree, and is treated as a 'capstone' class (Myers, 2003).

The aims of the class are for students to:

- be exposed to a wide range of practical and theoretical issues related to information systems development
- apply this knowledge by developing a prototype information system for an external client
- prepare to work as an IS professional in a wide range of application domains, giving particular strength in commercial application development.

3.2.1 Organisation of the class

Students work in groups (of usually five), with each individual taking two roles. Primary roles may include project manager, project planner, requirements, manager, database designer and maintainer, and quality assurance manager. A secondary role is also taken by each group member that may include Software Configuration Management manager, test and review manager, documentation manager and usability manager. In addition to these formal roles, all members have to contribute to less formal roles, including: analyst, designer, developer, debugger, tester, reviewer, demonstrator and proof-reader. While students are responsible for these roles, the interrelated nature means they have to work

with others in order to succeed in their role. Groups are decided amongst the student body, and roles are decided within the group.

A Mentor is assigned to the group whose responsibility is (in less than 30 minutes per week) to provide guidance, support, and feedback to ensure successful project completion. Importantly, the Mentor is not the manager of the group – a role which one of the group members assumes. Consequently, there is a lot of independence of the group from the teaching staff. Therefore the group must decide how they will manage the project including when they are going to demonstrate the working prototype to the client. The group also has a major decision on what development environment to implement the working prototype in. The objective of this 'hands off' approach is for the group to gain real experiences related to formal group work, client communication, application of systems methodologies and the opportunity to apply what they have learned throughout their degree program instead of hand-holding them along the way.

Our approach is facilitated in conjunction with a teaching plan that requires the groups to produce specified deliverables throughout the class. Deliverables fall into two categories: system and project documentation; two or three iterations of the working system prototype. The system and project documentation is a collection of documents that both define the specification of the systems prototype and how the group will manage the process of producing the working prototype. Central to producing the working prototype is the project plan which specifies in what order the functionality of the prototype will be added until it satisfies all objectives of the system specification. The Mentor monitors the plan to ensure that incremental delivery of functionality occurs.

3.2.2 Mode of assessment

For many students, grades assigned for work completed are the motivating factor. Because of the risk of good people stuck in a poorly performing group (or vice versa), a combined assessment schedule has evolved. The balance is split as follows:

- *Individual coursework.* A theoretical essay and presentation on topics related to the process of the project, during the first semester. Feedback is received from their peers related to content presented. Five percent of the grades are awarded by university staff.
- *Group coursework*. Various deliverables are formally graded – Each piece of documentation contributes to a 'documentation grade' worth 10%. A grade of 35% is allocated for the resulting final system prototype. Ten percent is allocated for a presentation of the system prototype to Lecturers and students.
- *Individual final examination.* An examination ties back directly to the project work. This allows students the opportunity to demonstrate an in-depth, retrospective, reflective, assessment of their personal work. Commonly this will be cross-referenced to the project post-mortem by the marker. The exam is worth 40%.

3.2.3 Differentiating features

There are some features of the class are unique and reinforce that it is attuned to a 'real-world' situation.

Client acquisition

The 'real-world' nature of the project requires groups to find their own client for whom to build the systems prototype. Normally clients are small business (often less than 20 staff) in the city which is a short walk from the university campus. Maybe as a result of the strong bond between the city's business community and the university, this has never been a problem. Project groups are encouraged to find a client by Week 2. Students acquire clients using personal networks, cold-calling a business, or approaching a business which has before acted as a client. Anecdotal evidence from students indicated that they felt this task was a lot easier than expected – in most cases the first client approached agreed to be the groups' client.

The role of the client

Having agreed to involve themselves it is necessary for students to keep their client engaged in the project for no preparation or ongoing support is provided directly to the client from university staff. Since there is a major emphasis on the analysis and design phase in the first semester, the possibility of leaving the client out of this entire process is unfortunately increased – especially if the traditional SDLC model is employed. According to Mann and Smith (2004), if the traditional SDLC model is followed, within the confines of a capstone class, there is a risk that the client will only interact with students during the Investigation and Analysis stages (essentially the second half of semester 1). Traditionally clients would not have had interaction with developers during design or implementation stages, resulting in them having received no feedback until mid-second semester. Such delays meant the client could lose confidence in the group developing their information system.

To avoid this, in the early stages of the project where the tasks of requirements capture, analysis, design, and modelling are conducted, we utilise the concept of a Throw-away prototype by encouraging the students to initially create a Lo-Fi prototype (Rudd et al., 1996) of the system after the initial requirements capture and analysis. Lo-fi prototypes, especially paper-prototypes (Rettig, 1994) are powerful tools that allow designers to demonstrate their understanding of the clients' business processes and how the proposed tools support the business, not on matters of fit and finish. This allows for immediate feedback from the client as well as an opportunity to validate system requirements.

In the latter stages of the project when the actual working prototype is being developed, the focus is on building an evolutionary prototype and at certain points throughout semester 2 the group demonstrates the working prototype to the client for validation of requirements and feedback.

Logbooks

It is the responsibility of each student to maintain a log book of progress (Baker, 2003). For each week the student is expected to record the problems faced, resolution of those problems, and lessons learned. Effort spent each week on various processes and products is also recorded. The logbook is checked by the Mentor weekly to ensure that the student is involving themselves in the project but not spending too much time on certain tasks. The logbook is also a vehicle to allow the student to reflect on what they have done throughout the project and both serves as the basis for a project post mortem constructed

by the group at the end of the project and as source material that may be used to answer the questions in the final exam.

3.3 Class 3: management information systems

This is a 4th year honours class, evenly split between Accountancy and Information Science students, both groups in their final year of their honours degrees. The students would not have ordinarily met in a class before, so there is a potential for segmentation and division. The class is focussed on the acquisition of high level strategic knowledge in the domain of information systems implementation. The class is over the whole year, two 13 weeks semester (180 contact hours), the first semester is classroom activities on cases, and the second semester is the practical application of the knowledge gained in association with a live client and a real business problem. From the first moment the students are treated as young professionals and are expected to respond accordingly.

The initial instruction centres on ICT cases, where small groups (varies from individuals up to five members) are presented with a contemporary commercial problem to solve. The groups are continually rotated in personnel and size so the students learn to learn together across the potentially disparate disciplines of accounting and information systems. It is also important that they learn to cooperate with new people and respect different personalities. The class is from 8–10 am Friday so the challenge of early rising during the winter months is real. To overcome this, on several occasions breakfast is provided by the staff as both an inducement and a reward for the commitment. For the duration of the second semester teams then interact with a business and provide a professional report on an aspect of a strategic ICT implementation. The groups are totally in charge of the client relationships, project management and reporting. There are three milestones during the semester when the students are expected to report on progress in a classroom setting.

The student will develop knowledge and skills in:

- defining, designing and implementing information systems to meet corporate needs and objectives
- managing information as a resource
- the contemporary issues in ICT and their impacts on business practices
- alignment of IT and corporate strategies.

A key role of management is to design, operate and manage corporate information systems so as to achieve adequate control, responsibility, reporting and development practices within an organisation. Responsibilities for these functions usually fall to the CEO, CIO or the COO so will require the knowledge and skill of accountancy, management, information science, economics, marketing and other business disciplines. This class reflects this broad approach to information systems and will equip the student with the corporate wide and strategic views of IT and information systems.

3.3.1 Organisation of the class

During first semester the students work and research in the rotating groups on case studies (eight in total). The classroom activities are divided in three. The lecturer

provides an overview of the case and the contextual setting, the students work on the case, and a verbal report is then provided by each group. This process takes two hours. The groups, either collectively or individually hand in a two page written 'case report' for assessment three days later. The results of these case reports are handed back to the students at their class the following week. Each week as the groups rotate, a different student is responsible for the group's report – a mark is awarded to each member of the group. During 2006 the cases covered a wide range of contemporary issues – each with its own objective of focused learning imperatives. The students acquire a tool box of practical knowledge, experience and basic theory. Cases covered several topics including, systems development methodologies, choice of modern technology as a change agent, early adoption of leading edge technology vs. risk management, new technologies such as RFID and the management causes of system implementation failures.

During semester two, new groups are formed, usually four or five students. These groups interact with a real organisation. The groups have to produce a strategic ICT plan for the organisation they are involved with. Given the varied background of the students (accountancy and information science), the report must contain both technical and financial information relevant to the organisation and its development. This directs students to learn from themselves and pool knowledge in a team approach to solving the issues at hand. In no small way this replicates the reality of a professional consultancy. The lecturer in charge acts more as a consulting firm's senior partner than an academic. The lecturer develops a new relationship with groups – *one of Mentor and equal* – rather than master and pupil. In this way respect and relationships change from a standard classroom environment, to a truly business partnership.

3.3.2 Mode of assessment

Each case report in the first semester is assessed as is the second semester strategic plan. In the early case studies, students on a rational basis are responsible for the group work. In some cases individuals must hand in assessable reports. The split over the year is typically,

Case reports	$20\% = 8 \times 2.5\%$
Theory test	15% (end of semester one)
Presentation 1	10% (project outline 5% verbal, 5% written)
Presentation 2	25% (project result 15% verbal, 10% written)
Final test	30%.

3.3.3 Differentiating features

The level of professionalism and the nature of feedback differentiate this class:

Being professional

The students are treated as young professionals – in reality they are only months away from being unleashed on the commercial world. This belief evolves rapidly into a new and meaningful relationship between the student and the lecturer. It becomes one of a mentor and is founded on mutual trust and respect. That also implies one of a

professional relationship where the student and staff learn to rely on each other and meet their respective promises and commitments.

Breakfast during the lecture is trivial – but vital. In business there are deadlines and they must be acknowledged. Any student who drags themselves out of bed on a cold winter's morning at 8am is starting to act professionally and responsibly.

The rotation of groups and group members from one to five allows the students to mix and constantly learn from each other. They also experience different groups' dynamics which is a reasonable replication of a real world situation. Complacency is minimised and performance is enhanced.

Rapid feedback

Assessment is as immediate as it would be in the real world. Feedback is an essential component of the class. If students hand in on time (and NO late submissions are accepted), then the lecturer will return timely and thorough critical reports – both to individuals and to groups. Excellent reports are often rewarded with marks in excess of the maximum – this creates a very positive frame of mind in the students and encourages above average performance. Ninty-five percent of all pieces of assessment were handed in on schedule. On the other hand, assessment of the class overall by the students using standard university procedures returned a positive score of 97%.

The case studies act as the foundation for new knowledge, new ways of problem solving and real organisational problems in a contemporary context. These foundations are then built upon and exploited when the students encounter a live client in the second semester.

4 Discussion

Below we reflect on a range of diverse issues including: exposing students to the complex nature of real-world problems; the Mentor's role; student attributes we aim to develop; preparing students for employment; students being questioned by clients; the nature of assessment; quid pro quo for the client. Where possible, we illustrate discussions with quotations from recent students which were collected through formal student feedback processes.

4.1 The real-world as a classroom

Rather than providing all the structure and boundaries which often surrounds case studies (Cappel and Schwager, 2003; Naumes and Naumes, 1999), *real-world integration* aims for students to define their own boundaries in the face of tremendous complexity and almost unparalleled freedom. Within the limits of their academic degree, freedom is provided through them: finding their client and/or defining their project; negotiating terms with their client/Mentor; setting the timescales; deciding what should be given to the client and when; deciding whether to trust the 'designated authority' of the Mentor. As in reality, they are ultimately answerable to the client, and if their approach is unconventional but delivers client value then it is a success.

The aim is neatly captured in a student's comment that their project

> "provided the whole team a unique opportunity in which to place each aspect of the class and some of the real world workings involved in system development. It has provided an environment in which the team has had to work together as a cohesive team carrying out the lifecycle in a series of trials, learning experiences and progressions along the way."

However, instead of just bringing the real-world into the classroom, Classes 2 and 3 take the classroom into the real-world. This guarantees accurate replication of the environment in which IS professionals operate (Ellen and West, 2003).

Another reality is that other people may not prioritise your project as highly as you do. This is evident when a client takes more time that is reasonable to respond to requests for information. We have noticed that often students wait for this information to materialise always thinking that they deserve it just because they asked, or thinking that the information is always available in university assessments and so it will appear for this one too. As Mentors we often need to encourage groups to make progress despite the lack of concrete information.

4.2 The role of the mentor

The role of University Lecturer is quite different to that of Mentor and often students struggled to realise the difference despite reminders. This especially seems the case when the students have before encountered the Lecturer during their degree teaching a class that lends itself to a more formal lecturing style. The root of the differences between Mentor and Lecturer is that instead of clarity and direction (that comes from a Lecturer) in our classes the Mentor tends to bring unrealised complexities and unexplored alternatives which can succeed only in confusing an already problematic situation (i.e., encouraging a more reflective learning approach (Brockbank and McGill, 1998)). This lack of clarity and structure did cause some students to resent the Mentor who, in their opinion, "could have been more helpful and give more specific info to help groups" but this is something we have resisted for supportive working environments are not guaranteed in industry. Sometimes groups have even been observed to withdraw from the Mentor by using them less and less, instead of learning how to work more effectively with them. More specifically, some students would have liked "more information in the beginning!" and generally "more clarity in what is required", specifically "more clarity on what to put in a management report and how to tackle the assignment".

However, some students did seem to appreciate that this was a different sort of class where 'lots of autonomy' and "[the requirement of] a lot of independent learning" eliminated the strong directive role of Lecturer. Part of this is students having to agree matters themselves concerning the management of the process and delivery of the product/service due to the 'freedom of scope'. However, this point reinforces the importance of managing student expectations early in the project, and reiterating the nature of the Mentor's role when unreasonable requests for support are made. On the topic of role-playing 'consultants' or 'mentor', we did not observe O'Toole's (1992) suggestion that students might trivialise the subject if (for example) University Lecturers are involved in role playing and, thus, are more aligned with Kerr et al.'s (2003) view that Lecturers are best influencing the experience through active participation.

4.3 Student attributes we aim to develop

On personal attributes, we aim that by the end of their projects students will be: eager to continue learning and open to new knowledge; open to innovation in thought and practice; able to plan and prioritise their own work; able to self motivate and self monitor; able to critically evaluate their own work and the work of others; able to exercise independent thought and judgement; able to find, filter, organise and synthesise and apply information from a variety of sources; able to bring rigorous analytical, logical and methodological skills to structured problem solving; able to apply current knowledge in analogous circumstances; willing and able to solve unstructured problems; creative, adaptable and flexible when faced with novel circumstances; ethically responsible in their actions.

On interactive attributes, we aim that by the end of their projects students will be: able to work constructively as part of a team; able to lead others and delegate responsibility when appropriate; able to negotiate effectively; willing to fairly consider the views of others; able to interact effectively with people from a variety of cultures; able to communicate formally and informally with diverse audiences in oral, written and electronic forms.

4.4 The preparedness of students

A main aim of *real-world integration* is preparing students to 'hit the ground running' and be able to make an immediate impact when they move into industry, which for many the students should be on completion of the project (even for students in Class 1 who spend the entire third year of their degree in industry). Students appear to appreciate this:

> "it has been a really invaluable experience – it allowed us to get a glimpse as to what it is like to build a working system in the real world. We better understand how much work is required, the general process of developing a system and have learnt many other things that textbooks cannot teach us."

and "we believe we have learned a lot of industry related concepts which will prove invaluable once working in the field". There are several ways we aim to prepare students:

> Working closely with other individuals from diverse backgrounds for an extended duration on a single project is somewhat unusual as a student. These classes are unlike others, which require students to divide their time on other learning activities. The intensity and focus on the project allows student to absorb themselves in the application of knowledge, not the acquisition of new knowledge. Also, due to the size of the project they have to work together to succeed which seemed to establish stronger bonds than in less intense projects: "no exam, mostly based on group work – which makes team members help each other."

Being accountable to an external body for their ongoing progress, or lack of it, is a feature not often associated with university studies as often students work for themselves and can individually/collectively agree to miss a deadline with little more than a marking penalty. However, a client depends on on-time delivery and can levy emotional pressure on consultants who do not deliver. These tactics are used in these classes to reinforce the principle that people are relying on delivery of promised materials and ensure students know that their lack of delivery has consequences beyond their narrow world.

Consultants need to be resilient and we create different opportunities for reinforcing this, for example: when colleagues disappoint them; when they are being attacked for substandard work; when disappointing feedback hurts emotionally. All these are built into Class 1 and student groups are put under pressure to respond to criticisms – although support for this is provided by the Mentor.

In the viva, students are put on the spot by questions that they could not have expected, asked to respond to very awkward people who are challenging their professionalism and questioning whether their last eight weeks work has been spent appropriately. Although some students did "enjoy the group viva presentations", hopefully they do not experience such confrontations in industry, but they might be a little better prepared for it if they do.

Understanding the importance of documentation is something that the students later appreciated in Class 2. Despite their hesitance towards this part of the requirement, they later reflect that: "we didn't realise until the conclusion of the project how useful [documentation] it could be" and

> "now that the lifecycle is drawing to a close, the development team can grasp the needed documents, their use and their importance in each step along the way. Document preparation was lacking in this learning experience, but in the future they will be used in the correct context and enable the project to be better organized and developed."

In contrast, Class 1 students are invited, but not forced, to submit short well-written documents to the Mentor for comment and feedback. Almost no groups take advantage of this invitation – which may suggest that Class 2 might not fulfil this requirement if it were voluntary.

4.5 Talking to a client with confidence

In Class 1, the viva is meant to be an interesting event providing a new experience for students before they go into an environment in which they need to aggressively defend their ideas. Students seem to embrace this opportunity and many have demonstrated excellent analytical and lawyer-like questioning skills as well as persuasive defending abilities. Class 2 has a viva of a different type. The students demonstrate their evolutionary prototype to the client in a more formal meeting where the client is able to ask questions and make recommendations for changes to which the students are able to respond. Although maybe not designed as a confrontational event, it does force the students to defend their approach and answer pointed questions. One difference is perhaps that in Class 1, sometimes the management team appear unable to adequately challenge the consultants as they are also students. This brings the difficulty that the consultants are not able to demonstrate their knowledge and thus could score poorly on their answering of the questions. To avoid this the Mentor will put the consultants under as much pressure as they seem able to cope with through their own tough questioning. This way the Mentor can build an impression of how competent the group is – and so allocate a mark that is not dependent on the competence of the asking done by management team.

4.6 Varied assessment

These classes aim to assess factors other than technical skills (which have already been assessed in previous classes). Assessment focuses on process-related matters, for example: the actual outcome/recommendations made by the students and their appropriateness for the context; the methodology through which outcomes were developed; other matters associated with process (e.g., professionalism, communication with all non-consultant stakeholders). All assessment is continuous throughout the class, from Week 3 in the case of Class 1.

4.7 The client

Students sometimes have to be reminded that the client is not the University, nor the Mentor, but the company for which they are designing the system. In Classes 2 and 3, business clients are able to benefit directly and indirectly from the students' efforts. The clients are involved in the process of systems development and, in addition to having a designed system (direct benefit), they learn about the process of development (indirect benefit). In this sense the client becomes an intelligent customer who understands more about the concepts involved and can utilise this knowledge if they decide to progress to full system development.

Although often a significant problem for consultants (unfortunately) scope creep has never really emerged for our students (Keil et al., 1998), perhaps because of the client's awareness of time limitation and it being a student project. We are reminded of the importance of scope creep by a project manager who said to us

> "request from the customer is not a simple case of scope creep, indeed it is my opinion that the scope has crept completely out the building and got on the next train of town to be replaced by a random passing scope that saw a new niche in life and has afflicted itself upon my person."

This is perhaps a factor, which we should design into future classes.

4.8 Summary

In summary, mostly students seemed to appreciate the "chance to work on a big team project relevant to the real world", one reason being that "it gave us an appreciation of what is required to develop larger systems". Mostly students finish the project thinking that "overall, we believe the project went well". Critically, students normally reflect happily on the project they have done, particularly when they have an industrial client who may make use of their recommendations: "the final system that we developed is usable and met the requirements of the client so we have deemed this as a success" (also see Hoxmeier and Lenk (2003) for similar findings). This will provide them with rich anecdotes to brighten any job interview.

5 Conclusions

Our perspective is that students should be fully exposed to all the complexity which surrounds the job of an IS professional. What we have reported on here is our attempt to take the classroom into the real world through *real-world integration*.

We suggest that university classes should go beyond just teaching IS techniques by providing students with rich experience of managing the IS process whilst they deploy techniques in less certain environments than case studies typically offer. Through their innovative teachings and assessment, lecturers using *real-world integration* can immerse students in the complexity and confusion normally associated with IS projects. We recognise that this approach will take additional effort and bring new risks into the classroom, especially when real clients have to be found. However, these are risks which IS professionals confront each day and which our students would benefit from experiencing in a relatively controllable environment. We encourage other lecturers to share their innovative approaches for making the students' experience of IS design and development more akin to that of an actual IS professional.

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