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Marking EP coursework using electronic communication

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SUMMARY

This paper discusses experience of getting students undertaking EP coursework to submit their work electronically. This has a surprising number of advantages, beyond the obvious saving of paper, though there are disadvantages too.

KEY WORDS Assessment Coursework Electronic publishing Hypertext Test harness Virus

1 INTRODUCTION

Electronic publishing is a practical subject and one of the most important aspects of any EP course is the coursework: exercises undertaken by the students and marked by the teachers. The aim of marking is, of course, not just to assign a number to a piece of work but to give constructive feedback so that the students' work steadily improves.

Increasingly EP involves dynamic on-line documents rather than nicely formatted pieces of paper. Even if the final goal is a paper, as it is with a DTP system, it is important *how* the paper was produced. For example most teachers would prefer their students to make consistent use of style sheets rather than fix details of a document so that they are next-to-impossible to change.

Therefore what the teacher wants a student to hand in for marking is often not a piece of paper but a source file. In this discussion we want to concentrate on one aspect of marking: how the source file can be sent electronically to the marker and how the marker can make use of this electronic form. We will call this *electronic coursework.* We should emphasize that the marking itself is not electronic but is done by a human. We are a long way from the time where a computer could pass a reasonable judgement on the quality of an electronic document.

Electronic coursework is widely practised, and the purpose of this paper is not to expound any revolutionary new ideas, but to relate some experiences and to present some issues for discussion.

2 SIZE PROBLEMS

A common message throughout computing, and indeed human endeavour in general, is that the large is different from the small. In particular this applies to the submission of work for

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marking. Informal methods are fine for small numbers of students (say less than 20), but for larger numbers some more formal mechanisms are necessary to record that students have submitted their work, and that it has been marked. This may sound bureaucratic and boring but without it there are bound to be anguishing problems of the kind: 'I handed in my work on time but it must have got lost in the pile'. An advantage of electronic coursework is that recording mechanisms are easy to install, and we shall dwell on this aspect as it is a vital one, not only in our own institution but also in many others.

3 AN EXPERIENCE

The bulk of this paper is devoted to relating our experience, over the last three years, of using electronic coursework on an EP course at the University of Kent at Canterbury. Our particular experience has been mainly concerned with hypertext coursework, though we have also given thought to other document preparation systems. Hypertext is not concerned with paper at all, so there is no possibility of students handing in pieces of paper for assessment. The hypertext course involved about seventy students initially, rising to over a hundred this year, so the need for formal mechanisms for managing marking was paramount. The students were partly computer scientists and partly students with widely varying backgrounds who were taking a 'conversion course' to learn computing. All took readily both to the idea and the details of electronic coursework.

The coursework involved producing a hypertext document. The nature of the document has varied from year to year but always involves presenting some reasonably complex material in a form that allows different readers to pursue different paths through it. The work was done, as it happens, on Sun and DEC workstations running UNIX, but, as far as this paper is concerned, could have been done on any networked computers.

4 TRANSMISSION FROM STUDENT TO MARKER

When some coursework is set, each student is given a unique directory for preparing their work. (The directories are created by the system administrators, who run a UNIX shell script that takes the login name of each student registered for a course and prepares a directory accordingly.) Each such directory is only accessible to the student who owns it, and to a group called 'marker', which consists of the markers. The student prepares his coursework in the given directory.

At the cut-off time for the coursework an electronic drawbridge goes up: students are no longer allowed to write to their directories. At this stage it is possible to run electronic checks to identify the students who have not handed anything in, and/or to send electronic 'receipts' to those who have. (With handing-in on paper for large courses we have found a need to issue paper receipts to help resolve cases where students' work has allegedly been lost or mislaid.)

An advantage of this use of directories is that it caters naturally for cases where a student's work involves several different files. An alternative approach is, of course, for students to use electronic mail to submit their work, and this may be the only option if the course involves distance learning. It is, however, not always easy to transmit non-textual files (e.g. files containing bit-map graphics) using electronic mail. Moreover mail delivery cannot be guaranteed.

In the absence of networking, students need to submit work on floppy disks. With large numbers this can cause even worse handling and registration problems than for paper, and even, perhaps, extra complications if a disk turns out to be corrupt ('It was OK when I handed it in.')

5 PROPERTIES OF THE EP SYSTEM

Before discussing the marking itself, we would like to highlight two properties that are desirable in the EP system that is the vehicle for the coursework.

The first is that the source format be such that all or nearly all of the available computing tools can be applied to it. Thus if the coursework involves using an EP system called X, then X source files should be in a form that other tools can read. This applies for example if X uses SGML or *troff* mark-up, but does not apply if X source files have lots of idiosyncratic binary codes embedded in them. This reinforces the view that EP systems should be designed to be well integrated with their environment, rather than being stand-alone systems.

The second requirement is that the EP system should support annotations, and moreover that there should be provision for several sorts of annotation, e.g. the student's annotations explaining why he has done what he has, and the marker's annotations commenting on the student's work. The system for annotations should have the following properties:

- the annotations stand out as separate from the original.
- a student can systematically proceed through all the marker's annotations.
- annotation is possible on all objects, e.g. on pictures as well as text.

Fortunately these needs can be met by most EP systems (perhaps by using style sheets or higher-level logical objects). If all else fails, some kludges are possible, such as putting a unique character or string of characters before each of the marker's annotations. Students can then search for this in order to find all the annotations.

6 ADVANTAGES TO MARKER

Having coursework available electronically helps the marker to do a better job, and thus give better feedback to the students. This is what really justifies electronic coursework.

We have emphasized that marking involves human judgement rather than computer-generated ratings, but nevertheless the human marker can find computer-generated background material useful. On the hypertext coursework, for example, we ran the following electronic checks:

- a spelling check.
- an embryonic style check, that counted the number of usages of various hypertext facilities. See [1] for details.
- a consistency check that made sure that all hypertext links were properly connected.
- a size check.

Obviously the detailed nature of these checks depends on the material submitted, but we found it invaluable to look at the output from these checks before looking at the coursework

itself. For example if the style check showed that the student had an unusual balance in the use of facilities, it made us curious as to why: perhaps the work was just plain bad, or conceivably it was an unusual and original approach that was highly successful.

When looking at individual assessments it is valuable to have available the whole armoury of tools provided by the computer, in order to satisfy the marker's ad hoc needs for further information. Examples are searching for all occurrences of a given pattern or even comparing two students' work where copying is suspected.

7 MARKING

Though some EP coursework will involve doing prescribed closely defined tasks, a lot will involve creative design work. Marking here is somewhat subjective and it is hard to give general guidelines beyond the obvious one that the aim of the marker is to help the student do (even) better next time.

A problem we have encountered when marking hyperdocuments is knowing whether we have explored the whole document. Unfortunately most current systems do not have systematic aids for checking this, though the KMS hypertext system [2] automatically marks the buttons that have been selected. With linear documents such problems do not apply.

On all but the smallest courses, marking is a chore. A happy side-effect of electronic coursework is that we found marking less of a chore: indeed in small doses it has been interesting. Probably this is because we were able to explore students' work in an active way.

8 TEST HARNESSES

With programming assessments it is possible to write test harnesses that check whether the program works. Several such exercises have been reported in the literature. Such thorough testing is, however, unlikely to be possible in EP work, though markers may find the following checks valuable:

- syntax may be checked through scrutiny of the log files for LaTeX documents [3], or by the use of the *checknr* verifier for *troff* documents.
- structural checks can also be made. For a DTP exercise students might be expected to make use of style sheets rather than hard-wire formats into a document. Many systems either offer a hierarchy of styles (e.g. *Microsoft Word*, *Aldus PageMaker*), or allow a hierarchy to be created, (e.g. *troff*, LaTeX). Any changes to a style (possibly to an ancestor style held centrally on the network) will permeate to all other styles inheriting from this style. In order to test whether a student is using such a hierarchy correctly, the marker can make an eye-catching change to an element of the hierarchy (e.g. section headings to be red) and observe whether the document changes in the way it should.
- device independent checks may also be made, to a limited extent. If a document was formatted by the student for A4, what happens if the marker alters the size to US Letter, or even A5?

9 RETURNING WORK TO THE STUDENTS

There is a danger that, once hooked, one uses electronic methods just for the sake of it, rather than to bring measurable benefits. Even if students submit their coursework electronically, it is not necessary for the marker to return his comments electronically. Indeed, we have, in the past, returned comments to students on paper rather than via electronic communication.

If, however, the coursework is such that it would be helpful for the marker to make his comments as annotations on the student's work, then the annotated work should be returned electronically to the student. Such annotations have several advantages:

- if the student is going to pursue his work further, it is easy for him to insert the marker's suggested changes if these are embedded within the document. This is an advantage for all documents written or approved by more than one author, not just the rather artificial example of education.
- there is some potential for testing consistency of marking—it is a big worry to most of us, when marking a hundred different pieces of coursework, that the hundredth might have been marked to a different standard to the first. If the marker uses semi-standard annotations (e.g. 'Style-sheet not used: . . . '), this opens up the possibility of writing a checking program that analyses the annotations in some marked work and checks whether the mark suggested by the annotations is seriously out of line with the given mark. The marker can then have another look at any apparently anomalous cases.

Even if comments are returned to students on paper, the paper can, of course, be prepared using DTP. In particular copy-and-paste is valuable for:

- inserting pieces of the student's work into the marker's comments.
- inserting the output from checking programs, for example a list of spelling errors.
- inserting common paragraphs, for example if half the students make the same mistake, it is useful for the marker to prepare a paragraph explaining the error, and to paste this into each of the documents he is returning to the errant students.

10 THE VIRUS THREAT

Perhaps the biggest worry that most people have about embarking on an electronic coursework scheme is the problem of potential viruses. We shall therefore end by discussing this issue. A current trend in electronic publishing is to allow programmability. Thus there is a move towards *active documents* [4], where part of a document (for instance a table) can be generated by running a program rather than by being wired in. Similarly, hypertext facilities often involve programmability, such as is provided by the HyperTalk facility of HyperCard [5]. Many systems allow completely unrestricted programmability, in the sense that it is possible to call up any other application or to execute any system command. Such programmability is an ideal platform for a virus: for example the marker might view a table in an active document; this runs a program that indeed generates a table, but as a side-effect deletes all the marker's files, and, for good measure, also sends some obscene mail to the University Chancellor, emanating apparently from the marker.

Because of this danger we have taken the following preventive measures:

- running in a protected environment. Our 'marker' login is a separate login from our normal ones, and does not have write-permission to our other files. Thus the only

files a student can delete or change are the files concerned with the marking exercise. (We wrote the marks themselves on paper, so that these could not be changed by program, though we also kept them electronically in order to allow electronic analysis of marks.)

- using the protections offered by the EP software. Specifically the hypertext system that we were using, Guide [6], offers a 'safe' mode whereby the reader is alerted before any program (or other potentially dangerous operation) begins. The reader can examine the program and prevent it running if it looks suspicious.

It is also a comfort that we run in an environment where the whole file system is backed up every night.

Perhaps disappointingly, after all this thought to protection from viruses, we have not been seriously attacked: the worst that happened was an attempt to lead us into an adventure game. However the best crime is undetected . . . .

11 CONCLUSIONS

In conclusion, we can say that our experiences have been positive. In many fields of electronic publishing, electronic coursework is a must. Even if it is not a must, it is often worth applying as it helps the marker do a better job, in particular because he can use electronic tools to provide data that will aid his judgement.

Electronic marking is particularly appropriate on large courses, since it helps avoid the problems of managing the handing-in of work.

Lastly, perhaps the biggest danger of electronic coursework is the possibility of a virus attack, but if the marker is aware of the problem he can take reasonable preventive measures.

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