Making a Virtue out of Virtuality: Team Working in Distributed Environments

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Abstract: *This paper discusses the development of a new course within the UK Open University's undergraduate degree programme in Computing. The course, "M253: Team Working in distributed Environments" is intended to provide students in a distance learning environment with experience of working together as a team in a problem solving context, giving them an appreciation of the general issues involved in team working and the additional difficulties that arise when the team is not co-located. The paper presents some of the issues faced in designing the course and its associated assessment, and indicates some areas for future work.*

Key words: *Distance Learning, Teamworking, Virtuality, Asynchronicity, Product versus Process*

INTRODUCTION

There are frequent complaints from business leaders that the new graduates that they employ are lacking in a number of key areas, such as communication skills and the ability to work in teams. A recent example appeared in a Skills for Business feature on page 14 of The Times newspaper for 22nd March 2005 which stated that "*In our recent survey of 13,000 employers, over half felt that the education system was failing to equip people with the skills necessary for today's workplace*" and went on to say that "*It could be argued that two or three or more years solely in educational institutions don't give learners a capacity to make their way in the world of work. Especially if they are not taught other complementary skills such as communication, team working, customer relations, IT skills or management and leadership*"

Traditionally it has been argued that such skills are best learned in the workplace rather than the college. Increasingly however, in subject areas such as Computing, there has been pressure from professional accreditation bodies like the British Computer Society (BCS) to ensure that substantial teamworking activities are included in undergraduate programmes of study in the UK [1].

The Department of Computing at the Open University has a long tradition of presenting courses spanning the whole range of academic computing provision, at both undergraduate and post graduate level, but until recently has not offered a route leading to a named degree in Computing. However, the recent reorganisation and rewriting of courses to provide such a route, and the intention to ensure that the degree should meet the criteria for BCS accreditation, led to a reappraisal of the situation and a decision was taken to include a second level course in Teamworking within that degree programme.

In the context of business in general, and software engineering in particular, recent developments in technology and in business practice mean that "*Virtual teamworking is already commonplace and is rapidly becoming essential as organisations work in an increasingly collaborative way*" [3]. Since OU students work predominantly in a distance learning environment, and are used to the idea that much of their interaction with their course materials, their tutors and their fellow students is carried out using a variety of means of electronic communication, it was decided at an early stage in the design of the course that we would attempt to make working and cooperating at a distance an important dimension of the teamworking experience provided by our new course.

THE CHALLENGE OF VIRTUAL TEAMWORK

A recent review of the literature on virtual teams [10] provides a list of significant issues that need to be considered when operating in virtual teams. These include the need to establish shared norms and shared knowledge; provide a clear team structure and explicit intermediate goals; achieve a sense of cohesion and trust arising out of shared social information, maintain a social focus as well as a task focus; and develop clear decision making processes. Other issues that have to be addressed include: team size and the allocation of members to teams; diversity, including gender differences; project duration and schedule; timeliness and effectiveness of communication; asynchronous activity; leadership; and conflict resolution.

GROUPS OR TEAMS?

In much of the research and commercial literature the terms *group* and *team* appear to be used interchangeably, and in many computing degree programmes students are involved in activities described as group work. We would argue that there is a significant difference between the two terms, which is summed up in the words of two of the leading exponents of virtual teams, Jessica Lipnack and Jeffrey Stamps "*What are teams? The step from small groups to teams is short and simple. Teams exist for some task-oriented purpose. Orientation to task is what distinguishes teams from other small groups. While purpose is fundamental to all groups, teams are specifically, deliberately, and invariably about results*" [7, p 57] In a subsequent footnote they re-emphasise this distinction "*An oft-quoted research definition of teams offers the three small-group characteristics together with a task-oriented purpose: Teams are distinguishable sets of two or more individuals who act interdependently and adaptively to achieve specified, shared, and valued objectives*". [7, p 290]

The majority of group work courses that have been reported on from existing degree programmes in Computing take place in a predominantly face-to-face environment (e.g. [6], [9]). They tend to centre on the collaborative development of a piece of software, the role of the group being essentially to allow a somewhat larger and more complex software artefact to be produced than would generally be the case if an individual student was involved in the task. The assessment of such group activity tends to focus more on the quality of the product, and on the documentation and presentation of that product, than on the process by which it was created.

Since M253 is only a 10 credit course, we have attempted to decouple the process from the product, and to treat the teamwork elements as our primary focus, with the software elements providing a vehicle rather than constituting the ultimate, assessable deliverables. This approach is one which is supported by an excellent book on computing projects which encapsulates the findings of the EPCOS Project. Their recommendation is to "*consider awarding academic credit for successful accomplishment of tasks rather than assessing the products of those tasks*" [4, p 218]. In M253 we have attempted to encourage the establishment and maintenance of team identity and individual commitment to the team by emphasizing both team and individual reflection on their success in handling the major issues of teamworking, namely Roles, Responsibilities, Rules and Relationships.

As is frequently the case in other institutions, our teamworking course M253 forms part of our second year degree programme, since there is a common (but probably unfounded, see [9]) perception by the more able and motivated students that the grades they are awarded for such a course will be held down because of the lack of effort or ability

of their fellow group members, and will adversely affect their final classification. We have provided an assessment package in which the balance between team and individual contributions is approximately equal. However, the overall result for an individual student is recorded as a Pass or Fail and does not contribute to their ultimate degree classification, although the actual marks gained are made available to the students.

VIRTUALITY

Most existing surveys and reports indicate a half-hearted approach to virtuality (what we might term semi-virtuality) since they indicate that teams should be brought together, both initially for the purpose of team formation, and subsequently whenever anything critical or final is required (e.g. [7], [10]). Alternatively they presuppose the existence of two or more small co-located groups cooperating over a distance (e.g. [2], [5]). Since neither of these options is available to us in the OU context, we have decided to make a virtue of our inability to bring team members together, and have gone wholeheartedly for the concept of remote working, with teams made up of isolated individuals, pushing the concept of virtuality towards its limits in terms of the spatial distribution of team members. Taking this approach even further we decided to dispense with the OU's usual regional tutorial structure, and have randomly allocated individual students to their teams, and teams to tutors, on a nation-wide basis. Communication for the initial presentation of M253, which commenced in February 2005, is carried out using the OU's First Class conferencing system, with which students are already familiar.

TEAM FORMATION

Because we are working in this extremely virtual environment it is important to get students committed to their team at a very early stage. Warming up exercises are supposedly critical to team formation, and are often part of the face-to-face activity used to establish teams and to allow individual team members to gain knowledge of, and confidence in, fellow team members prior to commencement of work on the main tasks for which the team is being set up. We have included an initial 3 week formative phase in the course, mirroring later project activities, to help teams to get acquainted, and to establish effective working practices in a non-assessed, non-threatening environment.

One of the important issues in teamworking is the time that it takes to create the working relationships that allow the team to be successful. "*The proper metaphor – living system or machine – is critical to the understanding of virtual teams. It is hard enough to get face-to-face teams to happen, to 'jell' over time. It is doubly hard for virtual teams. Teams grow. They take time to develop – and virtual teams tend to take even longer. Ironically, they don't really have the time*" [7, p 126] In the context of our fairly extreme version of virtual teams we have therefore decided that each project presentation will take place over a period of 6 calendar months, to allow adequate time for appropriate relationships to be established and effective working procedures to be developed.

TEAM MANAGEMENT AND LEADERSHIP

Much of the literature assumes the need for *management* of virtual teams and also talks about *leadership* (e.g. [8], [10]). These two concepts need to be distinguished, the first being more of an external issue whereas the second is predominantly internal to the team. In our context, management is more to do with the initial setting up of the teams and the setting of the overall team objectives, in terms of task(s) to be undertaken, time scales within which the various specified deliverables are to be produced, and possibly provision of suitable resources. In a sense we, as a course team, are the managers, but are adopting an extremely hands-off role, except for emergencies. Our course tutors' role is

also substantially hands-off. Their responsibilities are to monitor, possibly to moderate, and to mark, but definitely not to manage, their teams.

We want leadership to be something that emerges from the way in which the team configures itself in order to achieve its objectives, given the time constraints and the resources available. An interesting discussion of leadership in virtual teams is to be found in the book by Lipnack and Stamps already referred to. They take the view that, in order to operate successfully, such teams need to be *polycephalous*, that is to have many leaders. Thus "*It takes more than one to lead a successful virtual team*" and "*Leadership is pervasive in virtual teams ... there are (at least) six basic leadership roles needed in virtual teams...*" [7, p 176] In the formative introductory phase of our course we emphasise the need for the team, in the context of the tasks that they will be undertaking during the project, to identify what some of those roles might be and what responsibilities they entail, and to attempt an initial allocation of roles amongst the team members.

THE COURSE STRUCTURE

Our approach to these concerns has been to create a generic team project framework, into which specific scenarios can be dropped for each re-presentation of the course. The nature of these scenarios is such that no detailed specialist knowledge of the application area is necessary for an individual to be able to take part in the project. For the first presentation we have used a scenario in which a successful holiday accommodation agency wishes to computerise its operations and to establish a web presence, and the team is engaged to advise them on how this could best be done.

The case study only sets the context in a very general sense; everything is very loosely specified, leaving a lot of things to be decided by team members as a result of their own investigations and experience. Part of the initial task is for team members to investigate the scenario and to share their findings with each other, and to reach a consensus on the priorities to be further investigated and analyzed.

The course materials that students receive include a printed Course Guide and an extensive set of online Resource Sheets covering relevant theoretical and practical aspects of both working in (virtual) teams and working on the analysis and documentation of system requirements. The Resource Sheets are provided as guides to the sort of techniques and notations that might help students with the tasks they have to undertake, rather than giving mandatory instructions as to how they should proceed or what methodology they should follow. The Guide contains background course information, plus a detailed presentation and explanation of which Resource Sheets students should be reading, and what activities they should be undertaking week by week, although these too are presented as guidelines rather than mandatory instructions. We want teams to make their own decisions about all such matters, within the framework of the deadlines which we have set for their intermediate and final assignments.

There are three distinct phases of project activity, each structured around an Activity / Assessment Sheet, with both team and individual deliverables required at each milestone. Each deliverable comprises both a partial product and a reflection on the process by which that product was produced. The Activity / Assessment Sheets are only released at the beginning of the phase to which they apply, in an attempt to focus teams' attention on the current task. The team reflection is centred round the roles, responsibilities and rules that teams have developed and implemented, whilst the individual reflection is centred round the relationships, in terms of the way that the team has formed and performed. All the reflection is evidence based, using materials from team deliverables, team conferences,

documentation of decisions and individual project logs. We have tried to build in the concept that partial success in either process or product should not be regarded as failure, provided that their reflection shows that lessons have been learned that could improve future virtual teamworking performance.

We have concentrated the teams' attention on problem analysis and specification rather than implementation, since we want teamworking issues to be their dominant concern, both in the activities undertaken and in the assessment of those activities, rather than worrying about software development issues and concerns about the quality of the ultimate product. Vagueness is the order of the day – the whole project is based around clarifying the nature and extent of the problem space, rather than getting bogged down in the technical details of implementing a solution.

To keep communication overheads manageable, especially in the context of remote, asynchronous working by individual team members in a time-constrained environment, we have restricted initial team size to a maximum of 6. Individuals are allocated to teams at random, and we have made no attempt to create teams which are *balanced* in terms of categories such as Belbin's roles (see, for example [9]). However, we have provided some relevant resource materials at the end of the first phase of the project, which we hope will inform teams' collective reflection on their experience of the course up to that point, and possibly lead to a re-think and readjustment of their practice for the subsequent phases.

CONCLUSIONS AND FUTURE WORK

To date we have run an accelerated trial of the first half of the course materials with two teams of volunteers, and as a result we have modified some of the material in preparation for the first live presentation, which commenced in February 2005. One of the more interesting results from the trial was the need to provide more guidance on roles, responsibilities and rules. These do not always arise naturally – the tutor group in our trial run was an interesting example of this, with all the members - many of whom were aware that they were fairly dominant individuals - deliberately holding back from taking any leading role. This resulted in their team not completing the allotted tasks within the available time frame, whereas the less aware and less experienced student group were more successful!

Interestingly, in the first live presentation, we are already facing demands from students for the whole set of tasks to be made explicit so that teams can leap into implementation mode, whereas we are trying to focus their attention on the specification! We are also finding it difficult to convince both students and tutors that there is no *right,* or even *best* answer, either in terms of the deliverables they submit or the processes by which their teams operate to produce those deliverables.

We expect to be able to report to later conferences on a number of interesting aspects of the course. In particular the existence of suitably anonymised archives of the student team conferences should provide us with a substantial corpus of material that can be analysed for evidence of team behaviours, in terms of issues like the establishment and maintenance of trust within teams, the dynamics of team decision making, and the most suitable team role models for effective remote team work.

We know that, in the OU's standard FirstClass conferencing facility, we do not have an ideal environment for the kinds of communication activities that our teams need to engage in. For example, the lack of good mechanisms for handling substantially persistent but asynchronous communication, the lack of adequate *presence* or *awareness*

mechanisms, and the lack of good mechanisms for supporting time-constrained decision making processes spring to mind. As a result of our investigations into existing environments, and our experiences of running the course, we hope to be able to specify an ideal electronic environment to support virtual team activities.

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