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ABSTRACT
This paper reports on a qualitative study aimed at investigating whether Australian Information Systems (IS) students undertaking a team-based capstone subject with real clients believed the subject had enhanced their employability skills. This research is important because UK and Australian governments and industry are increasingly pressuring universities to focus more on developing employability skills. The paper makes a contribution to the literature since there are few empirical studies examining students’ perceptions of capstone subjects and none, to our knowledge, focusing on employability skills. Our study suggests that students believed the capstone subject did improve a broad range of employability skills and it also demonstrates the interrelated nature of these skills. We conjecture that the team-based, real-client model of capstone is particularly useful, compared to other capstone models, because it is especially effective at integrating the range of employability skills such as teamwork, communication, problem solving and self-management.

Keywords
Employability skills, capstone subject, Information Systems.

1. INTRODUCTION
A capstone subject is the culminating subject of a programme and provides students with the opportunity to consolidate skills and put into practice theory learned throughout their entire programme (Yue et al, 2009). Capstone subjects are often used in computing disciplines such as computer science (e.g. Dunlap, 2005; Goold, 2003; Joy, 2009) and Information Systems (IS) (e.g. Brandon et al, 2002; Davis & Comeau, 2004; Myers, 2003; Steiger, 2005; Tabor, 2005; Wei et al, 2007; Yue et al, 2009) so that students can apply the skills and knowledge gained during their degree programme in a life-like context. In some countries such as the UK computing degrees will only be accredited by bodies such as the British Computer Society if they include these subjects (Joy, 2009). Most of the academic literature concerning final year computing capstone subjects focuses on describing the structure, design and content of the subjects, as well as the educator’s reflections on their use (Dunlap, 2005; Goold, 2003; Keogh et al, 2007; Mills et al, 2008; Myers, 2003; Tabor, 2005; Wei et al, 2007). These experiences are valuable because they provide other computing educators with practical ideas on how to use these approaches successfully in their own degree programmes.

There have been few empirical studies, however, that explore the students’ experience and perceptions of final year computing capstone subjects. There are some notable exceptions. Joy (2009) reported final year students’ experience of individual projects in such areas as workload, software development methodologies used, and motivating factors. Davis and Comeau (2004) report on senior students’ perceptions (after completing an individual project in which they wrote an ERP business case and configured ERP software for simulated firms) on the learning materials and their understanding of ERP. Yue et al (2009) describe briefly students’ perceptions of using open-source software during a team-based capstone project with a real client involving both company and academic supervisors. However, none of these capstone studies focus on students’ perceptions about the development of their employability skills.

Our study aims to address this gap in the literature by exploring students’ perceptions on whether a final year undergraduate Information Systems (IS) capstone subject—involving teams in a software development project with real clients—enhanced their employability skills. Our focus on employability skills is critical in light of the growing recognition in the UK (McKinnon & McCrae, 2011) and Australia (DEST, 2002; 2006; 2007) that universities must focus more on developing these skills in disciplines including computing. Existing research suggests that work-related learning is effective at exposing students to various employability skills (DEST, 2007; Mason et al, 2006; McKinnon & McCrae, 2011) such as teamwork, communication, problem
solving and self-management. In this paper, we focus on a specific form of work-related learning—an IS capstone subject which combines teamwork and real clients—and explore whether students believed they enhanced their employability skills.

In this paper, we first define and provide an overview of the nature of employability skills and how these apply to an IS context. We then describe our final year capstone subject and our exploratory, qualitative research approach. Next we present our analysis which examines whether and how students mentioned or described improvements in each employability skill. We then finish with conclusions and future research ideas.

2. EMPLOYABILITY SKILLS FOR COMPUTING STUDENTS

There have been business and policy led initiatives in both the UK (CBI, 2009) and Australia (DEST, 2002; 2006; 2007) to define and embed employability skills in university degree programmes. There has been wide debate about the terminology in this area and, specifically, what is meant by employability skills (DEST, 2002; Green et al, 2009; Hager et al, 2002). For the purposes of this paper we use the definitions provided by the Confederation of British Industry (CBI) (2009) – as recommended by McKinnon and McCrae (2011) – and the Australian Department of Education, Science and Training (DEST) (2002) respectively:

“A set of attributes, skills and knowledge that all labour market participants should possess to ensure they have the capability of being effective in the workplace – to the benefit of themselves, their employer and the wider economy” (CBI, 2009, p. 8).

those “… required not only to gain employment, but also to progress within an enterprise so as to achieve one’s potential and contribute successfully to enterprise strategic directions” (DEST, 2002, p. 3).

Both definitions are very similar. They emphasise that employability skills enable graduates to progress in their careers both personally and also within the organisations they work. One discrepancy relates to the inclusion of attributes in the CBI definition, while DEST makes a distinction between skills and attributes: skills relate to an ability to carry out a particular task; and attributes are personal non skill-based behaviours and attitudes. We see them as interrelated. For example, confidence (an attribute) can affect an individual’s ability to apply a skill. In this paper, however, we focus on skills rather than attributes which influenced students’ development of employability skills during the final year capstone subject.

While there are slight variations in terminology, there is considerable commonality between the employability skills identified by CBI (2009) and DEST (2002). In Table 1, we synthesise and adapt these reports to arrive at a combined summary of the elements which comprise each employability skill. Table 1 shows that there is considerable similarity between the employability skills in the UK and Australian reports. The notable differences are that CBI has numeracy as a separate skill while DEST embed numeracy into communication and problem solving. Similarly, CBI does not have planning/organising (which relates mostly to project management) but DEST’s planning/organising, among other elements, includes understanding business which corresponds with CBI’s Business and Customer Awareness.

While the intention is that employability skills should be generic enough to apply to any discipline, industry or company, there is also recognition that these skills are best developed in a disciplinary context (Barrie, 2004; 2005; DEST, 2006). Many peak information and communication technology (ICT) bodies such as the ACS\(^1\) in Australia and the SFIA Foundation\(^2\) in the UK articulate sets of discipline skills for computing graduates. Other bodies also explicitly include sets of employability skills; for instance, the ACM and AIS’s Curriculum Guidelines for Undergraduate Degree Programs in Information Systems (IS2010) (Topi et al, 2010) and the Seoul Accord\(^3\). While there is considerable overlap between IS2010 and the Seoul Accord’s employability skill sets IS2010 includes some important elements relevant to the IS profession that the Seoul Accord does not; namely interviewing and negotiation. This is understandable since the Seoul Accord is designed to cover all computing disciplines but IS2010 is specifically for the Information Systems discipline.

The foundational skill categories in IS2010 correspond roughly with the employability skills in Table 1:

- Leadership and collaboration skills (corresponding with teamwork and planning/organising) are important because IS graduates often work in (global) cross-functional teams when analysing business problems and developing the software requirements.

\(^1\) Australian Computer Society

\(^2\) http://www.sfia.org.uk/

\(^3\) http://www.abeek.or.kr/accord/contents.jsp?menu_i=144&menu_m=199
Table 1: Employability skills in the UK and Australia (adapted from CBI, 2009; DEST, 2002)

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Communication</td>
<td>Communication</td>
<td>Effective writing and speaking; effective listening, reading and questioning; effective negotiating and persuasion; using/establishing interpersonal networks; sharing information; effective use of technology for communication purposes; effective use of numeracy for communication and persuasion.</td>
</tr>
<tr>
<td>and literacy</td>
<td>Teamwork</td>
<td>Identifying team member strengths; effective mentoring and feedback to the team; defining a role as part of the team; effective personal contribution to the team; effective cooperation, negotiation and persuasion within the team; working toward a shared goal.</td>
</tr>
<tr>
<td>Business and</td>
<td>Planning and</td>
<td>Effective use of resources; allocating people/resources to tasks; establishing clear goals and deliverables; adapting allocated resources to respond to contingencies; making decisions; initiative; engaging in continuous process improvement; understanding business, their drivers of success, systems and interrelationships.</td>
</tr>
<tr>
<td>customer</td>
<td>organising</td>
<td></td>
</tr>
<tr>
<td>awareness</td>
<td>Problem solving</td>
<td>Collecting and analysing facts and information about situations/stakeholders to understand problems; researching solutions; testing assumptions about problems; independence and initiative in identifying and solving problems; applying different problem solving strategies; developing practical, creative and innovative solutions; using mathematics (including budgeting/finance) to solve problems.</td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td>Initiative and</td>
<td>Adapting to new contexts; identifying new opportunities; translating ideas into options; initiating innovative solutions; taking calculated risks; developing strategic and long-term visions.</td>
</tr>
<tr>
<td>and enterprise</td>
<td>enterprise</td>
<td></td>
</tr>
<tr>
<td>Self-management</td>
<td>Self-management</td>
<td>Accepting responsibility; effective time management (e.g. setting priorities, timelines); articulating personal ideas; evaluating and monitoring personal performance; accepting feedback; flexibility.</td>
</tr>
<tr>
<td>Learning</td>
<td>Technology</td>
<td>Effective use of word processing, spreadsheets, computer file management and Internet search engines; learning new IT skills; organising data using IT; using IT as a management tool.</td>
</tr>
<tr>
<td>Application of IT</td>
<td>Technology</td>
<td></td>
</tr>
<tr>
<td>Application of</td>
<td></td>
<td>Effective manipulation of numbers; general awareness of mathematics (e.g. measuring, estimating, formulae) and its application in practical situations.</td>
</tr>
<tr>
<td>numeracy</td>
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• Communication skills are needed by IS graduates because they must:
  o listen to, observe and interview stakeholders and analyse organisational documents/processes in order to understand business problems and formulate software solutions;
  o present requirements and possible solutions to clients;
  o write reports and specification documents.

• Analytical and critical thinking skills (corresponding with problem solving and initiative/enterprise) are important because IS graduates must be able to analyse ethical/legal issues and risks associated with complex situations, solve complex problems, and be highly innovative and creative. They must also be able to translate ideas and stakeholder needs into various IS solution options, and apply their systems analysis skills to new situations.

• Negotiation skills (combining elements of communication, teamwork and planning/organising) are essential for IS graduates because their role involves complex negotiations with service providers, users and other stakeholders – all with competing interests and priorities. They must also have good negotiation skills within their project teams in order to work effectively.

The link between IS and problem solving is supported by other authors who have looked at IS professional skills. For example, Noll and Wilkins (2002) define problem solving in an IS context as "the ability to interpret business problems and develop appropriate technical solutions" (Noll & Wilkins, 2002). Problem solving for IS professionals also includes using processes and modelling methods to understand problems, handling abstraction, and it also requires creativity and innovation (Gregor et al, 2008).

The overlap between the skills in Table 1 and IS2010 also highlights the challenges (and arbitrariness) of defining employability skills. For example, understanding business could be listed under problem solving rather than planning and coordination since employees need an understanding of business to solve business problems. Similarly, teamwork requires excellent communication skills. What is clear, however, is that regardless of how skills and their elements are defined, students are expected by businesses to demonstrate these skills prior to entering the workforce. Further, the interrelated nature of the skills and elements implies...
that it is important for computing educators to develop learning experiences which give students the opportunity to integrate these employability skills, rather than only exposing students to subsets of the employability skills.

3. ICT CAPSTONE SUBJECTS

Our review of the literature on computing capstone subjects suggests that there are various designs which can be used. All the computing capstone subjects generally require students to produce deliverables such as specifications, design documents and user manuals, although in the UK a dissertation may also required (Joy, 2009). Capstone subjects are generally done in teams of varying sizes during a single semester (Dunlap, 2005; Goold, 2003; Keogh et al, 2007; Mills et al, 2008; Myers, 2003; Steiger, 2009; Tabor, 2005; Wei et al, 2007; Yue et al, 2009), although in some cases they might run for an entire year (Joy, 2009) and be undertaken individually (Davis & Comeau, 2004; Joy, 2009). One major area of difference among capstone subjects is that some use hypothetical or simulated businesses or scenarios (Bennett & Watson, 2006; Brandon et al, 2002; Burns, 2006; Myers, 2003; Steiger, 2009) and others use real clients (Dunlap, 2005; Goold, 2003; Keogh et al, 2007; Mills et al, 2008; Tabor, 2005; Wei et al, 2007; Yue et al, 2009). In the capstone subject analysed in this paper, students worked in teams to complete a software development project with a real, assigned client during a single semester.

In this particular case, staff placed students into project teams of six or more students with one student appointed as project manager. Since the IS programme is relatively small, most students were known personally to staff and the project leader was selected on the basis of observed leadership aptitude. The project manager was given a brief description of their allocated project, as well as the name and contact details of their client. This directive nature of team and project allocation is consistent with practice in industry.

Students were responsible for all aspects of the project including:

- interviewing clients to scope the project and to analyse the firm’s business processes and information handling practices in order to understand the firm’s problems and needs;
- designing a suitable IS solution for the business which solved the firm’s identified problem(s) and needs;
- implementing the IS solution for the business and preparing all documentation such as design specifications and user manuals; and
- managing the project and deciding on the overall approach, tools, techniques and implementation strategies.

There was a framework of deliverables over the twelve-week semester. A comprehensive document was given to students at the start of the semester which contained guidelines on the expectations of each deliverable. The industry project was worth 80% of the total mark for the capstone subject. The remaining 20% was awarded for an individual reflective essay on a project management topic which had to be illustrated with the student’s experience gained during the project.

4. RESEARCH METHOD

The aim of this study was to explore students’ perceptions of whether the IS capstone subject helped them to develop or enhance a broad range of employability skills. The primary data collection method for gaining in-depth insights into these perceptions was semi-structured interviews so that we had flexibility to explore issues which we did not anticipate when designing the interview questions.

The first questions asked during the interviews were open-ended such as asking students about their key experiences, benefits gained and challenges encountered during the capstone subject. The intention behind these questions was to see if students mentioned any employability skills they developed without being prompted. The interview then became more specific by asking students to reflect on any skills or strategies they learned regarding their interactions with clients, working within the project team, presenting their ideas to stakeholders, working with information and solving problems. It was only toward the end of the interview that specific questions relating to employability skills such as problem solving were prompted so that we minimised researcher bias.

The interviews were conducted by telephone for 20-30 minutes, were recorded if students agreed and later transcribed verbatim. For those students who did not wish to be interviewed (e.g. due to confidentiality concerns or time constraints) we provided an anonymous web survey. The survey included 12 open-ended questions which were similar to the semi-structured interview questions.
This paper reports on the qualitative responses from 23 past and current students of the capstone subject who participated in the interviews or the survey. All the qualitative responses were coded using a thematic condensation approach in which each response is categorised into certain themes around employability skills.

The participants in this study were current and past students of an IS capstone subject during 2006-2009. There were 83 past students from 2006-2008 whereby 69% were male and 82% were aged 20-24 in the year they studied the subject. Of these students only 22 could be contacted because contact details stored in the university database were no longer current. Despite this obstacle, nine past students agreed to take part in an interview and three participated in the survey representing an acceptance rate of 55%. All 25 current students (84% male and 84% aged 20-24) enrolled in the 2009 subject were invited to participate, and six agreed to take part in interviews and five completed the survey, representing a 44% acceptance rate. We have omitted a demographic breakdown of participants in this paper to eliminate any risk of participants being identified. This is also why we did not elicit demographics in the anonymous survey. For instance, it was highly likely that a specific participant could be identified if they were female or older than 24.

We also do not compare the experience of students against their final results in this paper. It is possible that this comparison could have produced deeper insights by determining if higher performing students were more successful at developing employability skills during the capstone subject. However, the design of the research prevented us from eliciting students’ final result in the anonymous survey because the research was conducted before the final results were available. This meant we could not do the comparison because we could only associate final results data for interview participants.

We were unable to examine self-selection bias (e.g. by comparing the views of those who participated versus those who did not) due to the difficulty of contacting past students and due to the anonymous nature of the survey. This is a possible limitation of the study because a typical response from past students who did not want to participate was that they were too busy. This could have been a polite way of saying they did not value their capstone experience. However, the findings reported in this paper do reflect the negative experiences of some students (e.g. ineffective project teams) and therefore suggests that the findings are not entirely biased towards students who perceived the capstone subject as an enjoyable, highly beneficial experience.

The small sample size for this project meant that comparisons between past and current students would not have resulted in reliable findings. Another limitation of this study is that self-reporting by respondents in interviews and surveys is not an objective measure of whether they had developed specific employability skills. However, self-reporting can be a valuable method for demonstrating aspects of students’ academic development (Tapper, 2004) and are argued to have merit in indicating the development of employability skills which can be difficult to demonstrate using more objective measures (Bath et al, 2004). In addition, the focus of this study was on students’ perceptions of their development or enhancement of employability skills, so self-reporting was appropriate.

5. FINDINGS AND DISCUSSION

In this section, we structure the findings concerning students’ perceptions of the IS capstone subject around the employability skills in Table 1 although we use IS2010 to help interpret these skills in an IS context. The advantage of using Table 1 is that it includes employability skills such as self-management which are not part of IS2010 (perhaps because they are of a personal or generic nature rather than being specific to IS). In this section, quotes from students are identified by an alphanumeric code for instance PS1, PS2, CS1, CS2 etc, where PS indicates past student and CS indicates current student.

5.1 Communication

Interviewing clients to gather information on business and software requirements is a key communication skill for IS professionals. For most students the opportunity to interview a genuine client provided rich learning opportunities. One student explained the significance of this like so:

“Just learning how to deal with an actual real client was a huge deal. Learning how to read people, and interviewing – not just going and reading a piece of paper and asking questions like you do in high school.”(CS3)

In other words, the student learned not only to be sensitive to the unspoken messages clients send but also developed an understanding that interviews need to be prepared for, and yet cannot be entirely scripted. This theme was elaborated by other students who discussed how they learned to structure interview questions, prepare for an interview so it was productive, and, as the following quote demonstrates, keep the interview on track in a diplomatic way:
“I’ve learnt you’ve got to make sure you get every bit of information you want and don’t let the clients continually talk on about stuff and just stick to the point about what you need but without being rude or anything like that.” (CS1)

This student demonstrates a good understanding of the necessity of controlling an interview while maintaining a good working relationship.

Another important communication skill required of IS professionals is negotiation, especially negotiation with clients around issues of project scope. One student explained his group’s experience:

“You know, the client says, ‘like, we need this and this and this’, but in the time frame we have, we said, ‘we could do this’. And we need to bargain, do a little haggling, maybe compromise a little bit here and there. But at the end we came to a good solution for both parties.” (PS3)

Client negotiation is a difficult skill for students because they often feel obliged to agree to all client requests. Students would rarely be exposed to this type of scenario unless they undertake projects with real clients, since mock business scenarios are usually scoped for students.

One of the strongest themes in the findings was that the capstone subject improved students’ presentation skills. This ability to present technical information in a non-technical way distinguishes the IS professional from other consultants. The learning afforded by the genuine nature of the presentation was a theme echoed by many students. The following quote is representative:

“I think the thing I liked the most or gained from was probably the presenting. I’ve done presentations at uni before but it’s always to students and they’re usually not really that interested but when you’re presenting to a client it’s a bit different because they don’t know what’s happening and you have to discuss it in a way that they will understand.” (PS2)

Here the student emphasises the need to communicate in a way that the client will understand. This is often a difficult communication skill for students to appreciate fully until they are faced with non-technical clients to whom they must present and be understood.

In terms of written communication, students are required to produce several professional quality technical reports as noted earlier in the paper. Students did not mention improvements in the ability to produce quality documents perhaps because by third year they have already acquired these skills.

5.2 Teamwork

Another very strong theme in the findings was improvements in the ability to work collaboratively in teams. Some students expressed this simply as an improved ability to work with others. For instance:

“That was also something else I’ve learned, and I think every other team member pretty much learnt, is that you’ve got to work in some way to get everybody working together, even if people don’t want to work together, you’ve got to” (PS1)

Since students had many opportunities to work in teams during their degree programme, this seems a surprising sentiment for a final year student. However, perhaps the intensity of the capstone subject means that each member’s contribution is vital. Indeed, some students felt their team was the best they had yet encountered:

“I have never worked in such a good team as that to be honest really. The amount of synergy, the interaction we developed over those twelve weeks to get everything done was just amazing really.” (PS6)

This student is explaining a phenomenon that occurs when teams gel, where there is a sense that the whole is greater than the sum of the parts. Indeed, considering that project groups were assigned by staff and composed of students with a variety of skills, backgrounds, and abilities this is a considerable achievement.

While the previous quotes demonstrate a focus on the team experience as a whole, some students emphasised the communication aspects of the teamwork they undertook. For instance:

“I gained a good experience in working professionally with a group of people aiming to achieve a given task at hand. I also developed communication skills which I have utilised since finishing the project.” (PS11)

While the following student emphasised the conflict resolution aspect of communication:

“There were things gained out of it, like teamwork, but… teamwork once again, certainly a lot of problem solving, conflict resolution, conflict resolution is massive.” (PS7)
These quotes highlight the interrelated nature of the employability skills; in this case communication and teamwork. Students working as individuals on capstone subjects would not be exposed as effectively to this combination of skills compared to students working in teams.

Some students were able to analyse their experience further and identified aspects of teamwork that were important to success. For instance this student learned the importance of prioritising and delegating tasks:

“...had to work on like, timelines and milestones, and make sure everyone was committed and knew when things are due, and just working together.” (CS6)

Other students commented on the importance of “break[ing] the project down right from the start into roles” (CS8).

Another strong reported theme attributed to the improvement in team working skills was managing and motivating less productive team members. For instance:

“I think probably the most valuable thing I gained is, is how to work effectively in a team. I've worked in teams before. Some effectively and some not so effectively. But I've learnt how to, even with a couple of ineffective team members, how to make them effective. So yeah, I've learnt how to be effective in a team and make other people effective.” (CS4)

This student clearly believed his team working skills improved even though he did not elaborate beyond improved effectiveness. However, other students provided more detail on working with initially ineffective team members “you have to talk to them and constantly keep in contact with them and let them know what’s going on” (CS1). This student's quote emphasises the importance of keeping team members updated while others emphasised how they learnt to be more tactful – “It definitely taught me also how to be a bit more diplomatic when giving instructions” (CS4).

These various quotes also highlight the interrelationship between teamwork and planning/organising skills, whereby the latter relates primarily to project management related skills. In other words, students recognised that an essential part of teamwork is the planning/organising skills such as allocating people to tasks and establishing clear goals and deliverables.

Some students attributed the improvement in teamwork skills to the authentic nature of the project. One student explained it like so:

“There was a lot of team work and it's a bit different to other uni assignments where the other ones were all based around getting like a pass or a good mark whereas this one actually had real life consequences I guess. Like we were actually working on something rather than just a uni assignment and so I think everyone was a bit more enthusiastic so it was good to actually work in a team of people that were keen on doing something.” (PS2)

This student believed that the team was more motivated because the project had real consequences.

Others students attributed improvements to their teamwork skills to the experience of working in a large diverse team over the entire semester.

“I haven't been working in a team for such a long period, like, a whole semester. So, like my team skills worked up a lot.” (PS3)

However, learning to work effectively together was not always straightforward. Students were placed into groups by staff and in most cases were teamed up with students with whom they had no prior relationship. One student expressed the experience like this:

“I would say the first thing was to learn how to work with people and you know different kinds of people with different demands and needs and requirements, so that was the first thing that I learnt.” (PS4)

Group work is common in undergraduate programs but usually students are able to choose who they work with, and most often this choice is based on friendship or ethnic familiarity. So being placed in a team with “different kinds of people” (PS4) provided a rich learning experience for many students.

Not all projects were successful. Sometimes students failed to deliver a working system. Students who worked on unsuccessful projects were less sure that the project had improved their teamwork skills. This is not surprising since the primary cause of project failure is team dysfunction. Students involved in a failed project identified a number of issues including unproductive meetings (“we kind of just sat around in meetings” PS7), lack of team cohesion (“there wasn’t much coordination between us because we were doing our own thing” CS2) and a weak project leader (“we weren’t getting the kind of commitment we expected from her” CS2). Although these students may not have felt their teamwork skills had improved, they arguably learned powerful lessons about team dynamics.
5.3 Planning and Organising

In the previous section, we noted that teamwork and planning/organising skills were highly interrelated because teamwork often involves one or more team members allocating other members to project tasks, and also negotiating and establishing clear goals and deliverables within the team. In other words, when students described the teamwork skills they used during the capstone subject they also often described the project management type skills underpinning planning/organising.

Another theme which emerged from the interviews was leadership, which is implied in planning/organising (e.g. allocating people to tasks) but is an explicit skill in the IS2010 model curriculum. Although each project group is assigned a group leader who has overall responsibility for the management of the team, some groups also created formal sub-groups with leaders, while others organised the work more informally. Most groups therefore provided a number of leadership opportunities. This was illustrated in the following student’s comment:

“And there was a fair bit of delegating tasks so even though we had an official team leader they didn’t always do all the team leading I guess. And like yeah, sometimes I’d just step up and do it and help out.” (PS2)

Two group leaders shared their reflections on their leadership experience.

“being a leader is pretty much, is trying to motivate, or motivate all the team members to obviously work towards the common goal” (PS1)

“learning how to work with a team, and how to handle people without handling them the wrong way. Yeah, definitely gained some leadership skills in that respect.” (CS4)

Interestingly, these team leaders chose to discuss the people aspects of the experience rather than the planning/organising aspects. Perhaps this is because there were fewer opportunities in the degree programme to develop these skills than there were for developing planning/organising skills.

A further element of planning/organising, based on the DEST categories of employability skills, is for students to gain an understanding of business. What emerged from the interviews was that students often articulated this understanding in the context of problem solving skills, as will be shown in the next section. This further highlights the interrelated nature of the employability skills, but perhaps also suggests that in an IS context understanding business would be more appropriately listed as an element of problem solving.

5.4 Problem Solving

The following quote illustrates the relationship between problem solving and understanding business in an IS context.

“Learning about a new business - that was I think the biggest… because we had to really understand the business and analyse it in order to be able to develop something that they wanted.” (PS4)

For the most part, however, students had difficulty articulating problem solving skills due to its multifaceted nature, including high level information gathering, analytical reasoning, critical thinking and creativity.

Other students described problem solving in even broader terms such as “being able to work with a real client that had real problems with their system” (PS1) or “real-world experience and dealing with a client’s needs was perhaps the biggest experience gained” (CS10). These statements suggest students believed there was something about the authentic nature of a real project that was an important aspect of exposing them to problem solving in an IS context.

IS2010 mentions the need for IS professionals to analyse ethical/legal issues and risks associated with complex situations. A particularly difficult issue for IS professionals is dealing with clients who have preconceived ideas about a solution. An ethical professional is obliged to steer the client from what they want to what they need. This is a tall order for students, but one that some students had to deal with.

“Clients can request something for the system that is not practical or efficient for their organisation so their requests need to be analysed carefully.” (CS7)

This comment suggests a high degree of complex problem solving as well as an understanding of the ethical responsibilities of an IS professional.

5.5 Initiative and Enterprise

Due to the self-directed nature of the project, teams had to develop a level of initiative that is not typically required in other subjects. Although students did not explicitly mention initiative, some described this subject as being “… totally the opposite to what I was used to” (PS7) and that in other subjects “… you get the all the information and everything given to you up front so all the lecture notes, study guides, everything’s just given
to you” (PS5). The lack of structure was for this student “… quite a challenge and I really enjoyed that because it sort of enabled me to actually go out there and explore” (PS5). Other students described experiences such as “… sometimes you had to think a little bit outside the square to get things done” (PS6) and “we had to figure out the problems for ourselves” (PS9).

Without being aware of it, these students are demonstrating not only initiative but a range of employability skills that employers value, such as the capacity to identify, gather, evaluate and use information, and problem solving.

Another element of initiative and enterprise is adapting to new contexts. Students frequently mentioned how they could translate theory and client requirements into IS solutions … “I just learnt how to apply the skills that I’d been learning” (CS4).

5.6 Self-management
Self-management is a skill that it highly interdependent on other employability skills so most students did not explicitly report improvements in this area. Although some students believed the course had provided an opportunity to improve their time management skills including learning to “prioritise your work and stuff” (CS2), “being on time” (PS3) and “working to deadlines” (CS1). This was echoed in more detail in the following quote which highlighted the issue of not just self-management in the context of the project, but also with respect to the capstone subject within the context of other subjects being studied concurrently.

“something I learnt was I didn’t juggle this properly with my other subjects which I should have, so that is something I learned but towards the end I managed to do that” (CS2).

Another element of self-management is accepting responsibility (see Table 1) and, although students did not explicitly mention this separately from other skills, they did discuss accepting responsibility in relation to the tasks they undertook; for instance, “we chose to do it” (PS10), “Joe, one other person and myself stepped up to do it” (PS2).

Time management was also an element in interviewing clients and many students mentioned the importance of making the best use of the limited interview time.

5.7 Learning
While students did not comment on an increased ability to learn per se, many students mentioned the fact that they had to learn new skills and software; for instance, “we did it, learning by ourselves” (CS2), “not everyone had Microsoft Access skills in developing the database, so we had to learn how to do it” (CS6). These comments also demonstrate initiative and self-management.

5.8 Technology
Technology is a key dimension in the Table 1 and, as an employability skill, relates to the effective use of technology to facilitate knowledge work. In an IS context, IS2010 does not explicitly mention technology perhaps because technology is the IS professional's tool of trade; however the Seoul Accord specifies modern tool usage as a graduate attribute. Indeed, students in the capstone subject are often called upon to learn new technologies to deliver the best solution for clients. This may require learning new software languages, software packages, or utilities; as one student explained “I guess, yeah, we had to like, learn the actual program, what to use, and then how to go about designing and developing the actual system” (CS6).

6. CONCLUDING REFLECTIONS AND FUTURE WORK
This study, although small, contributes to the literature since there are few empirical studies examining students' perceptions of capstone subjects and none, to our knowledge, focusing on employability skills. Our study suggests that the participants believed the capstone subject did improve a broad range of employability skills and it also demonstrates the interrelated nature of these skills. As detailed in the previous section, students reported improvements in all of the employability skills listed in Table 1 and discussed them in terms of the IS profession as per IS2010. Future research involving a larger proportion of past and current students (relative to the total population) is needed to reduce possible self-selection bias, and future studies with participants from other university schools of Information Systems will be needed to increase the reliability of our findings. In addition, this study did not explore whether students actually improved their employability skills, but instead only student perceptions.

Despite the limitations of the study we believe there are a number of important insights for IS educators in other contexts. The results of this study, which show the interrelated nature of employability skills, emphasises the need for students to undertake at least one subject in their degree programme which enables them to experience and develop these skills holistically. Our findings suggest that if educators wish to expose
their students to a wide range of employability skills then the team-based real client project approach in a capstone subject might be the best model. For instance, one alternative capstone model which is used (Davis & Comeau, 2004; Joy, 2009) is where students undertake an individual client project. This model can encourage students to develop and improve employability skills such as communication with clients, authentic problem solving, and initiative and enterprise. However, this model will not expose students to teamwork and associated intra-team planning/organising or communication skills. Our findings suggest that IS educators and degree programme developers could replace individual client projects in their capstone subjects with team-based client projects to maximise students’ exposure to the full range of employability skills in their final year.

An alternative capstone model commonly used is team-based projects with hypothetical organisations (Bennett & Watson, 2006; Brandon et al, 2002; Burns, 2006; Myers, 2003; Steiger, 2009). This model can encourage students to develop and improve such employability skills as teamwork, problem solving and intra-team communication. The interaction with real clients can be emulated to some extent but as Brooks et al. (2002) assert “… it is not possible to capture the full scope of the messy political, procedural aspects of actual team communication. The interaction with real clients can be emulated to some extent but as Brooks et al. (2002) assert “… it is not possible to capture the full scope of the messy political, procedural aspects of actual team communication. The consequence of this hypothetical model is that students will not be exposed to the authentic complexities of client communication (e.g. negotiating project scope) and of business settings which are part of planning/organising skills. The CBI (2009) and DEST (2002) skills matrices emphasise the importance of such authentic experiences being provided in IS degree programmes.

Perhaps most importantly, our findings suggest that one quality of client projects over hypothetical projects is that students have greater motivation to learn and contribute to their team. For example, participants in this study stated they were more motivated to work in the team and believed they had improved their teamwork skills because of the real consequences for clients and the authentic nature of the problems. There will always be the issue of members in group assignments having different priorities and skills, and therefore not contributing effectively to the team. However, the findings from this study suggest that client projects could be effective at reducing this problem when compared to hypothetical projects in which there are no consequences for lack of contribution other than lower marks.

However, this model of capstone subject is not without challenges for both educators and students. It can be resource intensive for educators to manage and may not be feasible in some degree programmes, such as those with large student numbers. First, suitable projects and clients must be found. To facilitate this we have developed a relationship with a community resource group which is able to invite, on our behalf, expressions of interest from local community organisations. An academic staff member must contact each potential client to determine if the proposed project is of sufficient scope and complexity to be suitable for a group project. Second, considerable time is required by staff to assign students to teams and to assign an appropriate project manager to each team. This requires a staff member to assess the subjects each student has completed during their degree programme—there is considerable flexibility for students to choose subjects in our degree programme—and to carefully balance teams in terms of skill mix and abilities. Third, a challenge we have faced in recent years is a lack of students with advanced technical skills. We have addressed this by encouraging students to use and customise open-source software to meet clients’ needs (interested readers are referred to Keller & Lamp, 2010).

The findings also indicate that students’ employability skills development during the capstone subject is not uniform. More specifically, each student appeared to develop skills at different depths depending on their role in the team, the dynamics of the team, and the nature of their project. For example, different team roles such as client liaison and programming were often undertaken by members with more confidence in those areas. This means that students may constrain their development of some of the employability skills if they are not encouraged to take on project roles which are outside their area of comfort. This issue can be mitigated to some extent by staff requiring all team members to undertake certain roles such as presenting to clients and taking on leadership for particular aspects of the project. Similarly, students whose projects fail (due to weak leadership, team dysfunction or scope blowout) may become disillusioned and may not gain the same benefits in terms of skill development as students whose projects are successful. Staff can reduce these risks to some extent by exercising due care in assigning team leaders and selecting clients/projects and by monitoring the student projects and by encouraging team members to change roles.

In summary, our study findings suggest that the unstructured nature of team-based client projects have the advantage of exposing students to realistic team, project and client problems which require them to develop and improve a wide range of interrelated employability skills. However, the findings also imply that this unstructured environment means that staff cannot ensure that each student is able to develop the same set of skills at the same level. This emphasises that employability skill development cannot be left until students undertake a capstone subject, but instead should be developed throughout their degree programme. More specifically, we believe that every subject in a degree programme should take on the responsibility of
developing one or more employability skills. In this way, by the time students undertake the capstone subject involving a team-based client project they will have a sound skill-base on which to integrate the full range of employability skills within the one experience.

This paper has presented students' perceptions of their generic skill development in an IS capstone subject. Further studies, however, are needed to capture other stakeholders' views including the graduate employers and the clients of the capstone subjects. In addition, it would be useful in future research to explore the graduates' reflections on whether the capstone subject helped them to gain employment and whether the employability skills learned were beneficial in their new work roles.

7. REFERENCES


