

Learning in Virtual Teams: Exploring the Student Experience

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Executive Summary

In 2005 an existing undergraduate course in project management was converted from face-to-face mode to wholly online mode. Wholly online mode means that there are no face-to-face classes at all, and all teaching and learning is facilitated through an online environment.

The revised project management course was designed with an underlying problem-based learning (PBL) pedagogy and used a simulated, fictitious telecommunications company, United Enterprises (UE), as a case study learning resource. The students worked in virtual teams to complete online learning activities and to solve authentic project management tasks for UE. Employees of UE were available online to provide direction and answer further questions about the tasks.

The overall research study used an action research methodology in which feedback was elicited from two groups of stakeholders involved in the project management course - students and teaching staff. The feedback was used to plan, develop and implement the new Information Technology (IT) Professional Practice course.

This paper reports on the findings of three anonymous student surveys that were conducted after each of the main project management topics and tasks were completed. The surveys sought feedback in a number of areas. However, the feedback reported here relates specifically to student opinions about their experiences of working in virtual teams within the learning environment. Other aspects of the research, including student perceptions of UE and feedback from the teaching staff, are not reported here.

Across the three surveys, most students indicated that they valued the opportunity to discuss various aspects of the course with peers and teaching staff online, and to interact with real-life employees of UE. Although discussion forums were the prescribed method for communication other forms of communication such as email, chat and face-to-face meetings were also used. According to the students, the best things about online group work were that it provides the flexibility of

time and place; it allows communication and participation to be recorded; and is an 'efficient' way of working. The worst things about online group work were that communication is more difficult and that team members leave participation and submission to the last minute. While up to 15 percent of students did not like the experience of online group work at all, overall students were generally satisfied with this style of learning and

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enjoyed the experience of working collaboratively within a virtual team.

The research has highlighted a number of areas where improvements can be made to the student experience of working in virtual teams. These improvements will be adopted in the development and delivery of the new course as part of the action research study.

Keywords: Virtual Teams, E-Learning, Drupal, Problem-based Learning, Experiential Learning, Lifelong learning skills.

Introduction

Virtual teams, also known as distributed collaborative teams, comprise of people who interact using telecommunications and electronic means to complete a particular organizational task (Edwards & Wilson, 2004). In the IT sector there is an increasing use of global virtual teams, where members are geographically and culturally dispersed (Massey, Hung, Montoya-Weiss & Ramesh, 2001; Powell, Piccoli & Ives, 2004). In the IT industry major companies are developing software through the use of virtual teams (Last, 2003). The ability to communicate effectively with team members, to work in a team to solve problems, to negotiate with colleagues and resolve conflicts, and to collaborate with culturally diverse members, are skills that are required of members working in virtual global teams. According to Lynch (2004), one of the greatest concerns for employers of IT graduates is not the graduate's lack of technical skills, but the lack of skills required to work effectively within a collaborative IT team. These types of professional skills are difficult to teach. An excellent way for students to practice these skills is to provide them with the workplace experience and to create opportunities where these skills are required of them.

In a literature review of virtual team research, Powell et al. (2004) identified 12 short-term studies that used student subjects. Virtual team success was found to be linked to team-building exercises; establishing of shared norms; and the specification of a clear team structure. According to the review, relationship building, perceived team cohesiveness and the level of trust are other factors which impact on the level of satisfaction when working within these types of teams. Last (2003) describes four themes - relationships, attitude, dialog and trust - and the associated cohesive attributes that emanated from her research of global teams of students in the Runestone Project. A number of studies have suggested how student virtual teams might be supported by teachers (see for example Fåhræus, Chamberlain, Bridgeman, Fuller & Rujelj, 1999; Last, 2003; Salmon, 2000; Whatley, 2004).

An investigation of Problem-based Learning (PBL) suggested that it would be an appropriate underlying pedagogy for providing the workplace experience and teaching the lifelong learning skills that are developed by students working in collaborative virtual teams. There are characteristics of PBL that closely emulate the workplace: authentic, open-ended problems are presented; the students work in groups to provide appropriate solutions to those problems; and problem-solving, teamwork, communication and leadership skills are practiced. In PBL, teachers are facilitators of learning and they provide the appropriate scaffolding as and when required. The computing industry in particular has a number of characteristics in common with PBL: computing is problem driven; lifelong learning skills are required due to the rapidly and continually changing nature of the industry; computing crosses discipline boundaries; and project groups are the pre-dominant mode of operation (Ellis et al., 1998).

This paper reports on student experiences of a course that used an innovative PBL approach (Goold, 2004) and was delivered wholly online. The research presented here is part of an ongoing study to develop a better experiential online learning environment for students to practice their professional skills. This paper reports specifically on one of the sub-goals of the study which was to gain an understanding of how students interacted with the new environment, particularly as members of virtual teams. Three student survey questionnaires were used to collect the data.

The paper is structured as follows. The next section provides some background about the course, including details about the learning environment and the student teams. This is followed by a description of the study that sought to elicit feedback from students undertaking the course. In the last sections of the paper the results of this feedback are discussed, limitations of the study are identified and conclusions are drawn.

Background

Project Management and Information Systems is a third-year undergraduate course undertaken as part of an IT degree at Deakin University, Australia. The course is structured around the PMBOK framework (PMI Institute, 2000). Prior to 2005, this course was taught in face-to-face mode with traditional lectures, tutorials and practical (laboratory) sessions. Assessment for the course consisted of a formal exam and three assignments.

In Semester 1 2005 the course was converted to wholly online mode. The assessment and much of the course content remained the same, but the delivery of the learning materials and the way in which students interacted with faculty and course resources were quite different. The underlying problem-based learning approach, and the use of a fictitious organization United Enterprises (UE) as a case study, created a new and innovative type of online learning environment. UE was created to give students a work place setting (context) where they could work as members of IT virtual teams to solve authentic problems for UE. The UE organization had a number of employees who could be contacted to help out with any queries. The UE employee roles were played by the teaching staff.

At the start of the semester students were grouped into teams by faculty. There were 21 teams, each with about seven students.

The course covered three main topics:

1. People in Project Management

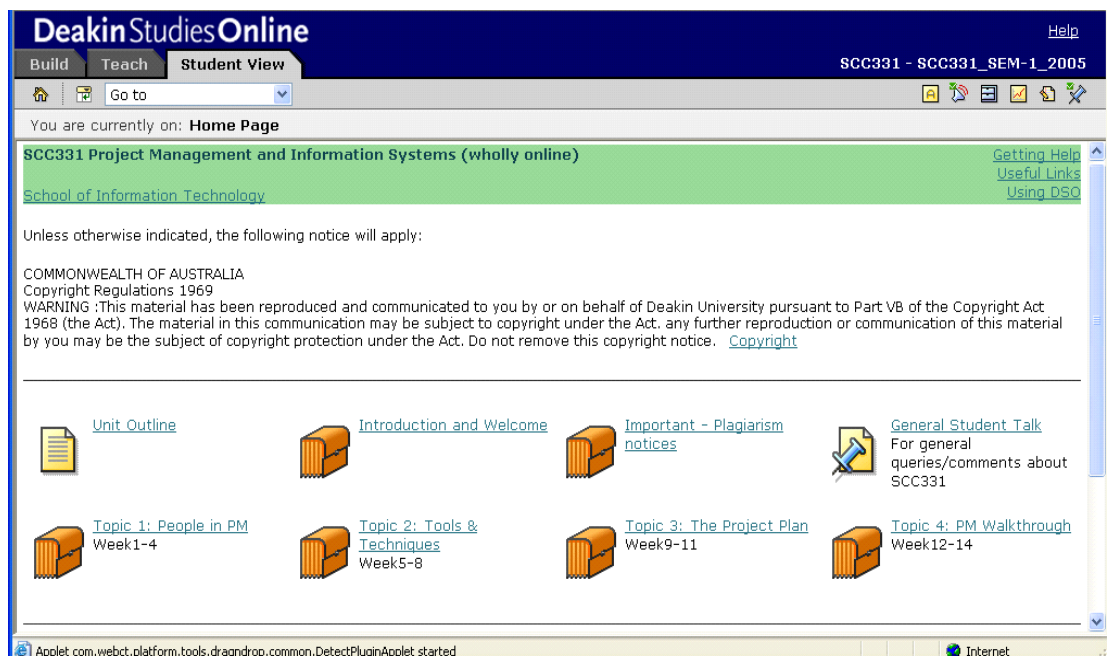


Figure 1: The DSO interface

2. Project Management Tools and Techniques
3. Planning and Managing IT Projects.

For each topic, students were required to discuss particular aspects of the topic, to complete group activities and to complete an assessable group task.

The course was made available through the University's e-Learning platform known as Deakin Studies Online (DSO). DSO is powered by WebCT Vista and is used for content provision as well as providing a number of other features including discussion forums to facilitate student collaboration. A course interface in DSO is shown in Figure 1.

The United Enterprises Organization

The United Enterprises website was created as a separate entity outside of DSO to provide students with a realistic organizational context in which to solve project management tasks. It was made available to students through URL links in DSO. UE was created using Drupal, an open source discussion-based tool. The UE website contained information and documents relating to UE, its functions and staff. Fictitious UE employees had their own page on the website and students could access these pages and post messages. The front page of the UE website is depicted in Figure 2. Each of the virtual teams of students had access to their own discussion within UE. Students were able to participate in group work through discussion boards and they were able to post items in a blog-like fashion that could then be commented on. Arguably the ability for learners to subscribe to communication within a learning environment is an extremely significant factor in the success or otherwise of that context (Farmer, 2004).

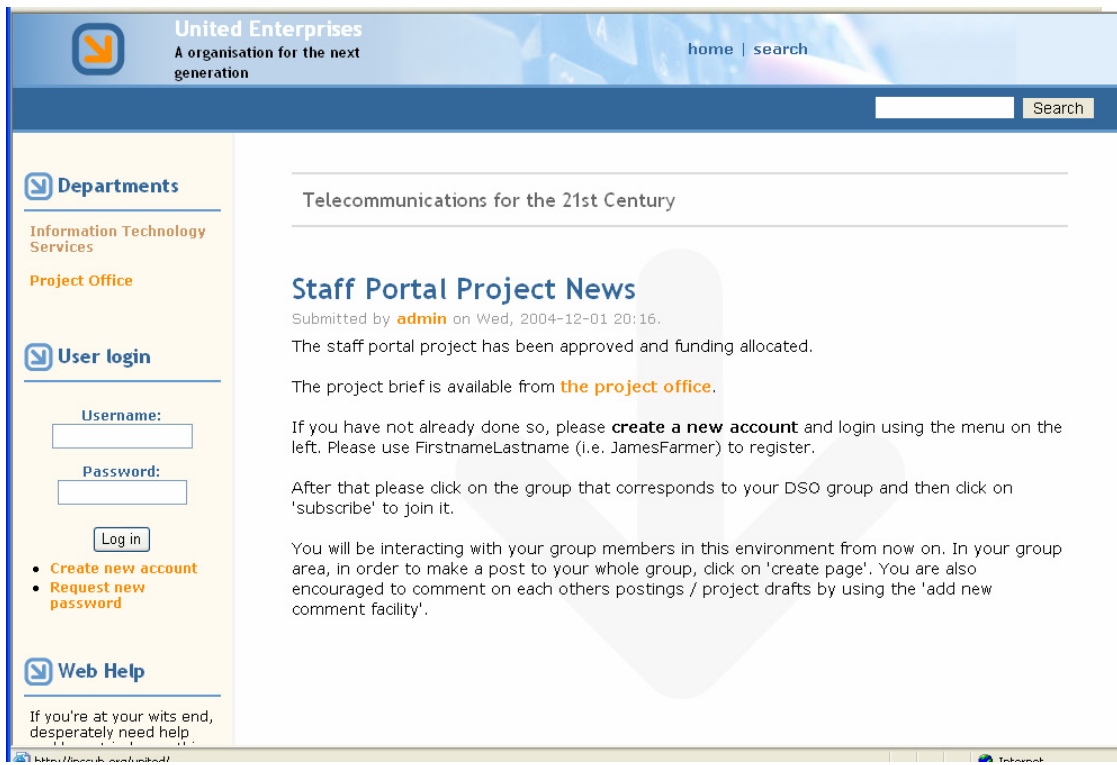


Figure 2: The UE interface

Course Content and Student Tasks

The three main topics of the course – People in Project Management; Project Management Tools and Techniques; and Planning and Managing IT Projects - each had an associated assignment (problem) and students were required to work as a virtual team to provide a solution. A fourth topic, essentially a review of the course in preparation for the examination, was also provided. Topic 4 was optional and had no assessment or group work component associated with it.

Topic 1 spanned four weeks of the 13-week semester. Students were asked to get to know the members of their virtual team, complete a basic online personality test and combine these results with an outline of their technical skills in a proposal to their team about how they would contribute throughout the semester. Subsequent discussion resulted in the election of a leader who was responsible for coordinating the work that contributed to the team's first assignment. For the assignment students were asked to review the curriculum vitae of UE employees and then to outline and justify which of these employees would be suitable to work on a proposed network integration project. The discussion, collaboration and submission of this first assignment task took place in DSO. The resources on the UE website provided the information to be able to solve the task.

In Topic 2 students were required to explore the four core functions of the project management framework: scope, time, cost and quality (PMI Institute, 2000). They completed readings and posted messages to their team's discussion area in DSO. They worked together to complete the four tasks within set deadlines.

Topic 3 focused on planning and managing IT projects. Students developed a project plan that required them to draw on their combined knowledge gained throughout the course. The project plan was in response to a tender document published on the UE website. The team was encouraged to conduct the collaboration and discussion in the team collaboration area within the UE website. Teams were also encouraged to contact UE employees to clarify any queries they had about the tender document or the work that they were required to do. The UE employees were the course teaching staff, role playing as employees of UE.

The Study

The overall study used an action research approach (Reason & Bradbury, 2001). 'Action research is an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action intervention, and reflective learning' (Avison, Lau, Myers & Nielsen, 1999). As part of the study, feedback about student satisfaction with course resources and the learning environment was elicited at the end of each of the three topics covered. Students were asked to complete a voluntary, anonymous online survey questionnaire. The survey was set up as a URL link in DSO.

Each survey questionnaire consisted of between 20 and 40 questions. Most questions required respondents to select an option from a seven-point *Likert* scale indicating the level of agreement with the corresponding statement. Several short-answer questions were also included to allow respondents to offer feedback in their own words. Table 1 shows information about all three survey questionnaires, when they were delivered and the rates of completion. The completion rates are higher than those for comparable University-wide voluntary online surveys.

The three surveys focused on particular aspects of the topics and on specific aspects of the learning experience. All three surveys asked the same questions about the experiences of teamwork and working within a virtual team. This paper reports on results pertaining to these common questions. Student reporting about other aspects of the course are generally not discussed here.

Table 1: Survey Questionnaires and Completion Rates

Survey	No. of Questions	Date	Total Enrolled	Surveys Completed	Completion Rate
1	22	Week 4	146	64	44%
2	39	Week 8	141	52	37%
3	37	Week 13	138	50	36%

Survey 1: People in Project Management

Overall Topic 1 provided students with resources about IT project teams and the different types of types of roles performed by members within IT teams. The staff section of UE provided information about UE employees and their roles and responsibilities to put the resources in context. Survey 1 focused on exploring the students’ attitudes towards learning in a virtual team and their views about the content of Topic 1 and the UE organization.

Survey 1: Results

Figure 3 shows a breakdown of the types of technologies that students indicated they had used to communicate with one another whilst completing tasks relating to Topic 1. Respondents primarily used the DSO discussion boards (n = 62) to communicate with their team members. However, a third of respondents also used email and chat programs to work with their virtual team, despite the fact that these were not supported within the DSO or UE environments.

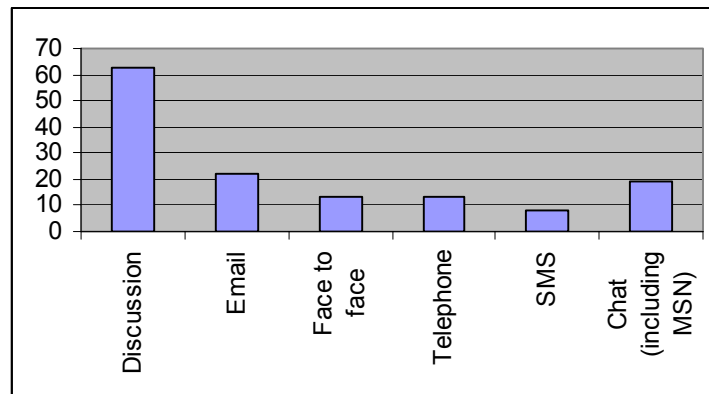


Figure 3: Preferred technology

The results indicated that on average students felt that they learnt more through discussion with their peers and teaching faculty than they did by using the prescribed text or doing the readings alone.

Figure 4 shows results for question that asked students to indicate how much they enjoyed working in face-to-face groups (Mean= 5.5, Std. Dev=1.321). It contrasts these results with those to a ques-

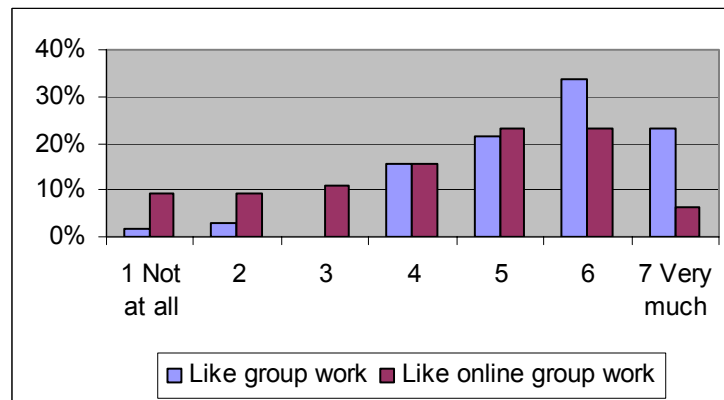


Figure 4: Enjoyment of group work

tion that asked students to indicate how much they enjoyed working in an online group, such as the virtual team they worked in for Topic 1 (Mean= 4.32, Std. Dev=1.749).

Whilst on average, students enjoyed working in a group in a situated classroom setting, most were less enthusiastic with working in a group within an online environment. The overall trend depicted in Figure 4 shows however that more students have a positive opinion about online group work than a negative one.

One of the activities in Topic 1 involved the creation and publication of individual biographies in the team discussion space in DSO. This exercise enabled students to get to know the members in their virtual team and to learn about their team members' strengths, weaknesses and technical abilities. Overall students were positive about this exercise and felt it helped them to get to know the members of their team

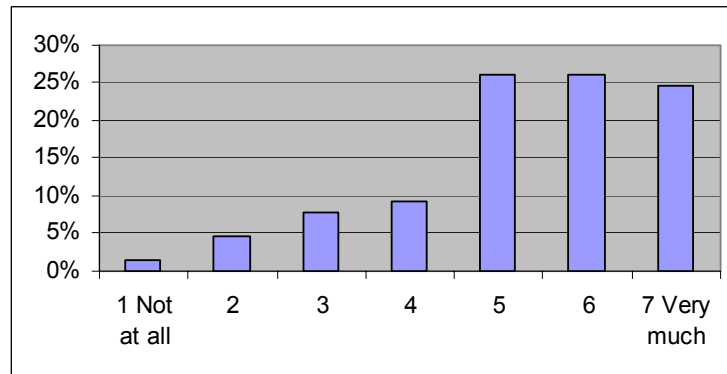


Figure 5: Getting to know group members via their biographies

(Mean= 5.28, Std. Dev=1.496). The results are shown in Figure 5.

In Survey 1 students were asked to write in their own words what they thought were the best and worst things about working in groups online. The responses are summarized in Table 2.

Table 2: Best and worst things about online group work

Best things	Worst things
Can work at any time any where	Discussion response time delay
Good communication which is quick and promotes equality	Team members prone to leave participation and submission to the last minute
Record of communication and participation	Misunderstandings due to text communication
Efficient, saves travel time and allows for no excuses relating to non participation	Harder to communicate than face to face discussion

Survey 2: Project Management Tools and Techniques

Topic 2 provided students with resources on project management tools and techniques. Survey 2 asked for feedback about the topic and about their virtual team. At this stage the students had been working together for eight weeks. The results of Survey 1 prompted more questions to be added to Survey 2.

Survey 2: Results

One of the standard questions asked in each of the three surveys was about the technology used in communicating with their virtual team. The results for this question in Survey 2 are depicted in Figure 6. The results for Survey 2 mirror the trends seen in Survey 1 (Figure 3). As expected, most students used the DSO discussion forum ($n = 52$), with some also using email and chat to facilitate communication with their team, an option not available in the learning environment.

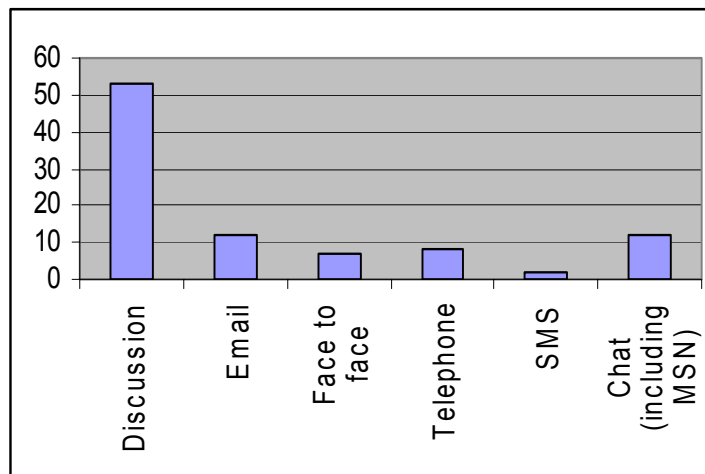


Figure 6: Preferred technology

Another set of questions that were asked in both Survey 1 and Survey 2 related to whether students enjoyed working in groups in general, and in online groups. For Survey 2 the approval rating for working in groups online shifted from being generally positive to being marginally positive with an increase in dissatisfaction, as shown in Figure 7 (“Like group work”, Mean=5.40, Std. Dev=1.609; “Like online group work”, Mean=3.57, Std. Dev=1.681).

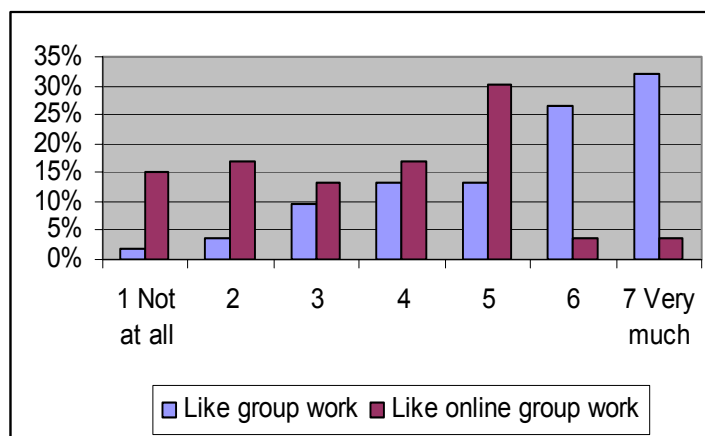


Figure 7: Group work and online group work

Survey 2 invited students to offer any comments they had about learning online during Topic 2 and respondents reiterated several main themes:

1. some team members were not participating or tried to join discussions just prior to deadlines;
2. the poor English skills of some team members made communication difficult;
3. teams should be self-selecting.

Responses to the survey question that asked students to indicate the amount of work they had done compared to the rest of the team can be seen in Figure 8 (Mean=5.08, Std. Dev=1.41). Many students felt that they had done slightly or considerably more than others and this finding is consistent with the first theme expressed in the general comments.

An analysis of results to a question exploring whether students experienced any technical problems when using DSO found that some students experienced problems. However, no clear trend emerged with responses spread relatively equally across all options in the distribution.

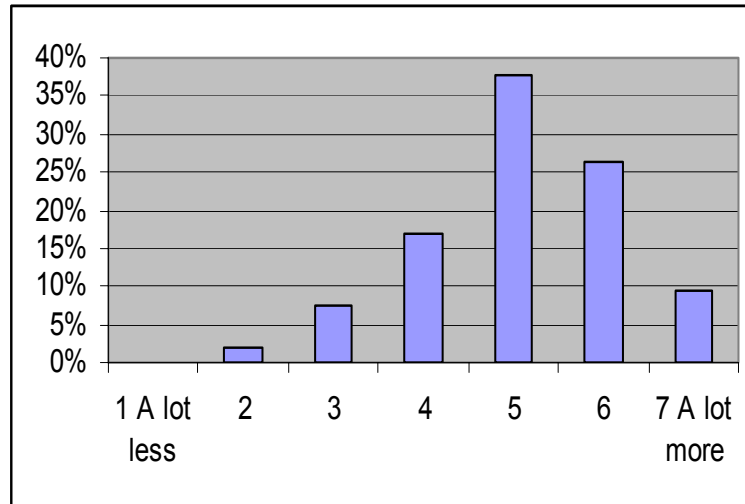


Figure 8: Comparison of workloads

To further explore student dissatisfaction with group work, respondents were asked whether they preferred to complete assignments alone. There was no strong trend either way. The majority of responses were neutral with only a slight skew in the distribution toward a preference of working alone on assignments (Mean=4.32, Std. Dev=1.837).

To rule out the mode of study as being the cause of dissatisfaction, the survey asked respondents to indi-

cate whether they enjoyed learning in an online environment. This question also produced a majority of neutral responses with no clear negative or positive trend evident in the distribution.

As with Survey 1, respondents were asked to indicate how useful the course resources were to them as study aids for Topic 2. While the general comments in Table 2 indicated that there was too much reading required in the course, responses indicated an increased preference for learning by reading course materials. Results showed an increase in approval for the course textbook (Mean=5.00, Std. Dev=1.547) and readings (Mean=4.74, Std. Dev=1.430) and a decrease in approval for discussion with their peers (Mean=4.36, Std. Dev=1.744) and discussion with teacher (Mean=4.34, Std. Dev=1.358). It should be noted that responses rating discussion as a learning resource were still on the whole quite positive

One alternative to text based learning materials, video lectures, was broached in the survey to gauge interest for possible inclusion in future offerings of the course. A statement asked students to indicate whether they thought they would use video lectures if they were provided. The results indicated a very positive opinion about the possibility of using them in future (Mean=5.40, Std. Dev=1.597).

The students' ability to rely on their team members to help complete tasks and assignments was another concern raised in the general comments. However, when asked to indicate whether they felt they could rely on the members of their team to complete the assigned tasks, respondents were largely neutral or slightly positive in their response (Mean=4.30, Std. Dev=1.526).

Survey 3: Project Planning and United Enterprises

The course culminated in each virtual team producing a project plan as part of Topic 3. Students were encouraged to collaborate within the UE discussion environment and to use the UE website as both an information resource and as a tool for communicating with UE employees if they required clarification. Survey 3 focused on the UE environment and the overall perceptions of the course.

Survey 3: Results

As with Survey 1 and 2, respondents were asked to indicate how they communicated with their group. The results are shown in Figure 9.

Despite being encouraged to work in UE for the duration of Topic 3, students continued to work in the familiar DSO environment. The trend for usage of other technologies to support collaboration mirrors those seen in the two previous surveys (Figures 3 and 6).

As in Surveys 1 and 2, students were asked to indicate how much they enjoyed working in their online group. The results for Survey 3 appear in Figure 10 (Mean=4.00, Std. Dev=1.738). Approval for online group work increased in comparison to the results from Survey 2 (see Figure 7).

Unfortunately, 15 percent of students did not like working in their online group at all. Further analysis was done based on the portion of respondents who responded with a '1' as their enjoyment of learning in their online group. Data for this subset of student was plotted for all survey questions and general trends across several questions showed that these students had slight or extreme difficulty working within UE. One survey question asked students to indicate whether they preferred working in UE compared to a face-to-face learning environment. Students in the subset analyzed, disagreed strongly with this statement (Mean=1.63, Std. Dev=1.168).

As with the previous two surveys, students were asked to indicate how much work they had done for Topic 3 in comparison with their teammates. The majority of students provided a neutral to positive response (Mean=4.70, Std. Dev=1.282).

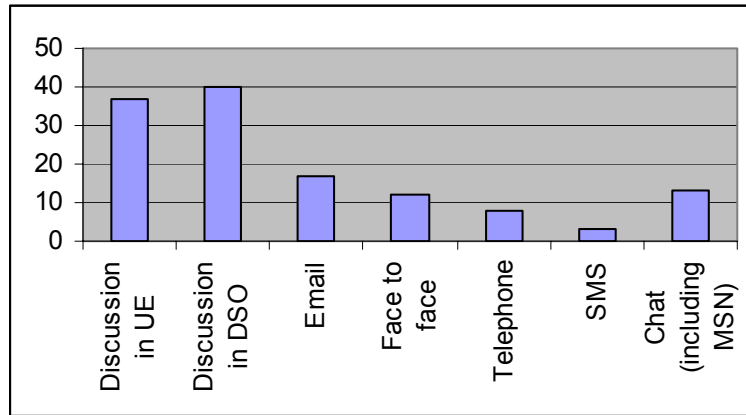


Figure 9: Preferred technology

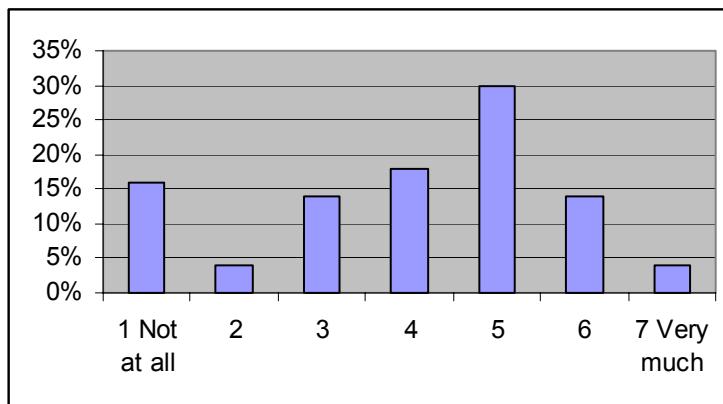


Figure 10: Opinions about online group work

Discussion

Overall the survey results showed that students enjoyed the experience of working in virtual teams. The perceptions of students in Survey 1 were that learning online provides flexibility in terms of time and place that on campus study cannot provide. Such flexibility is valued by students who are juggling studies with work, family and social commitments. These findings are consistent with the literature (Morse, 2003; Singh, O'Donoghue & Worton, 2005).

Student opinions about working in groups in a face-to-face learning environment were constantly positive indicating that working in groups is a valued part of the university experience for most students. Although the approval rating for working in groups online was also positive, it was

however lower than the rating received for face-to-face group work. According to the review by Powell et al. (2004) there are mixed results here from the literature, with some work detecting no difference, other work detecting more satisfaction with traditional teams; and other work again suggesting that virtual team satisfaction improves over time. The review indicated that satisfied virtual team members were more likely to have had training and used more communication methods. The student feedback does suggest that some current practices and technologies relating to group work of the current implementation of the course need to be improved.

Students supported the use of the 'get-to-know-you' exercise. These types of activities 'make the group more cohesive and trusting of each other' and 'may also help lower anxieties and resistance and resentment of using these learning activities' (Pena-Shaff, Altman & Stephenson, 2005, p426). At present this is the only team building type of exercise implemented in the course. Students may benefit from participating in additional exercises throughout the semester that focus on building rapport and mutual understanding. Providing guidelines for how to communicate effectively in a virtual team, and the reasons for these guidelines, can assist here too (Last, 2003). This supports the view that training contributes to virtual team satisfaction (Powell et al., 2004).

Students reported that discussing course content with their peers and teachers in the virtual environment helped them to understand the subject matter. Results indicated that on average students value discourse more than traditional means of content transmission such as readings and texts. The suggestion of additional resources such as video lectures received a very positive response from students who felt they would use them if they were provided in the online environment. Although video lectures as such are not appropriate for UE, there is nevertheless a need to provide a richer, more visually appealing environment and to provide resources in flexible formats to accommodate different learning styles.

While online learning and virtual teamwork offer flexibility of time and place, they also require the student to be self motivated and disciplined. Student feedback provided through the short-answer questions indicated that some students were frustrated when team members did not contribute or left their participation in group discussions and activities to the last minute. In each of the three surveys students indicated that they felt they had done just as much if not more work than their team members. It would be interesting to explore these group interactions further for evidence of social loafing (Terveen & McDonald, 2005).

Assessment issues also need to be addressed. Assessing the individual contributions of team members in projects is a challenging task. This is true of work done in face-to-face teams (Hayes, Lethbridge & Port, 2003) or virtual teams (Fåhræus et al., 1999). Although most activities were assessable in the project management course, the relatively small portion of marks allocated for each task did not serve to motivate all students to provide quality input in a timely manner. The motivation of credit is usually needed to persuade students to participate online (Fåhræus et al., 1999; Pena-Shaff et al., 2005). In the Pena-Shaff et al. study (2005) it was found that even a 10% grade was not sufficient to motivate all students in participating in online activities. Equitable distribution of work and participation remain goals to strive for when learning in a virtual team. At the same time, these types of problems provide further opportunities for students to practice their negotiation and conflict resolution skills.

A related issue raised by some students was team selection. The lack of participation in discussions by some members prompted some students to comment that they would prefer to select their own teams. Unfortunately, given the numbers involved in this course (almost 150 students) and the amount of content that must be covered in 13 weeks, this is not feasible from an administrative perspective. Further, self selection of teams does not reflect what happens in the workplace.

The technologies used in the course in DSO and the UE website proved to be satisfactory. Students experienced some difficulty using the UE website for discussion and collaboration in Topic 3. The latter may be a contributing factor for the 15 percent of students who did not enjoy working in a virtual team at all. A detailed evaluation of the UE website is beyond the scope of this paper but it should be noted that the UE does require improvement to provide a more usable and intuitive interface in future.

Students indicated that they regularly used email and chat programs to communicate with their team. Providing integrated chat facilities within the online learning environment would streamline the communication process for students. Asynchronous communication tools are useful because students can edit, reflect on and restructure ideas (Fåhræus et al., 1999; Pena-Shaff et al., 2005; Redfern & Naughton, 2002) but synchronous tools are more suitable for brainstorming activities where group decision making is required (Fåhræus et al., 1999; Redfern & Naughton, 2002). Effective tools for synchronous collaboration are currently lacking in DSO and the UE website. The introduction of integrated synchronous collaboration tools will allow for faster, easier collaboration amongst virtual team members, particularly for solving open-ended problems. A number of tools have been proposed and independent pilot studies of these tools are being conducted at present.

The face-to-face version of the project management course has traditionally had high student evaluations (above 80%). The student evaluation for the course dropped 15% with the conversion of the course to online mode. Although the rating is somewhat disappointing, the rating is still at the higher end for online courses at our University and is consistent with what happens when a course is offered for the first time or is markedly different from previous offerings. What is encouraging is the evaluation data regarding lifelong learning skills - written communication, problem solving, and ability to work in a team. Students rated all of these above 75%. These were all slightly above ratings for the previous face-to-face version of the course.

Limitations of the Study

The overall research was undertaken to inform faculty about student perceptions of a particular wholly online project management course, and the research reported here relates specifically to students' opinions about group work and virtual teams. Student feedback was considered to be very important for the planning of the subsequent IT professional practice course. The findings are therefore valid for a particular cohort of students, those studying the revised project management course in 2005. The findings are not generalizable but may be of interest to others involved in teaching online IT courses.

One of the major limitations of the study is that only the perceptions of students who responded to each survey are reported. The opinions of those who did not respond (56% for Survey 1; 63% for Survey 2 and 64% for Survey 3) and the eight students who withdrew from the course were not included. It is possible that the non-respondents may have entirely different views from those who did respond. Also, those who did respond may be students who were more interested in the course and were more active online. It is not clear how these students might view virtual group work and thus produce either positive or negative bias in the results. Anecdotal evidence suggests that high-achieving students prefer to 'do it alone'.

A second limitation of the study is that other factors which may influence perceptions of group work and virtual teams were not taken into account. Some 60% of the students undertaking the course were international students who articulate into the second or third year of IT programmes. Some of these students have limited prior experience of group work, poor English skills and need time to familiarize themselves with the University online environment (DSO). All of these factors detract from their learning experience and may influence their perceptions of group work and

how the project management course was delivered. The lack of technical skills, the lack of suitable access to the Internet and social loafing within virtual teams are other confounding variables which may have contributed to perceptions of group work and virtual teams for the entire student cohort.

Conclusion

This study highlighted that learning and participating in a team environment, both face-to-face and online, is a valued part of the student experience at tertiary level. Providing students with an opportunity of working within virtual teams in a simulated working environment allows them to experience the major mode of operation within the IT sector, the IT virtual team.

The overall action research study is continuing with further phases of planning, development and evaluation. The paper here has presented only one aspect of the first phase of the study – the self-reporting by students interacting with the new environment. Student feedback has identified a number of issues and concerns relating to group work and virtual teams, and these issues and concerns will be addressed in the new course in 2006. Every offering of the course will undergo a cycle of evaluation by all of the stakeholders so that the course continues to deliver the most appropriate type of learning opportunity for students who are about to embark on their professional careers.

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Biographies



Annegret Goold is a lecturer in the School of Engineering and Information Technology at Deakin University, Australia. Prior to joining Deakin in 1993 she worked as a computer programmer, analyst, technical writer and trainer. At present she teaches introductory IT, software engineering, project management and IT practice. She is also involved with supervising projects in the capstone course. Her research interests align with her teaching areas as well as in computer science education - particularly in online teaching and learning.



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