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Tendering in Virtual Teams – Challenges and Opportunities for Distance Learners

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Abstract

Electronic communication is proliferating throughout industry and academia. Its use is not limited to communications between individuals. Evolving technologies support and facilitate collaboration where individuals and / or teams work in geographically different locations to their colleagues. The challenges of working in such environments are briefly reported in this paper based on other work completed by the authors and others. The impact of such approaches is then explored in the context of the delivery of a course to third year distance learning students in the School of Architecture and Built Environment, University of Newcastle, Australia. We briefly review assessment strategies appropriate for students working in virtual environments. We then describe how we assessed our students using student peer / self-assessment and meeting logs. We describe some of the benefits of such multiple perspective assessments including students developing a clear understanding of their individual performance, the contributions they have made to the process and the outcomes achieved by their group. The paper also reports on a student evaluation of virtual teamwork and concludes by drawing on this feedback to argue that virtual teamwork has a place in the education of construction students.

Keywords: Teamworking, E-Learning, Virtual Classroom, Assessment, Self Assessment, Peer Assessment

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Introduction

The challenges faced by our antipodean School are not unique. We service a diverse student population drawn from a wide geographic area. Financial pressures limit the academic efforts of our students as many of them engage in part-time employment. Academics in our School work under different pressures and are currently grappling with a more competitive higher education environment and with a move to a flexible learning environment that meets the needs of students.

Our School comprises three disciplines viz. Architecture, Construction Management and Quantity Surveying, and Industrial Design. This paper focuses on our Construction Management and Quantity Surveying (CMQS) degree. We have recently responded to recommendations made by our accrediting bodies and university by re-organising and redeveloping our degree in CMQS. A significant change has been to merge the delivery of courses previous taught independently to CMQS and Architecture students. In addition, we have combined the delivery of CMQS courses taught to on-campus and distance learning students from Semester One, 2007.

Set within this context, this paper explores the delivery of an industry-focussed course to a cohort of distance learning CMQS students. The paper briefly describes the requirements of our accrediting bodies, and the needs for our students to develop soft-skills, such as communication and teamwork. These requirements draw on investigations we and others have conducted into communication in virtual teams as part of a Co-operative Research Centre for Construction Innovation (CRC CI) funded project. The implementation, delivery and assessment of teamwork within this distance learning course are also discussed.

Professional Accreditation

Accreditation bodies and many universities agree that graduates need to possess a range of generic attributes. Traditional views of teaching appropriate content are being surpassed by recognition that a range of personal attributes enhance the capacity for graduates to enter and progress in their chosen profession. Some of the attributes required by professional institutions include *communication* and *collaboration*. For example, Engineers Australia requires graduates to demonstrate abilities to:

- communicate with engineering, the team and the community at large; and
- function as an individual and as a team leader and member of a multi-disciplinary and multi-cultural team (Engineers Australia Accreditation Board, 2005).

Similarly the Chartered Institute of Building requires that graduates:

- demonstrate communication skills;
- demonstrate IT skills; and

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- demonstrate the ability to work with others (Chartered Institute of Building, 2006).

In Australia, collaboration in the context of CMQS education has been problematic. Despite the challenges of implementing collaborative methodologies, these have the potential to broaden students' experiences. The benefits to be achieved include the development of:

- a student centred approach;
- an increase in the level of participation and collaboration;
- writing and documentation skills; and
- deeper cognitive processing though interaction between group members.

The course described later in this paper requires students to work in teams to prepare an estimate, tender, tender construction programme and cashflow forecast for a construction project. Students work in teams to complete these tasks as the workload involved is too onerous for an individual. This reflects industry practice where these tasks are frequently completed by teams. Having students complete teamwork projects such as this is not new. What is novel is arranging for distance learners to collaborate in teams using (largely) Internet based technologies to complete the various tasks involved.

The complexities of merging virtual teamwork strategies into curricula remain largely unexplored in the CMQS discipline. Literature provides an understanding of the protocols followed within groups when members interact face to face. Broome and Chen (1992) and Galegher *et al.* (1990) examined group design and problem solving in the technological context in the industrial domain and their writing has informed the approaches we have adopted.

Finally, as will be seen later, we have provided assessment frameworks to support the activities students are required to complete. Such approaches have not been used extensively and require further development and evaluation. Hesitancy to embed assessment strategies into curricula has been fuelled by concerns about equity and the difficulties associated with discriminating between an individual student's performance and those of his / her team. Rewarding unproductive team members has always been a concern.

Effective Collaboration

The strategies we have sought to implement in our teaching are founded in investigations we and others conducted as part of a CRC CI project entitled "Team Collaboration in High Bandwidth Environments" (Bellamy *et al.,* 2005). This research explored recent developments in high bandwidth communications technologies which have the potential to dramatically improve collaboration in the construction industry.

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Our involvement in this project was to investigate the generic skills used by individuals and teams when engaging with different collaboration technologies. We identified the generic skills which support collaboration as:

- **Leadership**

Leadership is important because it decides the balance of relevant skills and contributions required of team members (Baird *et al.,* 2000). Moreover, team leader(s) need to be able to create teams which identify the important 'social links' between team members (Baird *et al.,* 2000).

- **Co-ordination**

Co-ordination and structuring skills are required for team members to work collaboratively in a virtual medium (Lahti *et al.,* 2003).

- **Feedback**

Abilities to provide feedback are important skills for team members. In an industrial setting, this is particularly relevant when junior team members communicate with senior decision makers (Baird *et al.,* 2000) and we have sought to make students aware of this. Being able to give feedback is crucial because information frequently needs to be validated before further progress can be made (Baird *et al.,* 2000). According to Emmitt and Gorse (2003) an effective way of developing skills in providing feedback is to conduct feedback meetings, either at the end of a project or at the end of a phase of a project. As will be seen later in this paper, we have required students to meet on a regular basis and to keep records of their interactions.

- **Interpersonal Relationships**

The way in which team members collaborate can impact on a team's ability to deliver a satisfactory product. In addition, social collaboration appears to play an important role especially when researching and determining limitations (Baird *et al.,* 2000).

- **Trust**

Trust is not easily created in a computer mediated environment, especially when team members have no prior experience of working with others (Jarvenpaa and Liedner, 1998). The commitment of others fosters trust, but this takes time to develop and may not reach high levels until towards the end of a task (Jarvenpaa and Liedner, 1998).

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- **Communication**

Virtual communication presents challenges. A number of factors constrain these interactions, for example:

- Lack of visual cues (such as facial expressions) as well as a lack of auditory input (where intonation, e.g. sarcasm, might influence understanding). Even when visual cues are used (e.g. when video conferences or web cameras are used) team members' abilities to communicate using non-verbal interactions (such as body language) can be inhibited (Hoyt and Evans 2000). However, technology does present some advantages when communicating over distance as they often allow more focused and concise information exchange between team members (Gabriel and Maher, 1999; Maher *et al.,* 2000). Furthermore, they may assist team members keeping to their task (Cleland and Ireland, 2002).
- Baird *et al*. (2000) found that virtual environments may not encourage feedback.
- Williams and Cowdroy (2002) note that communication is easier if team members have previously worked together.
- Synchronicity is also an issue as virtual teams can operate in both synchronous and asynchronous environments. For example, virtual team members may interact in real time (e.g. using video conferencing and / or electronic chat rooms), or through email or electronic bulletin boards (where there are delays between sending and receiving messages) (Maher *et al.,* 2000).
- Social interactions are likely to be inhibited in virtual meetings (Gabriel and Maher, 1999). This may be a factor delaying the building of trust noted above.
- Sharing visual information presents difficulties when it is presented through virtual media (Gabriel and Maher, 1999; May and Carter, 2001; Poltrock and Engelbeck, 1999). The significance of this limitation depends on the nature of tasks virtual teams are engaged on.

These constraints are not confined to the workplace. Recognising that they affect pedagogic teamwork, we have embedded activities that develop students' generic skills in a *Construction Integrated Project*. Furthermore, we have developed rubrics that recognise and assess students' teamworking skills. These are described below.

Construction Integrated Project

The *Construction Integrated Project* is delivered to third year CMQS students. It is completed on a project basis with students working in teams simulating construction

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companies. On-campus students work face-to-face, whilst distance learners work virtually. Each group aims to win a tender for the completion of a building in competition with other groups. Submitting the lowest bid does not necessarily result in the highest marks being awarded. Other factors are also considered, such as the level of detail that students have worked to, commercial awareness, originality and teamwork. This mirrors recommended industrial practice, which advocates that projects are not awarded on price alone. Rivalry between teams is generally intense. This course allows students to draw on the knowledge, skills and understanding they have accumulated in prior courses, and during their work experience.

Assessing students' work is a fundamental and pervasive element of teaching, and a potentially powerful means of driving continuous improvement. Assessment is a complex, multi-faceted process which motivates, directs and enhances student learning. Depending on circumstances, assessment may also:

- help to ensure that educational standards are appropriate and maintained;
- determine whether course objectives have been achieved;
- allow certification that programme requirements have been completed;
- provide feedback for the improvement of teaching to teachers and teaching units;
- identify high achievers against preset standards; and
- identify students in need of additional support.

When assessment is conceived, designed and implemented in a robust manner, it achieves all these purposes. We have sought to incorporate approaches that assess not only the product (i.e. the estimated costs and tender price for the building project) but the process students engaged in to deliver their submission. Inherent in the latter is assessment of teamwork.

Considerations for assessing groups

Group assessment can be used for a variety of purposes. For example, it can be used as a process for teaching interactive working techniques, for enhancing students' understanding of course content, for improving access to scarce resources and as a method of collective assessment. To ensure the outcomes of group assessments are equitable and credible, one or more of the following approaches are recommended:

- **Shared Group Mark** - A group submits one assessment item and where it is impossible to make a distinction between the efforts of individuals all group members receive the same mark. Having submitted a single assessment item, a proportion of the mark is allocated to this item, which is equally shared by all group members. A proportion of the mark may also be allocated for an

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individual's group planning papers or an individual paper analysing the group's teamwork processes.

- **Group Contracts** - A group assessment item may have a number of distinct components, and in this instance group members develop a contract between themselves specifying the component for which they are responsible. Marks may be awarded for each separate component or for the project as a whole with the group allocating, within the confines of the overall mark, individual marks on the basis of each members' contribution.
- **Peer Assessment of Contributions** - Criteria are established for the key competencies students are expected to demonstrate within a group assessment item. The item is marked in terms of these criteria and then, within the confines of that mark, group members are asked to determine the relative contributions of each member and allocate marks to individuals. Evaluation of the group process, via discussions between teaching staff and students, ensues on:
    - the distribution of work among group members
    - the way members of the group interacted
    - the use of resources.
- **Individual Marks** - Group-based activities may be set as assessment items for which each member of the group submits an individual assessment item, and receives separate and different marks. To assess an individual's contributions to a group assessment, marks may also be assigned on the basis of a viva or examination questions on the content and processes associated with the completed group assessment item.

Unsatisfactory performance by group members is not uncommon. Table 1 illustrates a procedure for managing unsatisfactory performance that we have used in various forms. It draws on current industrial relations practices, and so serves not only to address unsatisfactory performance per se, but introduces students to procedures they are likely to encounter in the workplace.

The assessment process adopted

The following deliverables were assessed:

- Estimate documentation simulating paperwork provided by estimators to the directors / managers of their construction company was assessed by lecturers. The rubric used to assess this work is provided in Appendix 1.
- Teamwork was assessed in two ways:
    1. Students assessed themselves and their peers using Table 2.
    2. Groups submitted logs of their activities which were assessed by staff.

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Marks for the self / peer assessments and the logs were converted into a multiplier which was used to factor the mark obtained for the estimate.

Team working skills do not develop simply with the formation of students groups and letting them perform group assignments. Teamwork learning environments need to be well designed, implemented, managed and evaluated. The teamwork assessment methodology described in this paper was piloted in an integrated problem based learning module delivered to first year CMQS students (Williams and Gajendran (2004).

Table 1: Procedures for Addressing Unsatisfactory Performance

- Where a student (A) is of the view that the contribution of another student (B) is unsatisfactory, A informs the lecturer in writing about: the nature of the circumstances causing dissatisfaction; how these circumstances prevent the team from producing the deliverables required of them; the nature of the improvement required of B; and a reasonable time within which reasonable improvement can be expected.
- The lecturer will then inform B of A's dissatisfaction – but make no reference to A by name.
- B may then respond to the allegations made by A – directly to the lecturer, or B may acknowledge A's dissatisfaction and work to achieve the improvements required by the date specified.
- If B's new contribution is found to be satisfactory by the majority of the remaining team members, B is allowed to remain as part of the team.
- If B's contribution is found NOT to be satisfactory by the majority of the remaining team members, the mark B receives for the work in question will be reduced by a percentage determined by the lecturer (who is informed by the remaining team members).
- If B's contributions are found to be unsatisfactory on a second occasion, B is required to leave the team. S/he is then required to complete work to be determined by the lecturer, and the mark for this work is capped.

Self / peer assessment

Generic skills associated with team participation were assessed using the self / peer assessment instrument shown in Figure 1. The methodology developed to support students in evaluating themselves and their peers was informed by the methodologies proposed by Habshaw (in Gibbs, 1995) and involved:

- providing detailed instructions of the process;
- providing opportunities for students to question and discuss the process;

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- trialling the assessment instrument before use.

The self / peer assessment process involved students ranking evidence of each skill on a Likert scale (see Figure 1). Each student submitted an assessment for his / herself as well as for all other group members. Staff then collated these assessments for all the students in each group, aggregated and averaged their scores and arrived at a score for each student. These individual marks contributed to the teamwork multiplier mentioned above.

Please fill in the following assessment sheet using the key below:

1 never
2 rarely
3 sometimes
4 most of the time
5 always fulfils task completely

For the person under consideration circle the number that is most appropriate:

	Never				**Always**
Participation in group meetings/discussion.	1	2	3	4	5
Degree of preparation for group meetings/discussions	1	2	3	4	5
Fulfils responsibilities allocated at group meetings	1	2	3	4	5
Communicates well with the group	1	2	3	4	5
Makes a positive contribution to group dynamics	1	2	3	4	5

1. **Participation in group meetings/discussion:** Ideally a student should participate in and contribute to group discussions. The contributions should reflect a familiarity with the issues at hand and be thoughtful and constructive.

2. **Degree of preparation for group meetings/discussions:** Ideally a student should have prepared for the group discussion by reading around the area for discussion in addition to their allotted task. They should be keeping abreast of where the group is in terms of discussion and direction.

3. **Fulfils responsibilities allocated at group meetings:** Ideally a student should responsibly fulfil any tasks assigned at group meetings and report on this activity at the next group meeting or date assigned by the group.

4. **Communicates well with the group:** Ideally a student should communicate their thoughts and ideas in a clear concise scientific manner. Communication can also take the form of diagrams, small presentations, handouts, use of the white board, or other aids.

5. **Makes a positive contribution to the group dynamics:** Ideally a student should contribute to the harmony of the group. They should encourage an atmosphere of intelligent discussion where all points of view are heard. They should not dominate the discussions or be argumentative; nor should they overly sidetrack the group by injecting issues not directly relevant to the task in hand.

Figure 1: Self / peer assessment of teamworking skills

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Logs

Each group of students was required to submit a log of their activities on a weekly basis using the template shown in Figure 2. Around ten logs were submitted for this assessment item and all were assessed using the rubric provided in Appendix 2. As will be seen from Appendix 2, students needed to submit evidence of their 'work in progress' that aligned with the issues / discussions and actions recorded in the logs. The team log thus provided evidence and validation of students' performance of tasks as well as documentary proof of the methodology applied by the group. Furthermore, the assessment of the log also provided a basis for student feedback about the activity.

PROJECT MEETING LOG	
Meeting Date: **Time:**	
Team Members Present:	
Report on Actions or Items carried over from previous log	**Member Reporting**
Issue No. 1 Discussed Description of the issue Decisions reached **Issue No. 2 Discussed** Description of the issue Decisions reached **Issue No. 'n' Discussed** Description of the issue Decisions reached	Participating Member
New Actions	Member to Action
Members in Attendance Sign-off	

Figure 2: Groupwork meeting log template

The marks calculated using the Log Assessment Rubric and the Self / Peer Assessment mark were combined into a multiplier which was unique to each student. This was then applied to the mark achieved for the final group report (the estimate – assessed in accordance with Appendix 1). A significant part of the assessment was based on presentation of this final group report and to a lesser extent, on the unique multiplier. The report provided evidence of critical thinking, problem evaluation and solution, research and evaluation of the literature. In summary, each student received a mark which was based on the efforts of his / her group, but tempered by their own efforts. An example showing how marks for a fictitious student are calculated is provided in Appendix 3.

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Evaluation

An on-line evaluation of teamwork was conducted for Semester One, 2006. Students were asked to respond to statements by selecting a response on a Likert scale. The sample size is small, with 14 out of a class of 18 students responding. All respondents were distance learners. Whilst the number of students polled is modest, some of the results provide strong indicators and we intend to survey a larger population in due course:

- 78% of students agreed / strongly agreed with the statement "I learned more about estimating, tendering and cost control by working in a group than I would have done by myself".
- Students were ambivalent about the disruptions caused by working in virtual teams as 43% agreed / strongly agreed with the statement "Working in a group with other distance learning students created problems which disrupted my learning".
- Similar reactions were made to the statement "Our team found it difficult to work together because we were not able to meet face to face" with 64% of students disagreeing / strongly disagreeing.
- Students overwhelmingly agreed with the statement "Team members shared a common understanding of what was required" as everyone agreed / strongly agreed.
- Students were divided about how formalised their working procedures were. 43% agreed with the statement "Our team did not have fixed procedures for working together - we made them up as our work progressed" whilst 57% disagreed / strongly disagreed.
- Students felt strongly that the course had developed their virtual teamworking skills. 93% agreed / strongly agreed with the statement "The course helped me to develop virtual teamworking skills (e.g. computer usage, e-communication)".
- Students were able to develop trust in others they had not worked with before. 71% disagreed / strongly disagreed with the statement "Working in a virtual team made it difficult for me to develop trust in my team-mates".
- Students were unsure about the impact geographic location had on their team. 47% agreed / strongly agreed with the statement "Managing our team's activities was made more difficult because we could not physically meet each other".
- Overwhelmingly students agreed with the statement "The teamwork tasks (logs and self / peer assessments) encouraged collaborative learning". 93% agreed / strongly agreed with this statement.

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- Similarly students agreed with the statement “The learning challenges were suited to collaborative learning” with 93% agreeing / strongly agreeing with this statement.
- All students agreed / strongly agreed with the statement “The (course) tasks encouraged real-life application of knowledge and skills”.
- 86% of students found the way in which BlackBoard (the Internet based learning management system used by our university) allowed them to share information with fellow group members was useful / most useful.

Students were also asked about the ways they shared information with their colleagues:

- 86% found email to be useful / most useful.
- The postal service was not favoured at all. Only one student rated this as useful, with 50% saying it was not useful / not at all useful, and 43% saying this method was not applicable.

When it came to communicating with their colleagues, students:

- Found email useful / most useful (86% of students).
- Saw the BlackBoard Group / General Discussion Board as useful / most useful (71% of students).
- Saw phone calls as useful / most useful (93% of students).
- Did not favour using faxes (43% rated this as not useful / not at all useful, 21% saw this as useful, and 36% saw this as not applicable).
- Either found face-to-face meetings not at all useful (14%) or not applicable (86%).
- Generally found virtual chat facilities (such as MSN Messenger) to be most useful (71%) or useful (7%). Only 21% saw this as either not useful or not applicable.

Students were also asked open-ended questions. When asked to identify what was most valuable about the course, 9 of the 14 students identified various aspects of teamwork. The following are some direct extracts of the comments students made:

- The most valuable thing is what can be achieved when ideas, experience of several individuals can be put together to solve a problem achieve positive results / solutions.
- Having the opportunity to work in a team situation with a helpful communication tool such as Blackboard. It was great to see how other students approach different aspects of university life and work.

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- Learning to program activities and distribute activities between team members. Understanding how different people perceive the [course] problem and how they think the problem should be responded to.
- Working in a virtual team was beneficial. Practicing communication and working in a group type environment was totally beneficial. It gave me an idea how other people are actually working in this course, how much drive they have and the level of work they are submitting.
- The most valuable thing for me about this course was being able to get other people's opinions and ideas, bouncing stuff off each other, getting support from team mates and generally feeling like you weren't working on your own as opposed to other [courses] where you submit an assignment on your own. Again my experience was excellent due to the fact that I worked with a great team, had I not worked with such great people who weren't equally committed, this [course] would have been a disaster.
- Teamskills e-teams building / communicating across the Asia / Pacific region.
- Learning how to work in a group that was unable to meet face to face was a big challenge as we all lived in different areas and we all had different ideas and opinions, but we managed to solve all the problems together after evaluating the issues as a group. I also learnt how to make more use of communication tools such as emails and Blackboard that I had previously only used several times and found the group discussion board and file exchange the best way to communicate to team-mates.
- Creating the logs, as a form of producing the meeting minutes for our telephone hook-ups over the phone… lead us to formulating a team directive that gave all members direction on what they were responsible for and when we wanted to achieve these goals.
- Gaining different ideas and approaches from the group members, experience in high rise buildings.

Concluding Comments

The ever-increasing use of electronic communication is impacting on industry and education. The new medium imposes risks and opportunities, and practitioners and academics need to be aware of these. Clearly there are lessons to be learned, and these are equally relevant in industry as well as in pedagogic environments. Delivery of distance learning courses that incorporate virtual teamwork are challenging to devise and manage. However, it is apparent that students value such opportunities highly.

Since we conducted our survey in 2006, we have progressed our approaches to virtual teamwork in a number of areas. Firstly we have changed the mode of delivery of our

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Bachelor of Construction Management (Building) programme to that of mixed-mode. We no longer distinguish between on and off-campus students and deliver our (largely) problem-based curriculum using a variety of materials and technologies. This evolution was influenced by many factors including our experiences of virtual teamwork reported in this paper. Secondly, many of the shortcomings of virtual teamwork appear to be addressed by the use of wikis. We are encouraged by the observations of Molyneaux and Brumley (2007) and intend to require students to use wikis to record their groupwork activities, logs and so on. Finally, we also see opportunities for continuing professional development activities that expose practitioners to virtual teamwork and develop their virtual teamwork skills (Williams and Sher, 2007).

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Appendix 1 – Estimate assessment rubric

Presentation

	Not yet competent	Pass	Credit	Distinction	High Distinction
Ease of understanding (8%)	Language was inappropriate. Sentences were long and rambling. Some text was 'padding'. Several spelling mistakes / typos / grammatical errors.	Language was appropriate. Some sentences were cumbersomely structured. Some text was 'padding'. A few spelling mistakes / typos / grammatical errors.	Language was appropriate and well structured. Little 'padding'. One or two spelling mistakes / typos / grammatical errors.	Language was appropriate, explicit and well structured. No 'padding'. There were no spelling mistakes / typos / grammatical errors.	Language was appropriate, articulate, explicit and well structured. No 'padding'. There were no spelling mistakes / typos / grammatical errors.
Structure (8%)	No 'contents' page or page numbers. Inappropriate (or non-existent) sub-division of report into sections.	Report was navigable, with a contents page. Page / sections numbers were provided.	Report was navigable, with a well structured contents page. Page / sections numbers were provided.	Report was easily navigable, with a well structured contents page. Page / sections numbers were provided. Overall layout of sections of report emphasised logic of content.	Report was easily navigable, with a well structured contents page. Page / sections numbers were provided. Overall layout of sections of report emphasised logic of content. Other identifiers / aids used to accentuate structure.
Graphical aids (4%)	Although appropriate, no / minimal use of graphical aids made.	Some use of graphical aids made where appropriate. Quality of aids adequate.	Frequent use of graphical aids made where appropriate. Quality of aids was very good.	Graphical aids used wherever appropriate. Quality of aids was excellent.	Graphical aids used wherever appropriate. Quality of graphical aids (such as figures / tables / graphs) was outstanding.

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Content

	Not yet competent	Pass	Credit	Distinction	High Distinction
Risk management (15%)	Superficial identification of risks, superficial risk analysis, and no risk response.	Some risks identified some analysis of risks, and superficial risk response.	Very good identification of risks, good analysis of risks, and good risk response inc. some assessment of implications of responses.	Excellent identification of a range of risks (inc. technical, managerial, contractual etc), very good analysis and ranking of risks, and considered risk response inc. financial implications of responses.	Outstanding identification of a wide range of risks (inc. technical, managerial, contractual etc), rigorous analysis and ranking of risks, and effective and considered risk response inc. financial, contractual and other.
Construction method (20%)	Superficial description of selected construction method. Superficial site layout.	Description of selected construction method showing some understanding of technical challenges. Adequate site layout (showing storage, access, egress, hoisting etc).	Very good description of selected construction method, giving evidence of an understanding of technical / managerial challenges. Resource productivities provided. Site layout (showing storage, access, egress, hoisting etc). Brief description of alternative construction methods.	Excellent description of selected construction method, giving evidence of a good understanding of technical / managerial challenges. A few 'storyboard' sketches and resource productivities provided. Site layout (showing storage, access, egress, hoisting etc). Brief description of alternative construction methods and brief assessment of their advantages and disadvantages.	Outstanding description of selected construction method, giving evidence of a thorough understanding of technical / managerial challenges. Several 'storyboard' sequence sketches and resource productivities provided. Site layout (showing storage, access, egress, hoisting etc). Brief description of alternative construction methods and in-depth assessment of their advantages and disadvantages.
Money (25%)	Superficial estimate of BoQ.	Estimate of most BoQ items provided, giving some summaries. Preliminaries costed. Adequate sample rate build ups provided for a few items.	Estimate of all BoQ items provided giving item, page, section summaries. Comprehensive costing of preliminaries, good sample rate build ups for a few cost significant items.	Estimate of all BoQ items provided giving item, page, section summaries, and lab / plant / mat costs for ditto. Excellent preliminaries, very good sample rate build ups for some cost significant items.	Estimate of all BoQ items provided giving item, page, section summaries, and lab / plant / mat costs for ditto. Outstanding preliminaries, excellent sample rate build ups for all cost significant items, average rates, checks for accuracy etc.
Programme (20%)	Barchart showing individual construction activities. Critical path / float not apparent. Numerous 'dangles'. No histograms provided.	Barchart showing construction activities. Few 'preliminary' activities shown. Critical path / float ambiguous. Some 'dangles'. Some resources histograms provided.	Very good barchart showing individual and 'preliminary' activities. Critical path / float apparent, Few 'dangles'. Resources histograms provided for cost significant resources	Excellent barchart showing individual and summary construction and 'preliminary' activities. Critical path / float clear. No 'dangles'. Resources histograms provided for cost significant resources	Outstanding barchart showing individual and summary construction and 'preliminary' activities. Critical path / float explicit. No 'dangles'. 'Smooth' / 'levelled' resources histograms provided for cost significant resources. Evidence of comparison with estimate resources.

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Appendix 2 – Log assessment rubric

	0 – 25%	26 – 49%	50 – 67%	68 – 84%	85 – 100%
Language (25%)	• Poor record, confusingly worded, containing unnecessary "padding". • Several spelling and punctuation mistakes. • No aspects of professional style used throughout.	• Limited record, understandably worded, with some "padding". • Some spelling and punctuation mistakes. • Few aspects of professional style used throughout.	• Good, clear record, explicitly worded, with little "padding". • One or two spelling or punctuation mistakes. • Some aspects of professional style used some of the time.	• Articulate record, explicitly worded, with no "padding". • No spelling or punctuation mistakes. • Most aspects of professional style used throughout.	• Highly articulate record, explicitly worded, with no "padding". • No spelling or punctuation mistakes. • All aspects of professional style used throughout.
Structure (25%)	Unclear who was responsible for what.	More or less clear who was responsible for what, but some major areas of uncertainty.	Generally clear who was responsible for what, but some areas of uncertainty.	Clear who was responsible for what, but some minor areas of uncertainty.	Absolutely clear who was responsible for what.
Issues / Decisions (25%)	• Mostly irrelevant issues discussed. • Impossible to understand how decisions were reached (i.e. founded on questionable evidence / research).	• Some issues that are generally relevant discussed. • Hard to understand how decisions were reached (i.e. founded on questionable evidence / research).	• Most issues that are generally relevant discussed. • Some decisions founded on evidence / research.	• All issues that are generally relevant discussed. • Most decisions founded on evidence / research.	• Relevant and far reaching issues discussed. • All decisions founded on robust evidence / research.
Evidence (25%)	No evidence provided.	Limited evidence provided.	Adequate evidence provided.	Good evidence provided.	Extensive evidence provided.

Language

- **Should be clear and concise.** There's no point in including extra words simply to have enough to fill up a few pages…
- Your logs should **not contain spelling mistakes** and should be **appropriately punctuated**.
- The style you write in should be **professional** – it should not contain colloquial terms, and similar references.

Structure

- Your log should **CLEARLY** show who is responsible for what.
- Your log should make it possible to **unambiguously** track an issue from one log to another. This is an aspect that, in the past, very few teams have addressed effectively. In particular:
  - progress on any 'New Issues' identified at the end of a log should be monitored and progress recorded at the start of the subsequent week's log.
  - any items carried over from the 'Issues ' and 'Decisions' sections of previous logs should be clearly identified (perhaps by a numbering system).

Issues and decisions

For each 'issue' you discuss, you need to record a 'decision' your team took. If you didn't reach a decision, you should say so. Similarly, if you decide to delay making a decision until you obtain more info' etc., say so.

Evidence

You need to submit evidence of the work that has been completed each week. This not only serves as proof of what you've done, but allows you to create an 'audit trail' of how you reached the decisions / deliverables you did.

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Appendix 3 – Example calculation of marks

Raw marks

Assessment scheme (summarised from Appendix 1)

Presentation (20%)

	Not yet competent	Pass	Credit	Distinction	High Distinction	
Ease of understanding			4			70
Structure			4			70
Graphical aids			4			70

Content (80%)

	Not yet competent	Pass	Credit	Distinction	High Distinction	
Risk management			4			70
Construction method			4			70
Money			4			70
Programme			4			70

Mark = 20% (Presentation) + 80% (Content)
= 20% (70) + 80% (70)
= 70%

Teamwork marks

1) **Logs (summarised from Appendix 2)**
Average mark for weekly 'logs' = 85%

2) **Self and Peer Assessments (summarised from Figure 1)**
Average for 'peer and self assessments' = 60%

Total marks

	Estimate	Logs	Self / peer Assessments	TOTAL = [(Estimate mark x 90%) x Log Multiplier] + [Self/peer x 10%]
Weighting	90%	Multiplier	10%	
Group and Individual data	Group mark = 70	85%	Student 'n's mark = 60	
Contribution	(70 x 90%) = 63	(63 x 85%) = 54	6	
Mark for student 'n'		**54**	**6**	**60**

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