CREATING A REALISTIC EXPERIENCE OF AN IS PROJECT: THE TEAM OF TEAMS APPROACH

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Abstract

This paper describes a final year project course that has been provided at the University of Tasmania and at Deakin University. The technique used has been called the team of teams approach. Unlike many project courses that emphasise the technical issues this course is more evenly focussed on the people involved in the project and the client. Students are formed into relatively large teams of between 9 and 16 and tackle a challenging, realistic project during a single semester.

KEYWORDS

IA01 IS Curriculum, EE02 IS Project Teams, CB0904 Communications Software

INTRODUCTION

It is considered desirable that all undergraduate students have some form of large project experience before graduating [1,11,14] However, it is virtually impossible to replicate the workplace within a university course. Time constraints, cost, variability of experience, equipment, the work environment and knowledgeable project managers are not readily available to construct an artificial project.

Surveys of employers have shown that the qualities that they consistently favour most highly in graduates relate to their communication skills, teamwork and their technical writing skills, besides their basic technical knowledge [2,5].

The team-of-teams approach presented in this paper was first described by Keen et al [19] and the use of a specialised computer mediated communications system by Lamp and Goodwin [20]. This paper consolidates these previous papers and includes 1999 data which was not previously available.

BACKGROUND

The Australian Business/Higher Education Round Table [2] conducted a survey in 1992 in which both businesses and universities were asked to rank the desired characteristics of graduates. (Table 1).

Desired Characteristics of Graduates	Rank Business	University
Communication skills	1	7
Capacity to learn new skills and procedures	2	5
Capacity for cooperation and teamwork	3	8
Capacity to make decision and solve problems	4	3
Ability to apply knowledge to workplace	5	4
Capacity to work with minimum supervision	6	6
Theoretical knowledge in a professional field	7	1
Capacity to use computer technology	8	2
Understanding of business ethics	9	12
General business knowledge	10	11
Specific work skills	11	9
A broad background of general knowledge	12	10

Table 1. Desired Characteristics of University Graduates

This survey indicates that business and universities differ in two major areas:

1. Communication skills, a capacity to learn new skills and procedures, and a capacity for cooperation and teamwork. In each of these cases the universities' rankings are well below those of business.
2. Theoretical knowledge in a professional field and a capacity to use computer technology. In these cases universities have rated these characteristics much higher than business.

A survey by the Australian Department of Education, Employment and Training [5] in 1990 asked 226 IT professionals to rank tasks according to how essential they were to the performance of their jobs. (Table 2). In this survey only 8% of respondents indicated that they had learnt to determine client needs from formal academic training, and just 2% had learnt to establish a project team from academic training.

Task	Essential	Mean time spent (hrs/week)
Determine clients needs	91%	2.45
Identify information strategy	91%	2.51
Identify problems in system	94%	2.69
Establish project team	93%	2.33
Define process functions	92%	2.73
Correct errors, testing	93%	2.57
Establish restore procedure	94%	2.15
Implement logic	91%	2.68
Write program from specifications	90%	2.93
Perform acceptance test	92%	2.29
Assist users	90%	3.07
Run help desk	90%	3.10

Table 2. 12 Most Essential Tasks of IT Professionals

A number of other studies [9,15,16] also identify the need to shift the emphasis in this way. This trend is also supported by a survey of IS job advertisements that appeared in the *Australian* newspaper over the past 20 years [12] and by feedback from significant recruiters [3].

One should not expect a university education to be an apprenticeship, nor to be intensive skills training. However, exposure to professional skills can enhance students' employment opportunities, and prepare them to have an open mind to the demands placed upon them by employers.

SPECIFIC ISSUES FOR SYSTEMS DEVELOPMENT

In addition to the traditional time, cost and performance measures, Lai[7] identifies a number of human-oriented characteristics that are essential for good systems development:

- Project Managers as Team Builders
- Complementarity
- Communication
- Commitment

Zahniser [13] has described a Teams-of-Teams approach to software analysis and design, called Design by Walking Around (DBWA). This requires three paradigm shifts:

1. From independent knowledge workers to a cross-functional team
2. From two-dimensional to multi-dimensional system modelling
3. From linear to concurrent development

COURSE STRUCTURE

The one semester IT Project course at the University of Tasmania has been offered since 1994. This course is offered in the final semester of the three year degree. All students taking the IT Project course have completed 5 semesters of professional development. [8].

A number of separate technologies were used together to support the teams: email lists, IRC, file servers. This had met with limited success. At Deakin University the computer mediated communications (CMC) tool, FirstClass [18], was used. It was hoped that using FirstClass, with its single consistent interface for all such functions, would be easier and more effective.

Each year different project topics have been used. These project topics and objectives are chosen to be:

- relatively open ended
- challenging
- aimed at the production of proof of concept systems, rather than fully developed solutions

Each project has a real client, to whom the project results are to be delivered. Students are strongly encouraged to be client focussed by adoption of the following criteria:

- Close interaction must be maintained with the client throughout the project
- The client and students have joint ownership in the project and its outcomes
- All key decisions affecting the outcome of the project must be made in consultation with the client

The project subteams are expected to resolve their interpersonal problems through conflict resolution and negotiation techniques. They may not pass these problems on to the client. The course coordinator only intervenes in these matters when absolutely necessary.

TEAM-OF-TEAMS COMPOSITION

The team-of-teams approach is based on a team size of 9-20 students. Each team has the same overall structure (Figure 1), although the actual numbers assigned to each subteam may vary with the problem area and number of enrolled students.

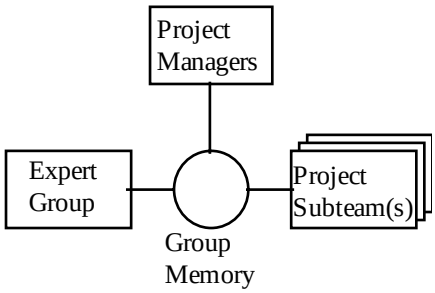

Figure 1. Team-of-Teams Structure

There is a group of 2-3 Project Managers whose primary task is to oversee the conduct of the entire project, and manage the mechanical aspects of the project and maintenance of project monitoring documentation. Project Managers should be good communicators.

There is a group of 2-3 Experts who are required to study the appropriate technology and tools required for the project. These must be mastered very early in the project life cycle, so that they can act as consultants to the project subteams later. Experts should be good at gathering and assimilating new material, and be capable of effectively communicating what they have learnt to others.

The remaining team members are split into Project Subteams, with 3-4 students per subteam. These students will perform the bulk of the project definition, analysis, design and implementation.

Students are assigned to teams by the course coordinator. As much as possible the teams and subteams are structured to be equitable in gender, ethnic background and academic ability. In particular, friends and close relatives are split across subteams.

TEAM-OF-TEAMS PROCESS

At the commencement of the course students receive a one sentence outline of the project from the course coordinator. All subsequent project and requirements definition is obtained directly from the project client.

The Project Subteams commence the work of developing the project definition and progressing to the preliminary design of the project. Each Project Subteam completes this exercise in parallel. The subteams are encouraged not to be competitive. The

Expert Group becomes familiar with the relevant technical material, reading manuals and associated documentation, and using software tools.

The whole team then meets to discuss the various preliminary designs, and determine the most appropriate design.

In the second phase the Project Managers determine the tasks required to complete the project, assign tasks to the Project Subteams and develop a task schedule. They may wish to restructure the Project Subteams, depending on the complexity of the various tasks. As much as possible concurrency of task execution is encouraged, with information sharing between Project Subteams coordinated by the Project Managers.

COMPUTER MEDIATED COMMUNICATIONS AT DEAKIN UNIVERSITY

Deakin University was established in 1974 with a charter to provide both campus based and distance education opportunities throughout Australia. It rapidly gained a reputation for excellence in distance education programs.

Evaluations of CMC at Deakin [31] and other educational institutions around the world [21, 22, 23, 24, 25, 26, 27, 28, 29 & 30] indicated the benefits of increased interaction between students, and the opportunity to work collaboratively to build knowledge and understanding of course content. The key tool was FirstClass. This system is also used by the UK Open University. [32]

An advantage of CMC is the visibility of each team member's contribution for the team participants and the academic staff. These tools are designed to improve communication while alleviating negative reactions. [17] With asynchronous communication extrovert personalities cannot dominate completely as in a face to face situation. More reticent students can still contribute. Straus [33] suggests that this equalisation effect is caused by the ability to participate simultaneously.

Asynchronous messaging results in automated documentation, which provide corroborating evidence of students' activities without imposing additional work. The file repository function ensures that each team member has access to files under development. The conference structure (see fig 2) is hierarchical, reflecting the team composition. The top level is open to all participants in Information Systems Project.

Each team also has their own conference. Access to the team conferences is controlled. This allows each team to operate in a secure environment Each team conference contains a general forum and further subconferences tailored to their needs. This was generally two work areas for the subgroups, a file repository for progress reports and a subconference for the work diary.

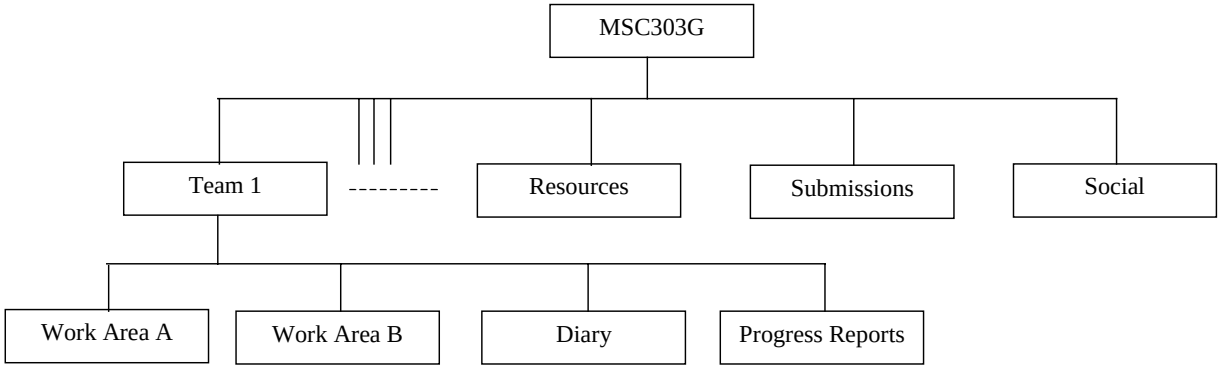

Figure 2 The hierarchical structure of the CMC environment for Information Systems Project.

ASSESSMENT OF STUDENTS

Table 3 shows the marking scheme used by the University of Tasmania. The marking scheme has components for individual, team and subteam marks. A component of the mark for the Project Managers and Experts is based on the overall team aggregate mark and an assessment of these groups' performances by the other students.

Assessment For Project Subteams	
Business Plan (B)	10% for each subteam
Preliminary Design (P)	10% for each subteam
Final Design (FD)	5% team mark
Implementation and Testing (I)	30% team mark
Documentation (DC)	10% team mark
Individual Report (IR)	15% for each individual
Reviews/Walkthroughs	20% for each individual
Assessment For Expert Group	
DTD (D1 & D2)	25% group mark
Aggregate mark	40% based on the marks obtained by the Project Subteams (for assessments of FD, I and DC) and evaluation of the Expert Group by the Project Subteams
Individual Report (IR)	15% for each individual
Reviews/Walkthroughs	20% for each individual
Assessment For Project Managers	
Evaluation, Plan, Progress Report (E & PP & PR)	25% group mark
Aggregate mark	40% based on the marks obtained by the Project Subteams (for assessments of FD, I and DC) and evaluation of the Project Managers' Group by the Project Subteams
Individual Report (IR)	15% for each individual
Reviews/Walkthroughs	20% for each individual

Table 3. IT Project Assessment Scheme

CMC DATA COLLECTION

An instrument was used to collect the students' opinions of CMC. Statistics on the number and location of messages posted to CMC were also collected. There was very

good acceptance of the use of CMC. Students found FirstClass easier to cope with than using generic internet tools. All students participated in its use and the vast majority used it more than once a week. (see Tables 4, 5 and 6)

Technological aspects of FirstClass:	easy to use	somewhat easy to use	somewhat difficult to use	difficult to use
How easy did you find FirstClass?	43	11	0	0
How easy have you found using generic internet tools?	15	13	18	8

Table 4 FirstClass compared to generic Internet tools

How often did you participate in the computer conferencing?	
not at all	0
a few times all semester	3
about once a week	3
about a few days a week	24
about every day	23

Table 5 Extent of use of CMC

Did any of the following concerns become problems in the unit?	no problem	minor problem	moderate problem	major problem
The use of CMC took more time than it was worth	32	19	1	1
I didn't receive enough training in FirstClass	35	12	5	1
I couldn't get access to a computer when I needed it	21	23	6	2
There were too many technical problems with the computer or network	11	30	5	7
I had a difficult time getting help with FirstClass	35	9	2	1

Table 6 Concerns with CMC

Two things that were negatively commented upon were the automatic logout facility, and the short daily aggregate time limit – two hours. Students would work in labs on with CMC open as a background task. Off-campus students tend not to have CMC open for a long period as they connect through, and are paying, their Internet Service Provider.

	1998 Teams				1999 Teams			
CMC Area	1	2	3	4	1	2	3	4
General	219	81	347	201	141	297	134	103
Work Area A	57	58	20	49	18	7	30	44
Work Area B	32	34	32	43	6	5	65	46
Diary	40	50	21	13	4	31	43	55
Progress Reports	0	11	10	2	1	5	9	8

Table 7 Number and location of messages posted to team areas

The statistics on the number of messages posted to CMC appear in Table 7. Students were asked to rank the nature of their use of CMC from one to four against the categories shown in Table 8, which also shows the averages of these rankings. As can be seen the main use was interacting with other students about the course work. This is confirmed by the relatively minor use of the Social folder on CMC.

How did you use computer conferencing?	
for social interactions with other students	2.0
for social interactions with the teaching staff	3.7
for instructional interactions with other students	1.3
for instructional interactions with the teaching staff	3.0

Table 8 Nature of messages posted to CMC

The effects of using CMC can be seen from Table 9 as being generally positive. In this area students commented on the positive effects in the areas of communications, team building and general team interaction. They liked being able to place drafts for team comments and the asynchronous communications possibilities, but felt it added to, rather than replaced, personal contact.

How did the use of CMC in this unit affect:	increased	somewhat increased	no effect	somewhat decreased	decreased
the amount of your interaction with other students?	33	16	4	1	0
the quality of your interaction with other students?	26	25	1	1	0
the degree to which your group became a team?	27	21	5	1	0
the need for face to face meetings by your team?	5	10	16	20	3
the ease of tracking the completion of your team's project tasks?	20	32	2	0	0
the amount of your interaction with the teaching staff?	6	25	19	3	1
the quality of your interaction with the teaching staff?	7	26	20	0	1
the amount of your learning?	13	36	5	0	0
the amount of your motivation to learn?	10	31	13	0	0
your familiarity with computers?	15	17	22	0	0

Table 9 Effects of CMC on unit learning

The feeling of most students was that the experience had been a positive one. (See tables 10 and 11)

How would you rate your overall experience of CMC?	
excellent	24
very good	16
good	11
fair	2
poor	0

Table 10 The value of CMC

Would you study another unit using CMC?	
definitely yes	33
probably yes	20
probably no	0
definitely no	0

Table 11 Willingness to use CMC again

COURSE EVALUATION

The courses are evaluated by the students at the completion of the semester. Tasmanian students most strongly agreed with the following statements:

- The practical project was a useful learning experience
- The group project was a good learning experience

- In this unit I was encouraged to think
- I have learned to make connections between this unit and others
- I have developed a better understanding of client issues
- The unit stimulated my interest in the subject

Some of the comments received by students as part of this SETL evaluation are:

> Educationally, we achieved a lot; ... The experience of communicating at a professional level with peers and superiors, across many actual or perceived barriers is not one that can be taught; this and many other types of 'incidental' learning make up at least half of the benefit gained from doing this unit.
>
> The unit was really good in making us use the skills and theory we had learnt and forgotten over the last three years. There is a great difference between knowing how to do something and actually doing it.

The unit evaluation at Deakin was also extremely positive, with high scores against all of the evaluation criteria. Some of the comments included:

- difficulty of developing roles within teams
- project got easier when the teams gelled
- FirstClass was a big help
- levelling – people took positions seriously
- leadership means listening
- great working with real clients instead of straight theory out of texts for [the] whole semester
- clients are difficult to handle sometimes
- client didn't know what they wanted
- client had changing requirements
- projects slip one day at a time

The clients were very pleased with the results of their projects. One client presented Deakin with a plaque in appreciation, and students with certificates of appreciation.

CONCLUSIONS

The team-of-teams approach has proven to be a very useful structure through which students have learned a great deal about teamwork, practical project management, and sharing information, as well as completing the technical requirements of the project.

The students rapidly appreciate that apparently simple tasks can become very complex. The initial optimism is tempered by the reality of the tasks they must complete. However, commitment to high quality output has been evident in all project teams. Students have gained a very real appreciation of each of the major human-oriented aspects of software development projects given by Lai[7].

The team of teams approach successfully scaled up to a much larger institution than the University of Tasmania where it was originally devised. The opportunity to use

the CMC tool has enabled students to focus on the project rather than becoming proficient in a mix of generic and internet tools.

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