AN INVESTIGATION OF PAPERLESS MARKING AND RETURN USING EASTS
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1 Executive Summary

1.1 Terms of Reference

The aims of the study were:

- To gauge student perceptions on the benefits and the deficiencies resulting from the usage of paperless assignment marking and return;
- To gauge marker perceptions on the benefits and the deficiencies resulting from the usage of paperless assignment marking and return;
- To identify computing technologies that provide efficiencies in paperless assignment marking;
- To identify procedures for the handling of paperless assignment submission, marking and return;
- To analyse statistically the amount of academic time required to mark various types of assignments in a paperless way compared with traditional marking approaches;
- To compare the cost savings to be obtained from paperless marking with any additional hardware, software or academic labour costs; and
- To provide recommendations and feedback to the Learning Materials Centre (LMC) relating to the use of EASTS for paperless submission and return of assignments.

In order to achieve these aims, a formal trial of paperless marking was undertaken. The key features of the trial were as follows:

- The study included 20 internal, distance education and offshore distance Information Technology (IT) subjects, with 545 enrolments and 1023 student assignments in Autumn and Spring 2005;
- The study included a range of hardware configurations, including desktop and tablet computers, with single and dual monitors, a graphics tablet and audio devices;
- The study included a range of software tools to assist with marking, including Microsoft Word, Microsoft Excel, Microsoft Access, Microsoft Windows Journal and Adobe Acrobat;
- Markers, including five full-time academic staff and three casual marking assistants, recorded their reflections on the hardware, software and marking techniques trialled;
- A limited comparison of the marking time required for the key marking hardware, software and approaches was undertaken; and
- A survey of students involved in the trial was undertaken, with 114 of the 545 students responding.
The members of the project team were Barney Dalgarno, Daryl Miller, Anthony Chan, Peter Adams and Phil Roy. Casual markers who also undertook paperless marking during the trial and contributed their comments on the process were Peter Swan, Katrina Kelly, Luci Skeers and Rob Boetto.

1.2 Recommendations

The following were the key recommendations from the study:

Key Recommendation 1. Paperless marking and return of assignments is unlikely to ever be as efficient or convenient as paper-based marking from the marker’s perspective but is nevertheless desirable due to other advantages it provides.

Key Recommendation 2. Paperless marking and return of assignments is highly desirable to students and should be made an option for all subject coordinators across the University as soon as possible.

Key Recommendation 3. Paperless marking and return of assignments should not be made mandatory at any stage in the foreseeable future.

Key Recommendation 4. The existing EASTS system provides sufficient paperless marking and return features to allow for its use to be made optional across the University once minor improvements have been made to the user interface.

Key Recommendation 5. The most important limitation of the existing EASTS system for paperless marking and return is the lack of a provision for batch download and upload of assignments.

The following were the additional recommendations from the study:

Recommendation 1. EASTS submission should be provided for on-campus students in all subjects across the University regardless of whether paperless marking is used.

Recommendation 2. Subject coordinators of all distance subjects should be provided with the option of paperless marking and return of assignments as soon as possible.

Recommendation 3. A feature should be added to EASTS allowing a student to specify whether their feedback should be automatically emailed to them, similar to the way that forum participants can specify that forum messages are emailed to them.

Recommendation 4. There is no need for major changes to the assignment submission features of the existing EASTS system.
Recommendation 5. The existing capabilities of the EASTS system allowing for students to retrieve paperless feedback are effective but the user interface should be improved.

Recommendation 6. EASTS should provide a batch download option, allowing the assignments of all students in a cohort to be downloaded in a single step.

Recommendation 7. EASTS should indicate the file size of each student assignment to cater better for remote markers downloading assignments over a slow connection.

Recommendation 8. EASTS should provide the option of automatically generating filenames for student assignments containing the student name, number, subject and assessment item number.

Recommendation 9. EASTS should cater specifically for ‘replacement’ assignment submissions and for submissions consisting of multiple files, and should also provide an indication within the Student interface of whether an assignment has already been retrieved for marking.

Recommendation 10. The provision of a mechanism within EASTS whereby a student can submit each part of an assignment separately to allow for separate marking of each part should be explored.

Recommendation 11. Thought should be given by academic staff to the design of the assignment task to ensure that student submissions can be marked efficiently using paperless techniques.

Recommendation 12. EASTS should provide a batch upload option, allowing the assignments of all students in a cohort to be returned in a single step.

Recommendation 13. The labelling of options within the EASTS academic interface should be improved to avoid ambiguity, and in particular the interface for return of paperless feedback should be improved.

Recommendation 14. EASTS should allow for assignment feedback returned to students to consist of more than one file.

Recommendation 15. EASTS should cater explicitly for an assignment resubmission and remarking cycle, if specified by the subject coordinator.

Recommendation 16. CSU should consider providing Adobe Acrobat software for the creation of PDF files as a standard on all academic desktop machines.

Recommendation 17. The recommended approach to the annotation of students’ work with comments when using a desktop computer is Word’s ‘Insert Comment’ feature.
Recommendation 18. Time can be saved in marking assignments for large cohorts by using either Word’s Clipboard or AutoText feature for saving and reusing comments.

Recommendation 19. Software tools allowing for the creation of mark sheets in a standard format, the automated tallying of marks and the ability to return such mark sheets along with a student’s annotated assignment would improve the efficiency of the paperless marking process.

Recommendation 20. Although the use of dual monitors allows for two documents to viewed at the same time, the process of regularly switching the focus from one to the other, to allow feedback to be entered in one document, while scrolling through the other, is not as efficient as the paper-based alternative.

Recommendation 21. Until the cost of Tablet computers comes down to something approaching that of Notebook computers, their purchase specifically for paperless marking is not recommended, except in subject areas where complex diagrams are an important part of many student assignments.

Recommendation 22. The use of an external ‘Pen and Graphic Tablet’ as an alternative to a Tablet computer for annotating student assignments is not recommended due to usability problems.

Recommendation 23. The use of audio feedback files is feasible within the constraints of existing bandwidth, but care needs to be taken in the selection of recording equipment and audio settings.

1.3 Limitations of the Study

The subjects included in the trial were all Information Technology (IT) subjects. Consequently, the academic staff and students involved had a higher than average level of computer literacy. Consequently, it is likely that students and academic staff from other disciplines will encounter additional problems to those identified in this study if they attempt paperless marking and return of assignments.

One of the initial goals of the study was to compare the cost savings to be obtained from paperless marking with any additional hardware, software or academic labour costs. It became clear during the study that it would be very difficult to carry out such an analysis in any objective way. The additional hardware, software and academic labour costs would depend greatly on the marking technique, the hardware, the software, the type of assignment and the skill level of the marker. The cost savings at the system level would be very dependent on the staffing levels and work practices of the Learning Materials Centre. Consequently, it was determined that this aim could not be met within the scope of the study.
1.4 Follow up Studies

Once the identified problems with the EASTS system have been resolved or a new replacement system implemented, a follow up study involving students and academic staff from a range of disciplines would be desirable.

Due to various methodological problems the data gathered comparing the time required to mark assignments using paperless and paper-based techniques was inconclusive. Further follow up studies comparing the marking time for various assignment types using paperless and paper-based techniques would be desirable.
2 Background

2.1 Terms of Reference

The Electronic Assignment Submission and Tracking System (EASTS) has been very well received by Distance Education Students, with the vast majority of students in many disciplines now submitting their assignments electronically. The system allows for electronic submission of assignments and also has capability for electronic return. However, the potential for paperless marking and electronic return of assignments has only recently begun to be explored.

Daryl Miller and Anthony Chan contributed to a trial of paperless marking of assignments and the return of sample solutions and student feedback via EASTS, conducted during Autumn 2004. As a result of this initial informal trial a number of barriers to paperless marking were identified. The purpose of this larger study was to further explore the feasibility of paperless marking as well as exploring alternative hardware, software and marking approaches to address the barriers identified in the initial investigation. The study was funded by the Division of Information Technology (DIT) and supported by the Learning Materials Centre (LMC).

The specific aims of the study were:

- To gauge student perceptions on the benefits and the deficiencies resulting from the usage of paperless assignment marking and return;
- To gauge marker perceptions on the benefits and the deficiencies resulting from the usage of paperless assignment marking and return;
- To identify computing technologies that provide efficiencies in paperless assignment submission, marking and return;
- To identify procedures for the handling of paperless assignment submission, marking and return;
- To analyse statistically the amount of academic time required to mark various types of assignments in a paperless way compared with traditional marking approaches;
- To compare the cost savings to be obtained from paperless marking with any additional hardware, software or academic labour costs; and
- To provide recommendations and feedback to the Learning Materials Centre (LMC) relating to the use of EASTS with paperless marking.

In order to achieve these aims, a formal trial of paperless marking was undertaken. The key features of the trial were as follows:

- It included 20 internal, distance education and offshore distance Information Technology (IT) subjects, with 545 enrolments and 1023 student assignments in Autumn and Spring 2005;
• It included a range of hardware configurations, including laptop, desktop and tablet computers, with single and dual monitors, as well as a graphics tablet and audio devices;

• It included a range of software tools to assist with marking, including Microsoft Word, Microsoft Excel, Microsoft Access, Microsoft Windows Journal and Adobe Acrobat;

• Markers, including five full-time academic staff and three casual marking assistants, recorded their reflections on the hardware, software and marking techniques trialled;

• A limited comparison of the marking time required for the key marking hardware, software and approaches was undertaken; and

• A survey of students involved in the trial was undertaken, with 114 of the 545 students responding.

2.2 The EASTS System

By default, distance students of CSU may submit assignment work electronically via EASTS - Electronic Assignment Submission and Tracking System. It is the EASTS facility that provides administrative and management control of the submission, tracking and return of assignments. Current standard practice of EASTS involves the printing of submitted assignments by the LMC, delivery to academics, marking and then return processing to students via the postal service, activities that naturally involve substantial time delays. The existing EASTS system has the following characteristics:

• EASTS is available to CSU Distance Education (DE) & Offshore Tutorial (OT) students, but not normally to internal students.

• EASTS accepts Microsoft Word (doc) or Rich Text Format (RTF) documents. Other file types are allowed where an academic agrees to retrieve them manually.

• Submissions are ‘printed’ at Wagga (for example, in 2005 1,010,000 pages were printed).

• Hard-copy (HC) assignments are couriered to the academic responsible for marking. Comments and marks are added to the HC which is then couriered to the Bathurst campus and returned to students [including OT] via the standard postal service.

Problems with the current EASTS paper based approach are:

• There are substantial time delays involved. The current HC process adds to the time that it takes a student to receive feedback and assessment on a submitted item. The delay in ‘delivering to an academic’ and ‘returning a marked submission to a student’ is estimated at being at between five to eight working days. In the case of students taught in Offshore Tutorial (OT) mode this delay is compounded by the longer assignment return times.

• The workload on the EASTS system and staff is increasing due to its popularity. The percentage of DE assignments handled by EASTS is increasing. In 2005 66% of DE student assignments were submitted through EASTS.
• EASTS incurs a substantial cost in printing and despatching of assignments, estimated by the LMC to be $98,500 in 2003.

• Internal students are not afforded the same facility as DE students. Many internal students have requested access to EASTS.

• The use of external markers requires administrative handling, tracking and delivery of printed assignments within schools.

Part of the outcome of this project was to assist in identifying hardware, software, procedures and practices that alleviate or overcome some of the above EASTS problems. In particular the paperless handling of assignment submission has the potential to:

• Reduce substantially the delays students experience in receiving returned assignments;

• Streamline the process of making assignments available to external markers, some of whom are located in metropolitan centres;

• Reduce substantially the printing costs incurred by the LMC and therefore CSU;

• Extend the facility of electronic lodgement of assignments to all appropriate CSU students;

• Reduce the likelihood of lost assignments;

• Provide better quality feedback to students; and

• Enable academics to more accurately identify cases of plagiarism and collusion.

2.3 Paperless Marking Support in the EASTS System

Although designed primarily for assignment submission and tracking, the EASTS system includes some basic features to assist with paperless return of assignments. The paperless return features of EASTS are normally unavailable and require a manual configuration option to be set before they are accessible to lecturers and students in a particular subject.

Because the features are somewhat rudimentary and have a number of interface deficiencies they have not been made widely available. For the purpose of this trial these configuration options were set, enabling the paperless return of assignments for the subjects included in the trial.
Once paperless marking is enabled, EASTS includes the following additional features:

- The ability for a lecturer to download a student’s assignment onto their local machine (this feature is available even when paperless marking is turned off, but once paperless marking is turned on, it becomes the standard way to retrieve assignments);
- The ability for the lecturer to upload a feedback file along with additional textual comments to EASTS;
- The ability for the lecturer to ‘return’ uploaded feedback to the students, after which the following two actions occur (having this return option as a second step in the process allows, for example, for a casual marker to upload a marked assignment for the subject coordinator to check, before the assignment feedback is accessible to the student);
- The automatic generation of an email to the student letting them know that their feedback is available for collection; and
- The ability for a student to download their marked assignment and view additional textual comments online.
3 Method

3.1 Overview

The project commenced in Spring 2004 with the exploration of hardware and software configurations prior to purchase. Main configurations considered included standard desktop computers and tablet computers each configured with single and dual monitors.

In Autumn session 2005, paperless marking was undertaken in seven on-campus, one DE and three dual mode subjects with a total enrolment of 254 students using 21 different assessment items and a total of 554 student assignments. A variety of assessment types, feedback styles and hardware and software configurations were trialled. Marking was undertaken by members of the project team as well as by external markers. Markers recorded their reflections on the convenience of various configurations and the effect on quality of output, as well as on relevant capabilities of the EASTS system. Additionally, students in the subjects involved were asked to complete a survey on positive and negative features of paperless marking and on the capabilities of the EASTS system.

In Spring 2005, paperless marking was undertaken in three on-campus, three DE and three dual mode subjects with a total enrolment of 280 students using 18 different assessment items and a total of 469 student assignments. Once again a variety of assessment types, feedback styles and hardware and software configurations were trialled and once again markers recorded their reflections and students were surveyed. Additionally in a limited number of assignments marking time for paper-based and paperless marking was compared, including a number of paperless feedback approaches.

The subjects included in the trial were all Information Technology (IT) subjects reflecting the teaching area of the project team. An earlier pilot study identified a number of usability problems with the EASTS system for paperless return of marked assignments and it was our view that a trial with students with limited IT skills may have resulted in an overly negative impression of paperless marking due to problems with this system rather than of paperless marking per se. Additionally, it was our view that for academics with limited IT skills to undertake paperless marking substantial support and resources beyond those currently available would have been required, and consequently it was unreasonable for such academics to participate in the trial at this stage. Nevertheless, we recognise that the sample used in this study will lead to limitations in generalising the results and follow up studies using a wider student and academic sample are essential.

3.2 Marking Techniques

Earlier trials of paperless marking had found that it had the potential to be more time consuming than paper-based marking. We believed that this inefficiency could be reduced through appropriate use of hardware and software and through appropriate marking techniques. Our views diverged, however, on which hardware, software and techniques would be the most effective in this context and a key aspect of the trial was to explore and compare a number of approaches. This section describes and summarises the
main hardware configurations, software packages, file formats and feedback styles included in the trial. Our conclusions about the relative effectiveness of each have been provided in Section 5.

In addition to the marking configurations and feedback styles listed in the tables in this section, some additional configurations and styles of feedback were trialled with very small numbers of students in other subjects by members of the project team. For example, audio was trialled in one assignment in one subject with a small number of students and a graphics tablet was used for a small number of students in another subject. Reflections from these informal trials have been also been included in Section 5.

### 3.2.1 Submission Formats

When operating in its default paper-based mode the EASTS system restricts student submissions to Word documents and RTF files. In paperless mode, any file format can be submitted as long as the marker has the software on their machine to handle it. Different assignment types lend themselves to different submission formats and consequently a number of different submission formats were trialled. An additional issue is how to handle multiple file submissions. For example, in IT subjects it is quite common for students to be required to submit program code or database files, in addition to documentation. One approach to this situation is to require the student to place all of the files into a single compressed Zip file. Alternatively, the EASTS system allows a student to submit multiple files for a single assessment item if desired. Table 1 summarises the submission formats trialled.

<table>
<thead>
<tr>
<th>Submission Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td>Word document</td>
</tr>
<tr>
<td>Word in Zip</td>
<td>More than one Word document in a Zip file</td>
</tr>
<tr>
<td>Word and Code in Zip</td>
<td>Word document and program code inside a Zip file</td>
</tr>
<tr>
<td>Word plus Zip containing Code</td>
<td>Word document as well as a Zip file containing program code</td>
</tr>
<tr>
<td>Word and Excel in Zip</td>
<td>Word document and Excel Spreadsheet in Zip file</td>
</tr>
<tr>
<td>Word with embedded PowerPoint</td>
<td>Word document with embedded PowerPoint slides submitted to EASTS. PowerPoint file also separately posted by students to subject forum.</td>
</tr>
<tr>
<td>System</td>
<td>Word document submitted, with web site or system deployed to another server as part of submission</td>
</tr>
</tbody>
</table>

### 3.2.2 Marking Hardware

There were four main hardware configurations trialled, which essentially consisted of desktop and tablet computers with and without dual monitors, as shown in Table 2.
A desktop computer with dual monitors provides a single screen area spread across the two monitors, with the user able to move the mouse smoothly between the two monitors. Additionally, separate documents can be displayed on each monitor, so that, for example a student’s assignment can be displayed on one monitor and a feedback sheet or marking rubric can be displayed on the other. Similarly, a Tablet computer with an external monitor acts as a dual monitor machine because the external monitor displays an extension of the desktop area displayed on the built in monitor. Some members of the project team also used a laptop computer. Because the capabilities provided by a laptop or notebook computer are identical to those provided by a desktop computer, they have been treated as a single configuration for the purpose of this study. More information about the hardware configurations and comments about issues identified with each have been included in Section 5.

<table>
<thead>
<tr>
<th>Marking Configuration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>Standard desktop computer</td>
</tr>
<tr>
<td>PC DM</td>
<td>Desktop computer with dual monitor configuration</td>
</tr>
<tr>
<td>Tablet</td>
<td>Tablet computer</td>
</tr>
<tr>
<td>Tablet EM</td>
<td>Tablet computer with external monitor</td>
</tr>
</tbody>
</table>

### 3.2.3 Return Mechanisms

As shown in Table 3 there are four different ways that assignment feedback can be returned to students. In this trial, all markers used EASTS for feedback return and all chose to return a document through EASTS rather than entering text into a feedback form. This is discussed further in Section 5.1.2.

<table>
<thead>
<tr>
<th>Return Mechanism</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EASTS document</td>
<td>Feedback document uploaded to EASTS system, email notification of availability automatically sent</td>
</tr>
<tr>
<td>EASTS text</td>
<td>Feedback entered into form in EASTS, email notification of availability automatically sent</td>
</tr>
<tr>
<td>Email</td>
<td>Feedback sent in body of email</td>
</tr>
<tr>
<td>Email attachment</td>
<td>Feedback sent as attachment to email</td>
</tr>
</tbody>
</table>
3.2.4 Returned File Formats

Assignment feedback, whether paper-based or paperless tends to take one of two forms:

1. The student’s work annotated with comments and marks.
2. A feedback sheet or marking rubric showing the student’s marks for each of a series of criteria, along with comments.

In many of the assignments in this trial it was desirable to include both types of feedback. This presented problems because the EASTS system restricts feedback to a single file. This limitation was addressed by either appending the feedback sheet to the student’s annotated document, or placing the feedback sheet and the student’s annotated document into a .zip file.

The actual file formats returned to students varied depending on the nature of the assignment, the file format of the student’s submitted work, the software used for marking and the marker’s individual preference. The most common return file format was Microsoft Word. Some members of the project team used Word to annotate the student’s work and to create a feedback file but preferred to convert the returned file to PDF using Adobe Acrobat. Where assignments were marked by writing directly on the student’s work using the tablet computer, it was necessary to convert the feedback file to PDF to allow the student to read it. The alternative of providing students with a free reader for the tablet computer’s Windows Journal file format was considered too cumbersome.

Where an assignment is marked against a series of criteria, and a separate mark is awarded against each, it is desirable to automate the process of adding up the subsidiary marks. Members of the trial team adopted a number of approaches to this. The simplest was to create a feedback file as a table in Word and to use Word’s Insert-Formula feature. Alternatively some members of the team created the feedback in file in Microsoft Excel and then either copied the marks into Word, created a PDF file from the Excel spreadsheet, or produced the feedback files using a Mail Merge in Word, using the Excel spreadsheet as the data source. Lastly, one member of the project team created a purpose built Microsoft Access database and generated the feedback sheets as a database report, before converting them to PDF.

Table 4 lists the return file formats used in the trial. More information about these return formats and comments about issues identified with each have been included in Section 5.
### Table 4
Return File Formats

<table>
<thead>
<tr>
<th>Return File Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td>Word document with inserted comments and marks</td>
</tr>
<tr>
<td>Word PDF</td>
<td>Word document with inserted comments and marks converted to PDF file</td>
</tr>
<tr>
<td>Excel PDF</td>
<td>Excel spreadsheet with inserted comments and marks converted to PDF file</td>
</tr>
<tr>
<td>Access PDF</td>
<td>Access application created specifically for recording student marks and feedback with output converted to PDF</td>
</tr>
<tr>
<td>Word Zip</td>
<td>Word document with inserted comments along with feedback file containing marks converted to Zip file</td>
</tr>
<tr>
<td>Tablet PDF</td>
<td>Tablet journal file with written annotations and marks converted to PDF</td>
</tr>
</tbody>
</table>

#### 3.3 Evaluation Techniques

The terms of reference of the project required us to evaluate paperless marking from an academic/marker perspective and from a student perspective.

Data gathered relating to the marker perspective was primarily qualitative. Each of the eight markers (the five members of the project team along with three casual markers), recorded their reflections on various aspects of the process throughout the project and these were consolidated into a single document of over 4000 words. The key points were then summarised and discussed by the members of the project team leading to the set of specific issues and recommendations discussed in Section 5.

It was originally intended that substantial data comparing the time taken to mark assignments in various formats would be gathered during the project. Our intention was that after an initial exploratory trial of the various approaches during Autumn 2005, it would be possible to formally compare the time taken for the key approaches in Spring 2005. Due to various logistic issues (including the sharing of a single Tablet computer) this marking duration data was gathered only for three assignments. Consequently, further studies will be needed before clear conclusions can be formed about the relative time required for the various approaches.

Data relating to student perspectives was gathered using an online survey at the end of Autumn and Spring sessions. All students involved in the paperless marking trial were asked to complete the survey using a combination of face-to-face reminders in class, emails and online forum messages. In all, 56 students responded to the survey in Autumn session and 58 in Spring session. The survey consisted of six Likert scale questions, one yes/no question, and five questions allowing the student to write free-form comments elaborating on their answers. Questions related to the students’ preference for paperless
versus paper-based submission and return of assignments as well as the capabilities of the EASTS system for assignment submission and retrieval. The complete survey has been included in Appendix B.

### 3.4 Summary of Subjects and Techniques

Table 5 shows the subjects, modes and assignments included in the trial and the subject enrolment in each case.

<table>
<thead>
<tr>
<th>Session</th>
<th>Subject</th>
<th>Modes</th>
<th>Assignments</th>
<th>Enrolment</th>
</tr>
</thead>
<tbody>
<tr>
<td>200540</td>
<td>ITC237</td>
<td>WI</td>
<td>1, 2</td>
<td>16</td>
</tr>
<tr>
<td>200540</td>
<td>ITC161</td>
<td>WI</td>
<td>1, 3</td>
<td>35</td>
</tr>
<tr>
<td>200540</td>
<td>ITC423</td>
<td>WI</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>200540</td>
<td>ITC114</td>
<td>WI</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>200540</td>
<td>ITC540</td>
<td>DE,OT</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>200540</td>
<td>ITC125</td>
<td>WI</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>200540</td>
<td>ITC204</td>
<td>DE,OT,WI</td>
<td>1</td>
<td>38</td>
</tr>
<tr>
<td>200540</td>
<td>ITC357</td>
<td>DE,OT,WI</td>
<td>1, 2, 3</td>
<td>46</td>
</tr>
<tr>
<td>200540</td>
<td>ITC557</td>
<td>DE,OT,WI</td>
<td>1, 2, 3</td>
<td>29</td>
</tr>
<tr>
<td>200540</td>
<td>ITC129</td>
<td>WI</td>
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<tr>
<td>200540</td>
<td>ITC429</td>
<td>WI</td>
<td>1, 2, 3</td>
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</tr>
<tr>
<td>200570</td>
<td>ITC270</td>
<td>DE,OT,WI</td>
<td>1, 2</td>
<td>20</td>
</tr>
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<td>11</td>
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</table>

Table 6 shows the assignment type, the submission format, the hardware configuration, the return file format and the return mechanism used for each assignment in the trial.
### Table 6
Assignment Types and Submission and Feedback Approaches

<table>
<thead>
<tr>
<th>Subject</th>
<th>Assign</th>
<th>Assignment Type</th>
<th>Submission Format</th>
<th>Marking Configurations</th>
<th>Return File Format</th>
<th>Return Mechanism</th>
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<tbody>
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<td>ITC237</td>
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<td>Programming</td>
<td>Word plus Zip Containing Code</td>
<td>PC, PC DM</td>
<td>Word PDF</td>
<td>EASTS document</td>
</tr>
<tr>
<td>ITC237</td>
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<td>Word plus Zip Containing Code</td>
<td>PC, PC DM</td>
<td>Word PDF</td>
<td>EASTS document</td>
</tr>
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<td>ITC161</td>
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<td>Written</td>
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<tr>
<td>ITC161</td>
<td>3</td>
<td>Written and Spreadsheet</td>
<td>Word and Excel in Zip</td>
<td>PC, PC DM</td>
<td>Word PDF</td>
<td>EASTS document</td>
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<td>ITC540</td>
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<td>PC DM, Tablet</td>
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<td>ITC357</td>
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<td>PC, PC DM</td>
<td>Word</td>
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<td>PC, PC DM</td>
<td>Word</td>
<td>EASTS document</td>
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<td>Word</td>
<td>EASTS document</td>
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<td>Zip</td>
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</table>
4 Results: Student Perspective

4.1 Student Survey: Quantitative Data

An online survey was made available to all students involved in the paperless marking trial at the end of Autumn and Spring sessions (see Appendix B for a full list of the survey questions). 56 out of 254 students responded in Autumn session and 58 out of 280 students responded in Spring session. Table 7 shows the distribution of respondents according to study mode and session.

<table>
<thead>
<tr>
<th></th>
<th>Internal</th>
<th>Domestic Distance</th>
<th>Offshore Distance</th>
<th>Unspecified Mode</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autumn</td>
<td>28</td>
<td>17</td>
<td>5</td>
<td>6</td>
<td>56</td>
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<tr>
<td>Spring</td>
<td>14</td>
<td>27</td>
<td>5</td>
<td>12</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>44</td>
<td>10</td>
<td>18</td>
<td>114</td>
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</tbody>
</table>

In the Likert scale questions, students were provided with a statement and were asked to indicate their degree of agreement from very strongly agree, to neutral to very strongly disagree. The following sections provide a summary of responses to these questions.

4.1.1 Preference for Electronic Submission

Students were asked to indicate their degree of agreement with the statement “I prefer electronic submission through the EASTS system to conventional submission of assignments (via post for distance students or through an assignment box for on campus students)”. The results, shown in Table 8 and Figure 1 suggest that respondents, regardless of study mode, would overwhelmingly prefer to submit their assignments electronically.
Table 8

Student survey responses to “I prefer electronic submission through the EASTS system to conventional submission of assignments”

<table>
<thead>
<tr>
<th>Study Mode</th>
<th>Very Strongly Agree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Very Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (WI)</td>
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<td>7</td>
<td>1</td>
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<td></td>
<td></td>
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<tr>
<td>Domestic Distance (WD)</td>
<td>37</td>
<td>5</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Offshore Distance (OT)</td>
<td>9</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unspecified Mode</td>
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<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
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<td>10</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 1

Student survey responses to “I prefer electronic submission through the EASTS system to conventional submission of assignments”
4.1.2 *Preference for Typed Feedback*

Students were asked to respond to the statement “I prefer typewritten or word processed feedback on assignments to hand-written feedback”. This question was designed to determine whether typewritten feedback was important irrespective of whether the feedback is then printed or provided electronically. The results are presented in Table 9 and Figure 2. Clearly there is a very strong preference for typewritten feedback again irrespective of study mode.

<table>
<thead>
<tr>
<th>Study Mode</th>
<th>Very Strongly Agree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Very Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (WI)</td>
<td>17</td>
<td>8</td>
<td>10</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Domestic Distance (WD)</td>
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<td>9</td>
<td>11</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Offshore Distance (OT)</td>
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<td>5</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>2</td>
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<td>24</td>
<td>22</td>
<td>15</td>
<td>6</td>
<td>1</td>
<td>5</td>
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</tbody>
</table>
I prefer typewritten or word processed feedback on assignments to hand-written feedback

Figure 2
Student survey responses to “I prefer typewritten or word processed feedback on assignments to hand-written feedback”

4.1.3 Preference for Electronic Return

Students were then asked to respond to the statement “I prefer to receive my assignments back via email or the web rather than by conventional means (in the post for distance students or in class time for on campus students)”. This question was intended to focus on the delivery of the feedback rather than the form of the feedback. The results are presented in Table 10 and Figure 3. Although there is a clear preference for electronic feedback, there is a sizable minority of students (especially on-campus students) who either would prefer to receive their feedback through conventional non-electronic means, or are uncertain of their preference.
Table 10
Student survey responses to “I prefer to receive my assignments back via email or the web rather than by conventional means”

<table>
<thead>
<tr>
<th>Study Mode</th>
<th>Very Strongly Agree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Very Strongly Disagree</th>
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</thead>
<tbody>
<tr>
<td>Internal (WI)</td>
<td>15</td>
<td>5</td>
<td>11</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Domestic Distance (WD)</td>
<td>22</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Offshore Distance (OT)</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unspecified Mode</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
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<td>21</td>
<td>19</td>
<td>11</td>
<td>9</td>
<td>3</td>
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</tbody>
</table>

I prefer to receive my assignments back via email or the web rather than by conventional means

Figure 3
Student survey responses to “I prefer to receive my assignments back via email or the web rather than by conventional means”
(The value 6 has been omitted as there were no strongly disagree responses)

4.1.4 Preference for Emailed versus Downloaded Feedback

Students were asked to respond to the statement “If assignment feedback is to be electronic, I would prefer to download it myself from an online system rather than having
it emailed to me” and the results are presented in Table 11 and Figure 4. There is no clear preference for either web based retrieval or emailed return of assignments. This probably suggests that the system should allow either for students to choose how their assignments are to be returned or for assignments to automatically be both emailed and posted to the web.

<table>
<thead>
<tr>
<th>Study Mode</th>
<th>Very Strongly Agree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Very Strongly Disagree</th>
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<tbody>
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<td>1</td>
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</tr>
<tr>
<td>Offshore Distance (OT)</td>
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</tbody>
</table>

If assignment feedback is to be electronic, I would prefer to download it myself from an online system rather than having it emailed to me

**Figure 4**

Student survey responses to “if assignment feedback is to be electronic, I would
prefer to download it myself from an online system rather than having it emailed to me”

4.1.5 Effectiveness of EASTS for Assignment Submission

Students were asked to respond to the statement “the existing EASTS system is an effective tool for electronic submission of assignments” and the results are presented in Table 12 and Figure 5. It is clear that students on the whole are happy with the submission part of the EASTS system. Internal students, although almost all agreeing with the statement, are less strong in their agreement than DE students. This may be due to the fact that most would have only used EASTS for assignment submission in a small number of subjects, whereas Distance students would typically have used the system for a number of subjects over a period of a few years.
Table 12
Student survey responses to “the existing EASTS system is an effective tool for electronic submission of assignments”

<table>
<thead>
<tr>
<th>Study Mode</th>
<th>Very Strongly Agree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Very Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (WI)</td>
<td>9</td>
<td>10</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Domestic Distance (WD)</td>
<td>17</td>
<td>13</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Offshore Distance (OT)</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unspecified Mode</td>
<td>5</td>
<td>3</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>32</td>
<td>33</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

The existing EASTS system is an effective tool for electronic submission of assignments

Figure 5
Student survey responses to “the existing EASTS system is an effective tool for electronic submission of assignments”
4.1.6 Effectiveness of EASTS for Electronic Assignment Return

Students were also asked to respond to the statement “The existing EASTS system is an effective tool for the electronic retrieval of assignment feedback”. The results here, which are presented in Table 13 and Figure 6, indicate that students are not as overwhelmingly happy with the features of EASTS for retrieval of feedback as they are with its features for submission of assignments.

<table>
<thead>
<tr>
<th>Study Mode</th>
<th>Very Strongly Agree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Very Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (WI)</td>
<td>4</td>
<td>12</td>
<td>16</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Distance (WD)</td>
<td>13</td>
<td>8</td>
<td>11</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Offshore Distance (OT)</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unspecified Mode</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>26</td>
<td>37</td>
<td>13</td>
<td>12</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

The existing EASTS system is an effective tool for the electronic retrieval of assignment feedback

![Chart showing survey responses](chart.png)
Figure 6
Student survey responses to “the existing EASTS system is an effective tool for the electronic retrieval of assignment feedback”

4.1.7 Overall Preference for Paperless Feedback

In the final closed response question, students were asked “do you think that electronic paperless assignment feedback should be used more widely?” The intention of this question was to get a single overall positive or negative response to the idea of paperless feedback. The results, as shown in Table 14 and Figure 7, show that students are overwhelmingly in favour of the wider use of paperless assignment feedback.

<table>
<thead>
<tr>
<th>Study Mode</th>
<th>No</th>
<th>Yes</th>
<th>Undecided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (WI)</td>
<td>2</td>
<td>33</td>
<td>7</td>
</tr>
<tr>
<td>Domestic Distance (WD)</td>
<td>2</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>Offshore Distance (OT)</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Unspecified Mode</td>
<td>2</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>92</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 14
Student survey responses to “do you think that electronic paperless assignment feedback should be used more widely?”
Do you think that electronic paperless assignment feedback should be used more widely?

Figure 7
Student survey responses to “do you think that electronic paperless assignment feedback should be used more widely?”

4.2 Student Survey: Comments

Comments typical of those received have been presented below, grouped by themes. They have been selected as indicative comments or because they provide useful insights. They represent roughly 20% of the number of comments received. Please note: all student comments are quoted as they typed them, with no correction of spelling or grammar.
4.2.1 Example Comments Relating to Electronic Feedback

Positive Comments

- “Easier to find and review assignment feedback”
- “No issues trying to understand handwriting”
- “You know the lecturer actually got it as you receive a confirmation email”
- “I can keep my feedback (marked Assignment) electronically, stored on disk with the submitted Assignment. At the end of my studies I'm hoping to a single CD with all my submissions and results.”
- “We can get access to the feedback from anywhere in the world in no time”
- “Speedy feedback is crucial for distance learning students in order to proceed/improve subsequent submissions”
- “DE students live various distances away from Uni and therefore receive their feedback at different times if sent by mail. It is good for all students to get their feedback at the same time and more quickly than is possible with the mail service”
- “DE students (particularly those of us who live overseas) can get feedback much more quickly.”
- “Feedback and results are more immediate”
- “If for some reason the assignment and attached marker comments were to be lost they would have been saved by the marker in an electronic format that could them easily be resent.”

Negative Comments

- “in ITC242 for assessment 1 I liked that the marking sheet was returned to us in class which meant that we got feedback with our marks and comments in front of us.”

General Comments (perceptions)

- “The potential of better assignment feedback. Currently, the hand written version lacks sufficient feedback. I guess its because of writers cramp. Now there is no excuse. If paperless is to be used, then students have a right to expect better feedback because markers no longer have to hand write the feedback. Typing it would make it quicker and easier, thus making it "easier and faster" to provide better feedback.”
- “I think that overall, any system that gives more actual feedback would be good. Its a pain getting a mark like 50-70 and not knowing what you did wrong (or what you did not quite right enough).”
4.2.2 Example Comments Relating to Online Delivery of Feedback

Positive Comments

- “It is easy to use. You can hand in the assignment no matter where you are, as long as you have access to a computer and the internet”
- “It is time efficient.”
- “It makes it convenient to check the assignment and then to hand it in straight away”
- “For distance students, they will receive feedback approx. a week earlier than they would normally”
- “instead of 5pm at the academic building it is 11:59pm”
- “It’s quicker.”
- “You know for sure that your assignment has been received immediately”
- “Can be accessed from anywhere that has an Internet connection”
- “can retrieve past assignments anywhere anytime”
- “As an internal student my assignments have to be in by 5pm in the assignment box, whereas with EASTs you have till midnight”
- “I can work while travelling”
- “it allows for greater flexibility for internal and distance students who work during the day”
- “same set of submission conditions as DE students, more fair.”
- “Potentially faster turn-around.”
- “In my case I am living overseas and receive assignments later than everybody else due to travel time. Electronic distribution would make it fairer as everybody would have the same amount of time to review their work.”
- “Electronic return is much faster, and can make the difference between getting an assignment back before an exam and not.”
- “easts is wonderful! I work for Australia Post and see the stress that students from other universities go through when submitting their assignments, trying to find the right envelopes and worrying whether it will arrive on time. It is so stressful for them to use the mail system.”

Negative Comments

- “Need to train lecturers how to use EASTS system more effectively so students can receive marks back in time, not a week before the exams”
- “One thing that worries me is security. If it were used more widely, students could hack and get other students’ marks. This can invade students’ marks and privacy.”
- “Too Slow! for submitting about 4MB assignment, It may be timeout, it need to be submitted several times”
- “Retrieval was pretty easy. It would be difficult however for those with a dial up system. Dial up is still used by those distance ed students in remote locations, overseas, or who travel quite a bit to places where the telephone exchange is bad an broadband is not available.”
4.2.3 Example Comments Relating to Printing, Environment and Cost Issues

Positive Comments

- “It saves paper (more environmentally friendly). My last assignment with screen shots and source code ended up being over 100 pages - I think its totally crazy to print something like that out, just to return it with a few comments.”
- “it saves paper and is easier for me to keep track of my assigments and marks easier then having to try and find the paper version.”
- “Many assignments can be VERY long, and require lots of ink and paper to print, thus causing greater expense to the student.”
- “Less paper wastage”
- “it saves trees!”

Negative Comments

- “It puts the cost on to us, the student to print it out, because we all like to keep paper records of things.”
- “i dont like paying for printer use”

4.2.4 Example Comments Relating to File Format Issues

Positive Comments

- “I can keep my feedback in eletronic format”
- “also a printer is not needed, so high graphic images are presented better”
- “It is easier to manage all subject content electronically”

Negative Comments

- “Assignments should be returned as PDFs, so it guarantees that nothing can be changed. Plus, it means the marker can be guaranteed as to how the results will look to the student.”
4.2.5 Example Comments Relating to EASTS, Including Technical Issues

Positive Comments

- “EASTS is a great concept, the current implementation of it could be cleaned up (mainly UI crappiness).”

Negative Comments

- “There was an issue where some assignments were returned as a word document and one came as a PDF, however the PDF did not download from EASTS as a PDF file. This was slightly confusing.”
- “East is a scary thing to use. You always have a fear that it won’t come out the way you want and you’ll never know until you receive feedback from a lecturer. (too late) You can never be sure the file actually made it anywhere because it sits there forever and looks like its doing nothing until ages later when you might receive an email. It doesn’t print colour which is bad for graphs. It won’t take files that IT students frequently use.”
- “EASTS should be expanded to accept more content types”
- “the EASTS system should accept file format other than Word format.”
- “needs a bit of work done with compatibility with non IE browsers (ie Firefox)”
- “To make assignment retrieval easier, clearer instructions for downloading and viewing would be better. Receiving the instructions in an email that were different to the instructions on the actual assignment retrieval site was also confusing, just make sure that everything tells us students the exact same thing to eliminate confusion.”

General Comments

- “It would have a suggested naming rule for the assignment file name”
- “In the case of the lecturer allowing different file types to be submitted, such a zip files, these should be enabled for that assignment so there isn’t the message saying EASTS can’t handle that file type. These should also be listed on the submit assignment page, along with a description of what is meant to be included within the zip file for example.”
- “The EASTS system is not very intuitive. A tabular format which shows my subjects, my submissions, and my receipts would be much more straightforward. Further, the EASTS system is very inflexible. It only supports Microsoft Word formats (short of HTML and text - near useless for most assignment submissions). It should be extended to support open standards (i.e. Open Office documents, not just RTF), as well as Excel. I’ve had assignments in past where I’ve had to copy and paste 40+ pages of Excel sheets into a Word document to submit the assignment. I understand the EASTS system can take other lecturer-approved formats; perhaps lecturers should be more able to accept some of these (such as Excel and Zip compressed files).”
- “I also think email notification of when an assignment is available for retrieval would be a good feature as I like to get mine as soon as it is available”
4.3 Conclusions and Recommendations

Based on the qualitative and quantitative results of the student survey, the project team make the following recommendations.

On-campus and distance students surveyed overwhelmingly preferred electronic assignment submission.

Recommendation 1. EASTS submission should be provided for on-campus students in all subjects across the University regardless of whether paperless marking is used.

Students surveyed overwhelmingly preferred typewritten feedback over handwritten feedback. Distance students surveyed overwhelmingly preferred electronic assignment return to printed assignment return. The majority of on campus students surveyed also preferred electronic assignment return but there was a significant minority who preferred printed assignment return.

Recommendation 2. Subject coordinators of all distance subjects should be provided with the option of paperless marking and return of assignments as soon as possible.

A sizable proportion of surveyed students would prefer to download their feedback from a remote system, a sizable proportion would prefer to have it emailed to them, and a sizable proportion are undecided.

Recommendation 3. A feature should be added to EASTS allowing a student to specify whether their feedback should be automatically emailed to them, similar to the way that forum participants can specify that forum messages are emailed to them.

The overwhelming majority of students surveyed are happy with the existing EASTS system for assignment submission. Negative comments about it related primarily to the user interface and the file formats accepted.

Recommendation 4. There is no need for major changes to the assignment submission features of the existing EASTS system.

Support among surveyed students for the capabilities of the existing EASTS system for retrieval of paperless assignment feedback was quite strong but not as overwhelming as support for its submission features. User interface inconsistencies were the most common cause for student concern.

Recommendation 5. The existing capabilities of the EASTS system allowing for students to retrieve paperless feedback are effective but the user interface should be improved.
5 Results: Marker Perspective

5.1 Reflections on the Paperless Marking Process

Paperless marking using the EASTS system involves the following steps:

- Retrieving each student’s assignment from EASTS to a local computer;
- Marking the student’s work, which normally involves either or both of the following:
  - Annotating the student’s work with comments;
  - Creation of a feedback sheet showing the student’s marks and comments against each criteria;
- Returning the marked assignment and/or the feedback sheet to the EASTS system for the student to retrieve.

The following sections discuss in more detail the process used, the problems identified and the solutions explored during each of these stages of the process.

5.1.1 Retrieving Student Assignments

The process that the marker followed in order to retrieve a single student assignment from EASTS, was as follows:

1. Open up the EASTS Academic interface
2. Choose the year and session
3. Choose the subject, enrolment mode and assignment number
4. Choose the student, to expose options for this student
5. Choose the Download Files option
6. Click on the hyperlink provided to download the file
7. Rename the downloaded file to include the student’s name and/or student number.

Each of these steps typically involved a delay while a new page was generated by the server and displayed in the browser. Consequently, the time required to download the assignments for an entire subject cohort was substantial (at least 1 minute per student if using a fast on-campus Internet connections and longer off campus).

The time required to download a single student assignment could be reduced noticeably if steps 4, 5 and 6 listed above were collapsed into a single option. More importantly, however, the provision of a batch download option to download all student assignments for a single subject in one go would substantially improve efficiency.
All members of the project team preferred to download all assignments to their local machine before commencing marking. A number of members of the team preferred to carry out marking offline, that is, on a computer disconnected from the network, and thus downloading all assignments before commencing marking was essential.

**Recommendation 6. EASTS should provide a batch download option, allowing the assignments of all students in a cohort to be downloaded in a single step.**

Student documents were downloaded from EASTS and stored in a single assessment subdirectory or in a subdirectory of the student’s name.

Casual markers downloading assignments remotely using a modem connection noted that the system did not indicate the size of each student’s file. This made it difficult to predict how long the download would take. This was particularly an issue for one subject where student assignments contained a large number of screen captures and some of the files were more than 10 Megabytes in size.

**Recommendation 7. EASTS should indicate the file size of each student assignment to cater better for remote markers downloading assignments over a slow connection.**

The use of a filename including the student’s name or their student number was very important to ensure that the correct feedback was returned to each student. The filenames generated by EASTS did not include this and consequently this had to be entered manually by the marker when downloading the assignment. This added noticeably to the download time.

**Recommendation 8. EASTS should provide the option of automatically generating filenames for student assignments containing the student name, number, subject and assessment item number.**

EASTS allows students to submit an assignment multiple times. Students sometimes do this because they are unsure of their first attempt to submit an assignment has been successful. They also do so if they decide to do some more work on an assignment after they have submitted it, in which case they then submit a later version of the assignment. In some subjects, students are required to submit multiple documents for a single assignment. These may be multiple Word document in some cases, or may be in different formats (for example, a PowerPoint presentations and a Word document). This can present problems for the marker in identifying the correct file or files to download for marking. The system should cater better for these situations.

**Recommendation 9. EASTS should cater specifically for ‘replacement’ assignment submissions and for submissions consisting of multiple files, and should also provide an indication within the Student interface of whether an assignment has already been retrieved for marking.**

Several members of the trial group reported that they prefer to mark certain types of assignment by marking every students’ question one response, then every students’ question two response, and so on. This allows the marker to commit to memory the
nuances of each part of the assignment and their specific expectations. This can easily be done with paper-based marking by leaving the student’s assignment open at the current page after marking a question. However, with paperless marking this is more difficult because opening and closing files, and locating the page containing the response to each question is time consuming. It is possible that the EASTS system could provide better support for this type of assignment. More generally, this is an example of the importance of thinking through the design of assignments which will be marked in a paperless way to ensure that the students assignments are organised in a way that allows efficient paperless marking.

Recommendation 10. The provision of a mechanism within EASTS whereby a student can submit each part of an assignment separately to allow for separate marking of each part should be explored.

Recommendation 11. Thought should be given by academic staff to the design of the assignment task to ensure that student submissions can be marked efficiently using paperless techniques.

5.1.2 Returning Student Assignments

The process followed by a marker to return a student assignment was as follows:

1. Open up the EASTS Academic interface
2. Choose the year and session
3. Choose the subject, enrolment mode and assignment number
4. Choose the student, to expose options for this student
5. Choose the Upload option and browse to locate the file to upload on the local computer
6. Click on the Return Assignment option
7. Enter text to be added to the system generated email sent to the student notifying them of the availability of the assignment feedback

Once again, the number of steps involved in returning student assignments meant that the time required was substantial and consequently a batch assignment return facility is seen by the project team as desirable.

Recommendation 12. EASTS should provide a batch upload option, allowing the assignments of all students in a cohort to be returned in a single step.

As an alternative to the return of a feedback file, EASTS also provides an Add Comments option, which allows a series of comments and marks to be entered into an online form, the contents of which will then be accessible to the student. This was not used by any
member of the project team because it was considered desirable to have more control over the format of the feedback document and also because most members of the project team preferred to carry out their marking away from the network.

The separate Return Assignment option was ambiguous and a number of members of the project team were unaware that their feedback was not accessible by the students until they had chosen this option. This separate step was found to be useful, however, when using casual markers, because it allowed the subject coordinator to view feedback before it was returned to a student and this allowed for quality assurance of the marking.

**Recommendation 13. The labelling of options within the EASTS academic interface should be improved to avoid ambiguity, and in particular the interface for return of paperless feedback should be improved.**

As discussed above it is quite common to return both a student’s assignment annotated with comments and a separate feedback file. EASTS currently caters only for a single file to be returned to the student, which required us to either copy and paste the feedback sheet into the student’s document (which tended to create formatting problems), or create a .zip file containing both the student’s annotated assignment and their feedback sheet (which at times caused confusion to students, and required them to have software for handling .zip files on their local machine). Additionally, a common scenario in academic work is that a student submitting unsatisfactory work is asked to resubmit an assignment. EASTS does not cater for this effectively.

**Recommendation 14. EASTS should allow for assignment feedback returned to students to consist of more than one file.**

**Recommendation 15. EASTS should cater explicitly for an assignment resubmission and remarking cycle, if specified by the subject coordinator.**

In most cases the files returned to students were in Microsoft Word format. This is now considered an almost universally readable format. One member of the project team preferred to return PDF files for students. Such files have the following advantages:

- The formatting and pagination is not dependent on the availability of fonts and the particular printer settings on the local machine;
- They do not require proprietary software to read (ie. the software for reading a PDF file is free); and
- They can be created in such a way that copying and pasting of text is disabled, which can be an advantage in discouraging plagiarism in some situations; and
- Once the Adobe Acrobat software has been installed, they can be created from any application, allowing for the output of less common application software to be provided to students as part of assignment feedback.

**Recommendation 16. CSU should consider providing Adobe Acrobat software for the creation of PDF files as a standard on all academic desktop machines.**
5.1.3 Marking Assignments

As part of earlier trials of paperless marking, a number of inefficiencies were identified. It was our hope that many of the inefficiencies in the actual ‘marking’ part of the paperless marking process could be addressed through innovative marking approaches using readily available hardware and software. Some of the key inefficiencies identified were as follows:

- Moving around the student’s document to cross check between sections of the assignment can be more time consuming on computer than on paper;
- If the student’s assignment contains more than one document it is difficult to view both documents at the same time within the screen area provided by a conventional computer monitor;
- If a feedback sheet is created for return to the student, the limited screen area of a conventional computer monitor requires the marker to switch back and forth between the student’s work and the feedback sheet, which is time consuming; and
- For many people typing is slower than handwriting;
- Annotating of diagrams in student’s work can be much more cumbersome on a computer than on paper.

In addition, we believed that some of the inefficiencies involved in paper-based marking could be reduced through appropriate use of marking hardware and software. These inefficiencies included:

- The time required to add up sub-marks awarded to each part of an assignment or awarded against each element of the marking criteria;
- The entry of student’s individual assignment marks into a grade spreadsheet; and
- The rewriting of certain comments on many students’ assignments.

As discussed in Section 3, we had divergent ideas about the particular hardware and software configurations and the particular marking approaches likely to be effective in reducing these various inefficiencies. The following were identified as being of potential merit:

- Insertion of comments in students’ work using features of Microsoft Word;
- Creation of a feedback sheet and the tallying of sub-marks using features of Microsoft Word, using Microsoft Excel and using Microsoft Access;
- The use of a desktop computer with dual monitors as a way of increasing the screen area available for viewing students’ work and feedback sheets;
- Adding handwritten comments and annotation of diagrams using a tablet computer and using a graphics tablet with a desktop computer; and
- The use of audio rather than typed feedback recorded using a microphone.
The following sections describe the way each of these approaches was trialled, leading to recommendations on their future use.

5.1.4 Adding Comments to Students’ Work using Word

Several features of recent versions of Microsoft Word were trialled to assist with the process of adding comments to students’ work. These included ‘Insert Comment’, ‘AutoText’ and the ‘Office Clipboard’.

The Insert Comment feature of Word allows for comments to be inserted in a document. Such comments can be read in a Preview Pane within Word or in a box beside the text. When the document is printed each comment appears in a box in the right margin of the page, with a line connecting it to the position in the text where it was inserted. An example of this has been provided in Appendix D. It was generally agreed by members of the project team that this is the ideal way to annotate students’ work with comments when using a standard desktop computer.

There was some concern among members of the project team about the fact that students with earlier versions of Word may not be able to view embedded comments. It was noted, however, that although the interface for viewing comments has changed in the latest version, this feature has been available for some time, and it is likely that students using a version without this feature would be unlikely to be able to view Word document created in the latest version of Word at all. An additional potential problem is that depending on the Word settings in place on the students’ computer, the embedded comments may or may not be visible. Consequently, if providing feedback using embedded comments, it is important that the students are told that the comments will be there and how to view them. The conversion of the file from Word to PDF format prior to return is another way that this problem could be addressed.

Recommendation 17. The recommended approach to the annotation of students’ work with comments when using a desktop computer is Word’s ‘Insert Comment’ feature.

One marker made extensive use of the Microsoft Office Clipboard as a way of storing a list of comments added to students’ work, so that each could be subsequently inserted into another student’s assignment. It was noted, however, that only the last entry in the Clipboard is retained when one exits Word. For an explanation of how to use this feature see Appendix D.

An alternative approach used by one trial member was the use of Word’s AutoText feature. This feature also allows for comments added to a student’s work to be collected and reused in other students’ assignments. Unlike comments added to the Clipboard, AutoText entries can be saved in the global template for reuse in later marking sessions. For an explanation of how to use this feature see Appendix D.

Recommendation 18. Time can be saved in marking assignments for large cohorts by using either Word’s Clipboard or AutoText feature for saving and reusing comments.
5.1.5 Creating Mark Sheets using Word, Excel or Access

A common approach to the provision of feedback on student assignments, whether carried out in a paperless or paper-based way, is to create a standard mark sheet, listing the criteria and including the marks awarded to the student against each criterion. The project team explored a number of approaches to the creation of such a mark sheet, using Microsoft Word, Microsoft Excel and Microsoft Access.

The simplest approach to the creation of a mark sheet is to use Microsoft Word, and create the sheet as a document containing a single table. If this approach is used, the ‘Formula’ feature of Word can be used to tally up the marks. The completed mark sheet can then be saved as a separate file to be returned to the student, or alternatively, if the students’ assignment has also been annotated with comments, the mark sheet can be copied and pasted to the beginning of the student assignment before returning it. Problems occurred in some cases with the formatting of the mark sheet once inserted into the student’s assignment, due to differing margin sizes and formatting stylesheets.

An alternative approach explored by one member of the project team involved the use of Microsoft Excel for the creation of the mark sheet. The ‘individual’ student spreadsheet generated was either inserted into the student’s assignment document or used along with the student’s assignment to generate a return PDF report file. When inserting the spreadsheet into a student’s Word or RTF file Word’s Insert/Object then CreateFromFile/Browse option were used. Examples showing an individual student spreadsheet ‘inserted’ into a return document and showing a student spreadsheet used to generate a return PDF document are shown in Appendix D.

Another approach to the creation of the mark sheet using Excel, which was explored by one member of the project team, was to create a ‘class master spreadsheet’ holding the marks against each criterion for all students in the class. This was then used in conjunction with Microsoft Word’s mail merge feature to generate a mark sheet for return as a Word document for each student. This process is explained in more detail in Appendix D.

A purpose built Microsoft Access database was also used by a member of the project team for marking and the creation of a mark sheet for return to students. A Microsoft Access form was used to enter student’s marks against each criterion. The mark sheet for each student was then generated as a database report and returned to the student as a PDF document. This approach required reasonable familiarity with the Microsoft Access software package and general database application knowledge. It required significant initial time to set up for each assessment, however marking was efficient. This approach is not recommended for mainstream use, however its effective use provides a proof of concept for the way that a generic software tool for this purpose provided University wide might operate.

The mechanical process involved in working with at least two files for each student (and in the case of the use of a master spreadsheet or database, three files), made mistakes by the marker more likely. During the trial there were a small number of return errors, where
students received other student’s feedback by mistake. The use of dual monitors was found to be somewhat helpful by some members of the project team in reducing the chances of such errors, as discussed in the following sections.

Recommendation 19. Software tools allowing for the creation of mark sheets in a standard format, the automated tallying of marks and the ability to return such mark sheets along with a student’s annotated assignment would improve the efficiency of the paperless marking process.

5.1.6 Increasing the Screen Area Using Dual Monitors

We identified early on that an increase in display space would enable them to handle more documents at the same time. There are many situations where markers need to see multiple documents relating to a student submission. There are cases for example where one needs to view the student script, generate a document of return comments and at the same time record marks in an individual and master spreadsheet document.

Some project styled student submissions required management of multiple documents. This included constructing a document of return comments and marks while viewing the different documents that make up a students submission. This included PowerPoint files, Word and RTF documents, program code, HTML files and so on.

In order to manage multiple documents we acquired dual monitor configurations for our desktop computers. The second monitor was configured as an extension of the first. This means that windows could be organised across both display screens.

One unanticipated problem with a dual monitor configuration is that when the desktop has been organised so that a separate document is open in its own window on each monitor, the mouse has to be moved from one monitor area to the other and clicked in order to make the other window active. This process was found to slow down the process of working across two monitors. A software utility named Tweak-UI was trialled to address this. This utility gives focus to the window that the mouse is located in and thus reduces the number of mouse clicks required when working with multiple windows. It was also found to be useful when working with multiple windows within a single monitor.

Members of the project team agreed that the value of a dual monitor configuration was not as great as anticipated. For example, some markers found that it was quicker to switch rapidly back and worth between windows on a single monitor using Alt-Tab than to use dual monitors.

We agreed, however, that there are circumstances when markers may need to view multiple documents and therefore require the use of dual monitors. The marking of project submissions, which contain multiple files, is one such case where dual monitors are necessary if paperless marking is to be used.

Recommendation 20. Although the use of dual monitors allows for two documents to viewed at the same time, the process of regularly switching the focus from one to the
other, to allow feedback to be entered in one document, while scrolling through the
other, is not as efficient as the paper-based alternative.

5.1.7 Adding Handwritten and Hand Drawn Annotations Using a Tablet
Computer or a Graphics Tablet

A Tablet computer looks like a laptop and can be used in a similar way. However, it also
comes with a stylus that allows the user to write directly on the screen. This can be done
while also typing on the keyboard, however, it is more common to rotate the screen and
fold it down backwards over the top of the keyboard. In this configuration the tablet can
be held in the hands like a closed book, and documents opened on the screen can be
directly written on using the stylus. When used in this way, mouse operations are also
carried out using the stylus. The Tablet computer used in this trial was an ACER Travel
Mate C300 Series

Like all Windows-based Tablet computers, the Windows Journal application was
preinstalled on the machine. This software will import any type of viewable or printable
file and allow for handwritten or hand drawn annotations to be made directly on top of
the document. To save the annotations, however, the file must be saved as a Windows
Journal file. If the original file was a Microsoft Word file, for example, it cannot be
returned to the student as a Word document once handwritten annotations have been
added. Although a free viewer for Windows Journal files is available, the project team
determined that it would be simpler to return the files as PDF documents. Because most
students have a PDF viewer on their computer, no additional software was required to be
installed by the student. Converting the Windows Journal files to PDF required the
Adobe Acrobat software to be installed on the Tablet computer.

Windows Journal provides tools for drawing lines, highlighting sections, and inserting a
text box. Lines that have been drawn can later be erased using the eraser. Text boxes can
be edited, moved and resized later and the font, size and colour can be specified.

The Windows Journal provides very effective tools for navigating through a document,
specifically a zoom tool, a hand tool which allows for a page to be dragged up and down,
and a set of page icons at the bottom of the screen allowing quick movement between
pages. These mechanisms were found to be much more efficient than the corresponding
features in Word and were found to approach the efficiency provided by paper-based
alternatives.

A text tool accessible from within the Windows toolbar allows the user to view a virtual
keyboard, which can be tapped by the stylus to enter typewritten comments. Alternatively,
the tablet provides basic handwriting recognition, allowing handwritten
comments to be entered into an area on the screen and automatically converted to
typewritten text. Because it was difficult to accurately write on the screen when
configured as a laptop computer, we used either the virtual keyboard or the handwriting
recognition rather than the Tablet’s built in keyboard. The Tablet also came with speech
recognition software, but this was not explored by members of the project team. Some
members of the project team found that their handwriting was easily recognised by the
software whereas others found that the text generated required substantial editing and thus the process was quite inefficient. This then limited the advantage of the tablet computer over a desktop computer for marking written work.

The project team found that a mark sheet, created in Word could be easily inserted at the beginning of the student’s document. This could be either done after entering the marks in Word, or alternatively it could be inserted as a blank mark sheet, with the marks entered by hand using the stylus.

One of the key benefits of the Tablet computer was the ability to draw directly on a diagram within the student’s assignment, just as can be done with paper-based marking. To provide similar feedback using Microsoft Word on a desktop computer required the writing of a lengthy paragraph referring to the part of the diagram concerned.

A monitor connected to the Tablet Computer enables it to be used in the same way that a computer with dual monitors can be used. In this way the benefits of increased screen area described above can be obtained while using the tablet. It is also possible to connect an external keyboard to the tablet so that it can be used in its ‘flat’ configuration but with the advantage of typed text. This was not explored by the project team because most preferred to use the tablet flat on their lap, without the encumbrance of additional hardware.

**Recommendation 21. Until the cost of Tablet computers comes down to something approaching that of Notebook computers, their purchase specifically for paperless marking is not recommended, except in subject areas where complex diagrams are an important part of many student assignments.**

An ACECAD ‘Pen and Graphics Tablet’ was also trialled by members of the project team. These graphics tablets come in different sizes. Essentially they provide a stylus [pen] and a small tablet ‘work’ area. The tablet is connected to a standard computer through a USB port.

The stylus is fitted with three buttons. The stylus can be used as a pen to annotate or write comments over screen displayed documents in much the same way they the mouse can be used to draw in graphics package. Software must be installed on the computer to achieve this.

We found that it was difficult to write ‘legible’ comments and add annotations to student scripts. Using a Pen and Tablet to mark up a script is very much like writing on paper with one’s eyes closed. We believe it is important that the marks made by a pen be displayed ‘where’ they are created.

**Recommendation 22. The use of an external ‘Pen and Graphic Tablet’ as an alternative to a Tablet computer for annotating student assignments is not recommended due to usability problems.**
5.1.8 Using Audio as an Alternative to Typewritten Feedback

In one assignment in a subject with a small number of enrolments, the provision of audio feedback was trialled. The particular assignment required the students to submit a PowerPoint presentation with embedded audio on a CD-ROM, so audio feedback seemed particularly appropriate. Initial explorations indicated that the quality level of audio recorded using the built in microphone in a Notebook computer was inadequate and consequently an external microphone was purchased. The Windows Sound Recorder program was used. The default audio recording settings resulted in very large files and so experiments were undertaken to find a balance between quality and file size. The chosen settings for recording were PCM format, 22KHz 16bit Mono. After recording the files were converted to the compressed MP3 format, choosing the settings MP3 22KHz Mono. This resulted in file sizes of 180kbytes per minute of audio. Most of the feedback files were about 5 minutes long, and thus between 500K and 1M in size, which is similar to a medium sized Word document. When recording using Sound Recorder it was found that the program would stop recording at the end of a minute and it was necessary to click on Record again to start recording. This was inconvenient but was something that one could get used to.

Recommendation 23. The use of audio feedback files is feasible within the constraints of existing bandwidth, but care needs to be taken in the selection of recording equipment and audio settings.
5.2 Marking Time Analysis

Marking time comparisons were carried out in three assignments during Spring 2005. In the first, ITC389 and ITC589 assignment 1, the marking time required for paper-based marking was compared to the time required to mark using paperless techniques with Word’s insert comment feature. In the second, ITC389 and ITC589 assignment 2, the time required for the use of a Tablet computer was compared with the time required for the use of Word’s insert comment feature and with the time required for traditional paper-based techniques. And in the third, ITC129 and ITC429 assignment 1, paperless marking using Word’s insert comments feature on a dual monitor computer was compared with using this technique on a single monitor computer. The results are summarised below.

5.2.1 Word versus Paper

In ITC389 and ITC589 assignment 1, 39 assignments were marked using paperless marking techniques with Microsoft Word’s insert comment feature on a standard desktop computer and the remaining 20 assignments were marked using traditional paper-based techniques. The assignment consisted of a written report of around five pages in length. The marker needed to regularly scroll (or page turn) forwards and backwards through the document in order to cross-check information in various sections of the report. A one-page feedback sheet was completed for each student assignment, and comments were also entered throughout the students work.

Table 15 summarises the relative time required to mark the assignments using each of the two techniques. The mean time for paperless marking was about 4 minutes longer than for paper-based marking using Word’s insert comments feature. A t-test showed that the difference between the two means was significant (p=0.001).

<table>
<thead>
<tr>
<th>Marking Technique</th>
<th>Number of assignments</th>
<th>Mean marking time (minutes)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paperless using Word</td>
<td>39</td>
<td>19.3077</td>
<td>4.44945</td>
</tr>
<tr>
<td>Paper-based</td>
<td>20</td>
<td>15.4500</td>
<td>3.36350</td>
</tr>
</tbody>
</table>

A limitation of the way this data was gathered, however, was that the sequencing of the marking was not controlled. Anecdotal evidence suggests that markers become faster as they work their way through a batch of assignments. Because a record was not kept of the sequence in which the assignments were marked and the sequence of paperless and paper-based assignment marking was not randomised the results may be questionable.
This problem was addressed in assignment 2 where the marking sequence was recorded for each assignment.

5.2.2 Tablet versus Word versus Paper

In ITC389 and ITC589 assignment 2, 18 assignments were marked using a Tablet computer, 17 were marked using Word’s insert comment feature on a standard desktop computer and 20 were marked using traditional paper-based techniques. The assignment was a written report, generally between 10 and 20 pages in length. As with assignment 1 discussed above, the marker was required to regularly scroll or page turn forwards and backwards through the document in order to cross-check the information in various sections of the report. A one-page feedback sheet was completed for each student assignment, and comments were also entered throughout the students work. Tablet assignments were marked using the Journal application, with comments and annotations to students work made with a stylus.

Table 16 summarises the relative time required to mark an assignment using each of the three techniques. The data suggests that paper-based assignments were fastest to mark, followed by Tablet assignments, followed by Word assignments. However, as mentioned, it is important to consider the marking sequence. Table 17 shows the mean sequence number for each marking technique. This indicates that the sequence was not balanced and thus if sequence is a factor, the figures in Table 16 may be unreliable.
Table 16  
Marking time comparison between paperless marking using Word, using a Tablet computer and using paper-based techniques

<table>
<thead>
<tr>
<th>Marking Technique</th>
<th>Number of assignments</th>
<th>Mean marking time (minutes)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper-based</td>
<td>20</td>
<td>22.7500</td>
<td>6.17188</td>
</tr>
<tr>
<td>Tablet journal</td>
<td>18</td>
<td>25.5556</td>
<td>7.48506</td>
</tr>
<tr>
<td>Word</td>
<td>17</td>
<td>31.0588</td>
<td>7.52056</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>26.2364</td>
<td>7.73152</td>
</tr>
</tbody>
</table>

Table 17  
Comparison of marking sequence between paperless marking using Word, using a Tablet computer and using paper-based techniques in ITC389/589 assignment 2

<table>
<thead>
<tr>
<th>Marking Technique</th>
<th>Number of assignments</th>
<th>Mean sequence number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper-based</td>
<td>20</td>
<td>28.80</td>
</tr>
<tr>
<td>Tablet journal</td>
<td>18</td>
<td>44.06</td>
</tr>
<tr>
<td>Word</td>
<td>17</td>
<td>14.24</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>29.29</td>
</tr>
</tbody>
</table>

A Univariate Analysis of Variance (ANOVA) including sequence number and marking time illustrates that both sequence number (p<0.001) and marking time (p=0.004) are highly significant. By including sequence number as a covariant, the estimated marginal mean of marking time for each technique can be calculated, with the effect of sequence number removed. Table 18 shows the results of this analysis.

Table 18  
Estimated marginal mean marking time comparison between paperless marking using Word, using a Tablet computer and using paper-based techniques, with sequence effect eliminated

<table>
<thead>
<tr>
<th>Marking Technique</th>
<th>Number of assignments</th>
<th>Estimated Marginal Mean (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper-based</td>
<td>20</td>
<td>22.593</td>
</tr>
<tr>
<td>Tablet journal</td>
<td>18</td>
<td>30.291</td>
</tr>
<tr>
<td>Word</td>
<td>17</td>
<td>26.231</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>26.2364</td>
</tr>
</tbody>
</table>
This analysis indicates that, contrary to the impression obtained from looking at the raw figures, paper-based techniques were in fact substantially quicker than marking using Word, which was again substantially quicker than marking using the Tablet computer. Clearly, further comparisons of marking time are required with the sequence controlled in order to confirm this conclusion.

5.2.3 Dual versus Single Monitor for Paperless Marking in Word

In ITC129 and ITC429 assignment 1, paperless marking using Word’s insert comments feature on a dual monitor computer was compared with using this technique on a single monitor computer. The assignment was a programming assignment and students submitted a Word document containing program code and sample output as well as files containing the executable version of their program. The marker completed a one-page feedback sheet, as well as entering comments as annotations within the student’s word document. The student’s code was executed only if an anomaly was discovered in their sample output. The use of a dual monitor allowed the marker to have the feedback sheet on one screen and the student’s document open on the other. Using a single monitor the marker had to either use Alt-Tab or the Windows task bar to switch regularly between the feedback sheet and the student’s document.

Table 19 shows a comparison of the marking times for each approach.

<table>
<thead>
<tr>
<th>Marking Technique</th>
<th>Number of assignments</th>
<th>Mean marking time (minutes)</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word using a Single Monitor</td>
<td>19</td>
<td>19.7895</td>
<td>2.14939</td>
</tr>
<tr>
<td>Word using a Dual Monitor</td>
<td>17</td>
<td>19.2941</td>
<td>2.33893</td>
</tr>
</tbody>
</table>

A t-test showed no significant difference between the time required to mark an assignment using a single monitor and a dual monitor (p=0.512). Once again the marking sequence was not randomised, with the mean sequence number for single monitor marking being 10.0 and the mean for dual monitor marking being 28. However, this time the sequence number did not correlate with marking time (p=0.248) and a regression analysis indicated that neither monitor type nor sequence number had a significant effect on marking time. Consequently, from this comparison it can be concluded that there was no difference between the time required to mark an assignment using a single monitor
and a dual monitor computer. Once again, further comparisons are required with other markers and other types of assignments to confirm this conclusion.
5.3 Summary of Positive and Negative Aspects of Paperless Marking

5.3.1 Positive Aspects of Paperless Marking

The following sections summarise the positive features of paperless marking identified by the trial group.

5.3.1.1 Reduces the Time Taken in Returning Marks & Comments

Conventional paper marking involves several steps which add to the time taken to return comments and marks to a student. Paper submissions must be printed and then transported to a nominated academic. These may be passed on to assistant markers thus generating further delays. Paper assignments once marked are conventionally posted back to students. Paper handling of assignments delays the return of marks and feedback to students. This delay is compounded for offshore students who must wait longer to receive back their scripts via conventional post.

Paperless handling of assignments reduces the time that it takes to return comments and marks to a student. This time savings is achieved by eliminating the numerous time delays that are associated with conventional paper handling of assignments. In particular it reduces the transport delays that are currently associated with handing of paper assignments. It also reduces substantially the time taken to provide feedback to offshore enrolled students. It also has the potential to reduce some of the time delays encountered when outside marker assistance is used, especially when they are located remote to the campus.

5.3.1.2 Potential Improvement in the Quality of Return Feedback

Paperless marking provides academics with the potential to improve the quality of the feedback they return to students. It enables the return of detailed and inexpensive feedback to students. It also makes it possible to provide richer feedback through the use of graphic, visual and aural material.

Paperless marking of assignments has the potential to reduce problems that students encounter in interpreting hand written marker comments. One student in our survey commented that it:

“Allows students to actually read the comments/feedback on their assignments - some lecturers handwriting is extremely hard to read and understand”

Paperless marking makes it possible for markers to construct item banks of typical generic responses. This process was used when handling student projects. The generic responses can be further refined for usage with future student submissions. We experimented with Office Clipboard entries and AutoText to facilitate the handling of generic feedback comments.
We found that these facilities make it possible to improve the quality of the feedback that is returned to students. Student survey responses also indicate a preference for typewritten feedback (see Table 9 and Figure 2).

5.3.1.3 Paperless Handling of Assignments Provides some Increase in Flexibility

Electronic copies of student scripts are more easily distributed to marking assistants than conventional paper copies. It is also possible to monitor the validity of marking scales used by distributing copies of the same assessment item to different assistants. The results returned by marker assistants can be later cross checked to check the overall adherence to the marking scales provided.

In some situations paperless marking provides greater flexibility in handling submissions. As an example it becomes more convenient for casual markers to retrieve submissions and to return related comments.

Electronic documents are more easily transported and replicated when compared with conventional paper submissions.

Some student submissions necessitate a paperless format. Examples of this type of submission include PowerPoint files, program code, Excel Spreadsheets and other project styled submissions.

In some cases it is not feasible to make online submissions. This may be due to the nature of the assessment items or to the size and number of files involved. Large IT software development projects for example are submitted via CD-ROM. These submissions may run to many hundreds or perhaps even thousands of files.

Some academics require students to make submissions where students mark up a provided hard-copy diagram. Such submissions are not suited to online assessment handling.

We therefore recognise that individual assessment practices vary considerably and submission arrangements should cater for these variations.

5.3.1.4 Paperless Marking provides an Improvement in Managing Submissions.

Paperless marking results in an electronic copy of the student submission and the return comments being held by a marker. It is therefore possible to discuss with a student misunderstandings they may have relating to a submission. Retaining student scripts may also facilitate better monitoring of student learning.

Retention of return comments facilitates the construction of an historical archive of comments that may be used in later semesters. This may enhance the assessment process and provide an improvement to the quality of student feedback.
5.3.1.5 Potential to improve Plagiarism and Collusion Checks.

Checks can be performed to check for plagiarism and collusion. If scripts are retained from semester to semester checks can be performed across cohorts in different semesters.

Members of the trial have used tools to perform systematic checks against student submissions. As an example JPlag software has been used to check Java code submissions and Windows Explorer has been used for simple textual searches.

URL references in electronic documents are easily checked when marking online. Texts in an electronic student script may be readily copied to a search engine for checking purposes.

We believe that managing electronic copies of student work makes it easier to perform plagiarism and collusion checks.

5.3.2 Negative Aspects of Paperless Marking

The following sections discuss the negative features of paperless marking identified by the trial group.

5.3.2.1 Paperless Marking Increases the Time taken to Mark Scripts

Several members of the trial reported that paperless marking increased the time that it took them to mark an individual student submission. There are many reasons given for this increase.

Marking in paperless mode requires many eye and hand coordinated movements which add to the time it takes to mark each script. Marks must for be added to the correct place in a spreadsheet. When handling conventional paper submissions one annotates the script and simply adds marks. We believe that there are less eye and hand movements involved when marking paper submissions and therefore less time is taken.

Several members of the trial group reported that they mark conventional paper based scripts by marking ‘every students’ question ONE response; then ‘every students’ question TWO response; and so on. After handling several scripts the sought responses are well committed to memory. This results in a marked reduction in the time taken to mark later scripts. Marking conventional paper scripts in this manner creates a real time savings and may also lead to more equitable marking outcomes for students in general. This advantage is currently lost with paperless marking.

We note that Adobe Acrobat has a facility for adding tagged bookmarks to documents. If students had this software they could add bookmarks to documents which may speed up the marking process for markers. It may however also lead to an increase in the overall difficulty that markers have juggling documents, individual marks and combined marks.

Marking in a paperless mode involves the management of multiple screen displayed documents. We believe that this increases the time that it takes to mark individual scripts.
5.3.2.2 An Increase in the Time Taken to Manage Submissions.

Paperless marking increases the handling time for student assignments. This is due to the additional time that is required to create storage areas for individual students, download student files, upload marks and return comments along with the added burden of operating the user interface currently provided by EASTS.

When handling paperless assignments trial members had to juggle the student script, a sought response, the mark and comments allocated for each student response along with a spreadsheet of overall students marks. This added burden of opening, moving, commenting and recording marks added substantially to the ‘time taken’ to handle scripts in paperless mode.

We felt that automated procedures and templates should be generated to speed up the process of accessing and returning student scripts. This may include ‘batch’ handling procedures.

Several members of the trial also managed to send the wrong return document back to students.

We felt that effort should be given to techniques used to handle individual and group marks. It may be possible to automatically generate linked documents which may simplify the collating process. Members of the trial manually extracted marks from student documents and added these to a master class document.

Downloading assignments and uploading return comments and marks is a tedious process when using a slow dial up line. As access to broadband becomes more common it could be expected that delays of this nature will be reduced.

We believe that it is important that EASTS displays the ‘size’ of student files that are to be downloaded. If batch facilities are used an overall size of files should be provided.

5.3.2.3 Better Planning is Required with Paperless Submissions

We found that better planning is required to manage paperless submissions. Assessment items need to be planned with paperless marking in mind. Students need also to be provided with clear and detailed guidance on submission procedures.

Students currently submitting to EASTS are unaware that files types other than Word and RTF are allowed. They are also unaware that they may make multiple file submissions. When students do make multiple submissions they receive error messages relating to their submission.

We believe that the EASTS interface needs to be more encompassing of differing submissions formats. We feel that better information needs to be provided to students in terms of the file types and the number of files that they are permitted to submit. This information should be ‘set’ for each assignment submission.
Detailed instructions are required to guide students in accessing their return comments and marks.

Managing paperless submissions requires the management of a student’s submission, comments and marks returned to a student and the combined marks of the class.

We also feel that there should be the possibility for academics to ‘check’ return comments and marks provided to individual students. This access should include the possibility of altering marks and comments.

5.3.2.4 Hardware/Software is needed by Markers and Submitters

Students need the required software, hardware and network capabilities to make submissions and to obtain the returned feedback.

At the academic level a computer is required to mark assignments. If a computer is not available one cannot mark assignments in a paperless manner. The capabilities and the limitations of ALL computer systems contemplated for use with paperless marking need to be considered in the design of assessment items. An example of this is handling WMA sound files or ‘reading’ inserted ‘comments’ made using the most recent edition of Microsoft Word.

Storing electronic submissions and student feedback requires additional hard drive storage space. In addition paperless materials need to be carefully backed up to guard against date losses. The loss of a pen drive with a class set of return comments could mean that scripts need to be completely remarked.

The purchase of specialised hardware such as Tablet computer and dual monitor configurations may be considered desirable by some markers, depending on the nature of the student assignments. The sharing of such equipment across a group of academic staff can result in cost savings but can impose constraints on the flexibility of the academic staff’s marking schedule. During the trial a Tablet computer was shared between three or four markers each session and this was found to be difficult to manage at times.
5.4 Key Recommendations

The key recommendations of the project team with regard to future use of paperless marking within the University are as follows.

Key Recommendation 1. Paperless marking and return of assignments is unlikely to ever be as efficient or convenient as paper-based marking from the marker’s perspective but is nevertheless desirable due to other advantages it provides.

Key Recommendation 2. Paperless marking and return of assignments is highly desirable to students and should be made an option for all subject coordinators across the University as soon as possible.

Key Recommendation 3. Paperless marking and return of assignments should not be made mandatory at any stage in the foreseeable future.

Key Recommendation 4. The existing EASTS system provides sufficient paperless marking and return features to allow for its use to be made optional across the University once minor improvements have been made to the user interface.

Key Recommendation 5. The most important limitation of the existing EASTS system for paperless marking and return is the lack of a provision for batch download and upload of assignments.
6 Summary of EASTS Considerations

The EASTS system is used extensively throughout CSU for the submission of assignments electronically. Although assignments are printed to hard copy as standard practice in the marking and return of assignment results, it is possible to request that assignments not be printed but handled in a paperless manner. Essential to the outcomes of this project was the use of EASTS in a paperless mode for a varying number and cohort of students throughout 2005.

The use of EASTS for paperless handling of assignments varies from standard paper-based handling of assignments. For students the submission of assignments via EASTS is the same for both paper-based and paperless marking. To receive assignment feedback and results, students are sent an email when the marker releases the assignment feedback in the EASTS system. The student can then view the EASTS system to retrieve the feedback and marking.

There are significant differences in the processing of submissions by marking staff when using EASTS for paperless marking. Paper-based marking requires no online interaction with the EASTS system as papers are printed and delivered to schools. Online paperless marking involves a process of the marker downloading the assignments from EASTS, marking, then uploading feedback into the EASTS system for the students to access.

The most significant problem with EASTS and paperless marking is that the procedure to download assignments and upload feedback does not scale. The process is based on working with individual students submissions, which is cumbersome for large cohorts. The following specific recommendations have been suggested by the project team relating to this:

**Recommendation 6.** EASTS should provide a batch download option, allowing the assignments of all students in a cohort to be downloaded in a single step.

**Recommendation 12.** EASTS should provide a batch upload option, allowing the assignments of all students in a cohort to be returned in a single step.

A number of additional recommendations relating to the EASTS system have emerged during this project:

**Recommendation 1.** EASTS submission should be provided for on-campus students in all subjects across the University regardless of whether paperless marking is used.

**Recommendation 3.** A feature should be added to EASTS allowing a student to specify whether their feedback should be automatically emailed to them, similar to the way that forum participants can specify that forum messages are emailed to them.
Recommendation 4. There is no need for major changes to the assignment submission features of the existing EASTS system.

Recommendation 5. The existing capabilities of the EASTS system allowing for students to retrieve paperless feedback are effective but the user interface should be improved.

Recommendation 7. EASTS should indicate the file size of each student assignment to cater better for remote markers downloading assignments over a slow connection.

Recommendation 8. EASTS should provide the option of automatically generating filenames for student assignments containing the student name, number, subject and assessment item number.

Recommendation 9. EASTS should cater specifically for ‘replacement’ assignment submissions and for submissions consisting of multiple files, and should also provide an indication within the Student interface of whether an assignment has already been retrieved for marking.

Recommendation 10. The provision of a mechanism within EASTS whereby a student can submit each part of an assignment separately to allow for separate marking of each part should be explored.

Recommendation 19. Software tools allowing for the creation of mark sheets in a standard format, the automated tallying of marks and the ability to return such mark sheets along with a student’s annotated assignment would improve the efficiency of the paperless marking process.

Recommendation 13. The labelling of options within the EASTS academic interface should be improved to avoid ambiguity

Recommendation 14. EASTS should allow for assignment feedback returned to students to consist of more than one file.

Recommendation 15. EASTS should cater explicitly for an assignment resubmission and remarking cycle, if specified by the subject coordinator.
7 Conclusions

7.1 Recommendations

The four key recommendations emerging from the study were as follows.

Key Recommendation 1. Paperless marking and return of assignments is unlikely to ever be as efficient or convenient as paper-based marking from the marker’s perspective but is nevertheless desirable due to other advantages it provides.

Key Recommendation 2. Paperless marking and return of assignments is highly desirable to students and should be made an option for all subject coordinators across the University as soon as possible.

Key Recommendation 3. Paperless marking and return of assignments should not be made mandatory at any stage in the foreseeable future.

Key Recommendation 4. The existing EASTS system provides sufficient paperless marking and return features to allow for its use to be made optional across the University once minor improvements have been made to the user interface.

Key Recommendation 5. The most important limitation of the existing EASTS system for paperless marking and return is the lack of a provision for batch download and upload of assignments.

In addition to these recommendations a series of other recommendations emerged relating to each of the project aims. These are discussed in the following paragraphs.

The first aim of the study was to gauge student perceptions on the benefits and the deficiencies resulting from the usage of paperless assignment marking and return. A survey of students involved in the trial was carried out, with 114 respondents. In general students were very positive about paperless submission and return of assignments. The project team have come up with the following recommendations as a result of this survey:

Recommendation 1. EASTS submission should be provided for on-campus students in all subjects across the University regardless of whether paperless marking is used.

Recommendation 2. Subject coordinators of all distance subjects should be provided with the option of paperless marking and return of assignments as soon as possible.

Recommendation 3. A feature should be added to EASTS allowing a student to specify whether their feedback should be automatically emailed to them,
similar to the way that forum participants can specify that forum messages are emailed to them.

Recommendation 4. There is no need for major changes to the assignment submission features of the existing EASTS system.

Recommendation 5. The existing capabilities of the EASTS system allowing for students to retrieve paperless feedback are effective but the user interface should be improved.

The second aim of the study was to gauge marker perceptions on the benefits and the deficiencies resulting from the usage of paperless assignment marking and return. The project team of five academic staff along with three casual markers marked 1023 student assignments using paperless methods during the trial. The following positive aspects of paperless marking were identified:

• Paperless marking reduces the time taken in returning marks and comments;
• Paperless marking leads to potential improvements in the quality of return feedback;
• Paperless handling of assignments provides some increase in flexibility;
• Paperless marking provides an improvement in managing submissions; and
• Paperless marking has the potential to improve plagiarism and collusion checks.

The following negative aspects of paperless marking were identified:

• Paperless marking increases the time taken to mark scripts;
• Paperless marking can increase the time taken to manage submissions;
• Better planning is required with paperless submissions; and
• Certain hardware and software is needed by markers and submitters.

The third aim of the study was to identify computing technologies that provide efficiencies in paperless assignment marking and the fourth aim of the study was to identify procedures for the handling of paperless assignment submission, marking and return. Markers in the trial used a range of hardware, software and marking procedures leading to the following recommendations:

Recommendation 11. Thought should be given by academic staff to the design of the assignment task to ensure that student submissions can be marked efficiently using paperless techniques.

Recommendation 17. The recommended approach to the annotation of students’ work with comments when using a desktop computer is Word’s ‘Insert Comment’ feature.
Recommendation 18. Time can be saved in marking assignments for large cohorts by using either Word’s Clipboard or AutoText feature for saving and reusing comments.

Recommendation 19. Software tools allowing for the creation of mark sheets in a standard format, the automated tallying of marks and the ability to return such mark sheets along with a student’s annotated assignment would improve the efficiency of the paperless marking process.

Recommendation 20. Although the use of dual monitors allows for two documents to viewed at the same time, the process of regularly switching the focus from one to the other, to allow feedback to be entered in one document, while scrolling through the other, is not as efficient as the paper-based alternative.

Recommendation 21. Until the cost of Tablet computers comes down to something approaching that of Notebook computers, their purchase specifically for paperless marking is not recommended, except in subject areas where complex diagrams are an important part of many student assignments.

Recommendation 22. The use of an external ‘Pen and Graphic Tablet’ as an alternative to a Tablet computer for annotating student assignments is not recommended due to usability problems.

Recommendation 23. The use of audio feedback files is feasible within the constraints of existing bandwidth, but care needs to be taken in the selection of recording equipment and audio settings.

Recommendation 16. CSU should consider providing Adobe Acrobat software for the creation of PDF files as a standard on all academic desktop machines.

The fifth aim of the study was to analyse statistically the amount of academic time required to mark various types of assignments in a paperless way compared with traditional marking approaches. The result of the comparisons of marking times was inconclusive due to methodological issues. Further studies are needed to explore this issue.

The sixth aim of the study was to compare the cost savings to be obtained from paperless marking with any additional hardware, software or academic labour costs. During the project it was determined that this aim could not be met within the project scope.

The seventh aim of the project was to provide recommendations and feedback to the Learning Materials Centre (LMC) relating to the use of EASTS for paperless submission and return of assignments. The following recommendations relating to EASTS emerged from the study:
Recommendation 1. EASTS submission should be provided for on-campus students in all subjects across the University regardless of whether paperless marking is used.

Recommendation 3. A feature should be added to EASTS allowing a student to specify whether their feedback should be automatically emailed to them, similar to the way that forum participants can specify that forum messages are emailed to them.

Recommendation 4. There is no need for major changes to the assignment submission features of the existing EASTS system.

Recommendation 5. The existing capabilities of the EASTS system allowing for students to retrieve paperless feedback are effective but the user interface should be improved.

Recommendation 6. EASTS should provide a batch download option, allowing the assignments of all students in a cohort to be downloaded in a single step.

Recommendation 7. EASTS should indicate the file size of each student assignment to cater better for remote markers downloading assignments over a slow connection.

Recommendation 8. EASTS should provide the option of automatically generating filenames for student assignments containing the student name, number, subject and assessment item number.

Recommendation 9. EASTS should cater specifically for ‘replacement’ assignment submissions and for submissions consisting of multiple files, and should also provide an indication within the Student interface of whether an assignment has already been retrieved for marking.

Recommendation 10. The provision of a mechanism within EASTS whereby a student can submit each part of an assignment separately to allow for separate marking of each part should be explored.

Recommendation 12. EASTS should provide a batch upload option, allowing the assignments of all students in a cohort to be returned in a single step.

Recommendation 13. The labelling of options within the EASTS academic interface should be improved to avoid ambiguity

Recommendation 14. EASTS should allow for assignment feedback returned to students to consist of more than one file.

Recommendation 15. EASTS should cater explicitly for an assignment resubmission and remarking cycle, if specified by the subject coordinator.
Recommendation 19. Software tools allowing for the creation of mark sheets in a standard format, the automated tallying of marks and the ability to return such mark sheets along with a student’s annotated assignment would improve the efficiency of the paperless marking process.

7.2 Limitations of the Study

The subjects included in the trial were all Information Technology (IT) subjects. Consequently, the academic staff and students involved had a higher than average level of computer literacy. Consequently, it is likely that students and academic staff from other disciplines will encounter additional problems to those identified in this study if they attempt paperless marking and return of assignments.

One of the initial goals of the study was to compare the cost savings to be obtained from paperless marking with any additional hardware, software or academic labour costs. It became clear during the study that it would be very difficult to carry out such an analysis in any objective way. The additional hardware, software and academic labour costs would depend greatly on the marking technique, the hardware, the software, the type of assignment and the skill level of the marker. The cost savings at the system level would be very dependent on the staffing levels and work practices of the Learning Materials Centre. Consequently, it was determined that this aim could not be met within the scope of the study.

7.3 Follow up Studies

Once the identified problems with the EASTS system have been resolved or a new replacement system implemented, a follow up study involving students and academic staff from a range of disciplines would be desirable.

Due to various methodological problems the data gathered comparing the time required to mark assignments using paperless and paper-based techniques was inconclusive. Further follow up studies comparing the marking time for various assignment types using paperless and paper-based techniques would be desirable.

7.4 Acknowledgements

The project team would like to acknowledge the financial support provided to the project by the Division of Information Technology through the Executive Director, Mike Rebecchi.

The project team would also like to acknowledge assistance provided to the project team of members of the Learning Materials Centre, and in particular, Katherine Klapdor, Paul Shaw and Sam Parker.

Lastly, the project team would like to acknowledge the contribution of casual markers to the project, specifically Peter Swan, Katrina Kelly, Luci Skeers and Rob Boetto.
## Appendix A. Project Expenditure

<table>
<thead>
<tr>
<th>Category</th>
<th>Expense</th>
<th>Expenditure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hardware and Software</strong></td>
<td>17 inch LCD external monitor</td>
<td>$462.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two Matrox Millenium G550 32Mb Dual Head graphics Cards allowing for dual monitor use</td>
<td>$454.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acer Tablet Computer with accessories allowing for an external monitor</td>
<td>$3,976.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Standard CSU software, including Microsoft Office for Tablet Computer</td>
<td>$550.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microphone</td>
<td>$49.95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Graphics Tablet</td>
<td>$99.95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adobe Acrobat (4 copies)</td>
<td>$192.00</td>
<td>$5,784.40</td>
</tr>
<tr>
<td><strong>Time Relief for Project Team</strong></td>
<td>Time release for exploring hardware and software configurations (30 hours @ $31.06)</td>
<td>$931.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time release for developing paperless marking procedures (24 hours @ $31.06)</td>
<td>$745.44</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time release for developing and pilot testing questionnaires (24 hours @ $31.06)</td>
<td>$745.44</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time release for data entry and analysis of results (29 hours @ $31.06)</td>
<td>$900.74</td>
<td>$3,323.42</td>
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<tr>
<td><strong>Miscellaneous</strong></td>
<td>Student Experience Conference Registration</td>
<td>$190.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final Report Printing</td>
<td>$240.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Statistical Advice</td>
<td>$100.00</td>
<td>$530.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>$9,637.82</td>
</tr>
</tbody>
</table>
Appendix B. Student Survey Instrument

Paperless Marking Questionnaire for Students

Please indicate which of the following subjects you were enrolled in this session:

<List of Spring or Autumn subjects provided>

Please select your mode of enrolment this session:

<table>
<thead>
<tr>
<th>Specify enrolment mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Campus</td>
</tr>
<tr>
<td>Distance</td>
</tr>
<tr>
<td>Overseas Distance</td>
</tr>
</tbody>
</table>

Please indicate your degree of agreement from Very Strongly Agree to Very Strongly Disagree with the following statements:

<table>
<thead>
<tr>
<th>Statement</th>
<th>Very strongly agree (7)</th>
<th>Strongly agree (6)</th>
<th>Agree (5)</th>
<th>Uncertain (4)</th>
<th>Disagree (3)</th>
<th>Strongly disagree (2)</th>
<th>Very strongly disagree (1)</th>
<th>Not applicable (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I prefer electronic submission through the EASTS system to conventional submission of assignments (via post for distance students or through an assignment box for on campus students).</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2. I prefer typewritten or word processed feedback on assignments to hand-written feedback.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>3. I prefer to receive my assignments back via email or the web rather than by conventional means (in the post for distance students or in class time for on campus students).</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
4. If assignment feedback is to be electronic, I would prefer to download it myself from an online system rather than having it emailed to me.

5. The existing EASTS system is an effective tool for electronic submission of assignments.

6. The existing EASTS system is an effective tool for the electronic retrieval of assignment feedback.

7. Do you think that electronic paperless assignment feedback should be used more widely?

8. If you answered yes to this question (or you are uncertain of your answer), please provide up to three reasons for the wider use of electronic paperless assignment feedback:

9. If you answered no to the above question (or you are uncertain of your answer), please provide up to three reasons why conventional printed assignment feedback should be retained:

10. Please give us any additional comments or suggestions you have about the ease of use of the EASTS system for assignment submission:

11. Please give us any additional comments or suggestions you have about the ease of use of the EASTS system for retrieval of assignment feedback:

12. Please give us any additional comments or suggestions you have about the way paperless marking was used in your subjects this session:
## Appendix C. Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>Distance Education</td>
</tr>
<tr>
<td>DIT</td>
<td>Division of Information Technology</td>
</tr>
<tr>
<td>EASTS</td>
<td>Electronic Assignment Submission and Tracking System</td>
</tr>
<tr>
<td>LMC</td>
<td>Learning Materials Centre</td>
</tr>
<tr>
<td>OT</td>
<td>Offshore Tutorial</td>
</tr>
<tr>
<td>RTF</td>
<td>Rich Text Format</td>
</tr>
<tr>
<td>WI</td>
<td>Wagga Internal</td>
</tr>
</tbody>
</table>
Appendix D. Miscellaneous Marking Tips and Shortcuts

Microsoft Word

Commenting Feature

The following short script provides an example of how the commenting facility in MS Word is used. A student script appearing as:

May be annotated using Insert/Comment [Microsoft Word] to become:
AutoText

Microsoft Word provides an ‘AutoText’ facility. This option enables markers to create short cuts that can be used to ‘add’ longer scripts [including diagrams etc] to a student’s return document.

To create a New Word AutoText Entry, select the “actual text” that you wish to enter. In the following example I selected the above paragraph shown in italics. You then select:

Insert/AutoText/New

The following pop-up window is provided:

Add your ‘short-cut’ for the AutoText entry by completing the above box. For the above example this was chosen to be AutoText

When you now type AutoText within your document you are given the opportunity to ‘add’ the selection by pressing the Enter key. When you do this the word AutoText is
replaced by your selection. AutoText comments can also be entered into a document by selecting them from the AutoText menu, rather than by remembering a shortcut for each.

AutoText entries may be saved in the global template where they become available to ALL opened and NEW documents. In addition, AutoText entries may be deleted or altered.

Members of the trial found that setting up AutoText entries takes time. It requires a deal of planning on the part of markers and only has benefit where a marker is looking to make usage of generic pre-prepared comments which can be used for other class members. Entries created in this way may in some circumstances be refined over time to provide high quality feedback to students.

**Clipboard Entries**

The use of Clipboard Entries was also trialled. To enable this feature in Microsoft Word a user should select Edit/Office Clipboard.

After performing this entry a second window appears to the right of your word screen. Entries may be added to the clipboard entry screen by selecting text and then choosing Edit/Copy. To use a clipboard entry one simply identifies the place for insertion in the main entry and then you click on the clipboard entry from the right window. The Clipboard entry is copied to the nominated position in your document.

Clipboard entries are not carried forward from one Word editing session to the next. It is therefore necessary to save Clipboard entries to a ‘separate’ file where one wishes to re-use those comments at a later date.
Example Word Feedback Sheet

(Note that the student’s name is fictitious)
**Excel**

*Example Excel Feedback Sheet*

<table>
<thead>
<tr>
<th>No.</th>
<th>On.Part</th>
<th>Sub-Part</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.(a)</td>
<td>(i)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1.(a)</td>
<td>(ii)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1.(a)</td>
<td>(iii)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1.(b)</td>
<td>(i)</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1.(b)</td>
<td>(ii)</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1.(b)</td>
<td>(iii)</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>1.(c)</td>
<td>(i)</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1.(c)</td>
<td>(ii)</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>1.(d)</td>
<td>(i)</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>1.(d)</td>
<td>(ii)</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>2.(a)</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>2.(a)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>2.(a)</td>
<td>(i)</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>2.(a)</td>
<td>(ii)</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>2.(a)</td>
<td>(iii)</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>3.(a)</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>3.(a)</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>3.(a)</td>
<td>(i)</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>3.(a)</td>
<td>(ii)</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>4.(a)</td>
<td>(i)</td>
<td>2</td>
</tr>
<tr>
<td>21</td>
<td>4.(a)</td>
<td>(ii)</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>4.(a)</td>
<td>(iii)</td>
<td>0</td>
</tr>
</tbody>
</table>

**Your mark =>** 13
### Another Example Excel Feedback Sheet

#### Plan Design/Model
- Design/model provides clear guidelines on requested coding direction: 0.5
- Design/model is well presented, complete and easy to understand: 0

#### Java Coding Style
- Effective use of classes, all data attributes and methods: 1
- Effective use of documentation, white space and indentation: 0.5
- Effective use of comments, white space and indentation: 0.5
- Declarative & return types are consistently used across model attributes: 1
- Classes correctly formulated and implemented need functionality: 0.5
- Model classes correctly formulated for use in second submission: 0.5

#### Submission Completeness
- The user interface menu supports all the simulated menu options: 1
- File handling routines are in a separate file & in model classes: 0
- Correct usage of state attributes/variables in the model classes: 0.5
- Exception handling has been used within file handling operations: 1

#### Program Execution
- Correct loading/initialising of the Bank instance via class data file: 1
- Correct addition of a new CS Account object to the Bank instance: 0.5
- Correct removal of a selected CS account from the Bank instance: 0
- Correct depositing/withdrawing from any nominated CS account: 0.5
- Correct count of the CS accounts managed by the Bank instance: 0.5
- Correct total account displayed when held by the Bank instance: 1
- Full display of account details for any nominated account number: 0.5
- Correct strengthening of the Bank instance to a data file on disk: 1

#### Late Penalty
- Your submission was 7 days late which incurs a loss of 7 marks: 7

#### Total Assignment Marks
- 5 out of 20

### General Comments

Your plan is rather light on. Include more planning with your submissions as this is to guide the direction that your code follows. Your documentation is also short on - provide comments that explain in problem terms what your 'methods' are doing.

Class Account should have accountNumber attributes and class CheckAccount which extends Account? If you are adding a Transaction object to a Cheque or Savings account you would only need to know the Account. For some strange reason you have included an accountNumber? Class SavingsAccount does not hold the functionality of handling transactions that is provided in class ChequeAccount. Consult the sample solution code for guidance in this area.

Your file handling routines will need to be re-located for the second assignment. They should be in either the model classes or in a separate file. Please consult the sample solution code for information in this report. Do not use changeable static attributes in modelled objects. I suspect that this in the cause of your programs instability. Refer to the sample solution code.

I found the quality of your program questionable. I was unable to repeatedly remove account number one. This could be affected when the account was a charge account with a negative account balance.

The problem statement indicates that this should be guarded against.

Daryl Miller.

(Note that the student’s name is fictitious)
Dual Monitors and TWEAK_UI

We found that when several windows are open on the screen at the one time that a window needs first to be ‘clicked’ before being used. Thus, for example, when scrolling a student script the window must first be given ‘focus’. This need to give focus to a window delays the process of marking scripts.

To try and overcome this ‘delay’ two members of the trial experimented with a software utility named TWEAK_UI. This software utility automatically gives focus to a window when the mouse enters the window workspace. This therefore reduces the number of mouse selections needing to be performed when handling multiple documents. As a consequence this software utility has the potential to reduce the time taken to mark student scripts.

The two members of the trial using this utility reported that it also hindered their usage of other some other applications.

Access

Recording Marks using Access

A purpose built Microsoft Access database application can be used for the purposes of marking and generating marking sheets for return to students. This approach requires significant setup time in the design of database tables, data entry forms and a marking sheet report customised for each assignment. These tasks require a reasonable familiarity with Microsoft Access and small database application design techniques. The advantage of this approach however are improvements in Marking time, automatic tallying of marks, and the ability to archive all students assignment feedback and results in one database application for a specific cohorts assignment.

The following diagram shows an Access data entry form used to perform the marking of a students assignment.
The features of the use of this form in marking are:

- Navigation between fields is performed quickly by using the tab key to move onto the next field;
- Marks are entered for each criterion with a guide to allocating marks included with each question;
- Question and assignment totals are automatically calculated;
- Feedback fields are provided for each question, with the use of drop-down lists for common feedback items. The common feedback items displayed are those relating to the specific assignment question and may be easily altered upon selection.
- A Comments button is provided beside each set of feedback fields so that new common feedback items may be added for a specific question, or existing items altered.

**Printing Marking Sheets from Access**

An Access form is used to select a student and then either preview their marking sheet or print it out, often in PDF format for return to the student. Alternatively, a paper version of the marking sheet may be printed directly. (Note: real student numbers and surnames have been removed from this image for privacy reasons.)
Following is an example of a marking sheet as previewed in Access.

ITC242 Assignment 2

Student ID: 999999999
Phil Roy

Assignment Total: 15.6 / 20

Question 1

<table>
<thead>
<tr>
<th>Description</th>
<th>Mark</th>
<th>Weight</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian mobile phone networks described (GSM, CDMA, W-CDMA, CDMA2000, 3G)</td>
<td>0.7</td>
<td>4</td>
<td>2.7</td>
</tr>
<tr>
<td>Description of key elements of mobile phone networks</td>
<td>0.6</td>
<td>4</td>
<td>2.4</td>
</tr>
<tr>
<td>Detail of the characteristics provided</td>
<td>0.8</td>
<td>4</td>
<td>3.2</td>
</tr>
<tr>
<td>Overall answer quality and presentation</td>
<td>0.7</td>
<td>4</td>
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<td>Reference deduction: In work, no in text, 1 no reference</td>
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Characteristics discussed should include: analogue or digital, frequencies used, number of channels, data rate. Put more of your own words into your answers. Try more interpretation and less quotation of your sources. There are other standards you should discuss: consider GSM, CDMA, W-CDMA, and CDMA2000.

Question 2

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<td>Definition of UDP: Connectionless, unreliable, layer 4 protocol</td>
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