Teaching and learning computing skills via an intranet-based course

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Abstract

This paper discusses a non-majorable first year University Computing course that provides novice users with fundamental computer skills. This paper-less course, now in its second year, uses combined lecture/practical sessions in addition to the Departmental intranet and the Web. The paper focuses on key issues relating to the experience of teachers and learners in this environment.

1. Introduction

This paper discusses a non-majorable first year University Computing course (COM120) that provides novice users with fundamental computer skills. This paper-less course, now in its second year, uses combined lecture/practical sessions in addition to the Departmental intranet and the Web. The course constitutes one third of a first year undergraduate's study programme and cannot be chosen by students who are majoring in computing or who are studying first year computer science.

This paper focuses on our experiences of developing, teaching and learning in this environment and highlights key issues and experiences from staff and student perspectives.

Section two describes the course syllabus and assessment. Section three discusses the teaching methods we employ, the use of on-line resources and our experiences of teaching the course. Section four describes the course from a student perspective. We conclude with general observations about our experience.

2. Course Overview

2.1 Syllabus

The typical first year undergraduate will tend to have had a certain level of exposure to IT. This is due to changes in the National Curriculum and increased use of computers in society. We therefore assume that traditional introductory computing curricula, focussing on application skills (such as word processing, spreadsheets etc.) are becoming increasingly irrelevant.

COM120 teaches skills that will have an increasing significance in the networked world. The course focuses on the World Wide Web, its associated technologies, use and socio-economic issues. We wish our students to become active contributors to the Internet, so we teach them the requisite skills, including: Internet use, Web page design and authoring, W3C standards, validation and usability, and electronic commerce. Developing Web pages is both motivational and familiarises students with source file management (Gurwitz, 1998).

The course also covers elementary programming skills, using a gradual incremental approach. The course begins with programmable Lego robots (called Lego Mindstorms) and an

associated graphical programming environment (Robolab). This establishes fundamental concepts of programming. We then cover BASIC (QBASIC), through which students acquire more advanced programming techniques, and problem solving skills. We end with Visual Basic and event driven programming, and students build Windows-style applications of their own. Topics such as interface design and VBScript are covered, to provide a link between the programming and internet aspects of the course.

2.2 Course structure

There are two themes in the course: Internet and Application Design. Both are taught concurrently in two 2-hour sessions each week. Each session is repeated three times for groups of 30 students (the capacity of the teaching laboratory).

Each session consists of a hybrid lecture practical, part taught and part supervised exercises or coursework. The material is on the departmental intranet. Each week's material is available at the start of the week and can be accessed via the Internet. Moreover, the COM120 laboratory is 24 hour access.

Though students can work through the material alone, it is designed to be delivered in the sessions. In the sessions, wall-projection of the lecturer's display enables the lecturer to discuss material in detail, and present demonstrations, ad-hoc examples and sample solutions. The students view and control the same material on their own workstation.

Each session is also attended by two postgraduate assistants. These are an invaluable support system for both students and lecturers. Students do not typically have to wait very long for help and the staff are usually kept busy. There is an informal atmosphere where students are not afraid to ask for help.

2.3 Course assessment

Students are assessed entirely on practical work (there is no examination). There are small scale Web-based and programming exercises that are assessed in-stream (where possible). Assessed exercises are completed in the students' own time and submitted electronically to the course conferencing system (run on a Lotus Domino server). There is also a Web-based dissertation on an approved topic of the students' choice. This either consists of a small collection of Web pages or a programming project accompanied by associated Web-based documentation. The dissertation reinforces the course material, as it is based on skills acquired on the course such as Web-page design, programming, etc.

Feedback to students is provided when work is demonstrated to staff during the sessions or via email after the coursework has been assessed. An on-line system is used for students to check their own progress. The course assessment pages are now updated from a database (mySQL) and personalised using a server-side scripting language (PHP). Students can access their own performance record featuring marks and comments.

3. The Staff Experience

The course is currently nearing the end of its second year. Our experiences fall into two broad categories; development and teaching of an on-line course and teaching using the hybrid lecture/practical style.

3.1 Course Content and Delivery

Figure 1 shows a screenshot of a typical page from the Visual Basic module. Sessions usually feature taught material and exercises. The taught material tends to be delivered early to allow the more capable students to complete more advanced optional exercises later in the session.
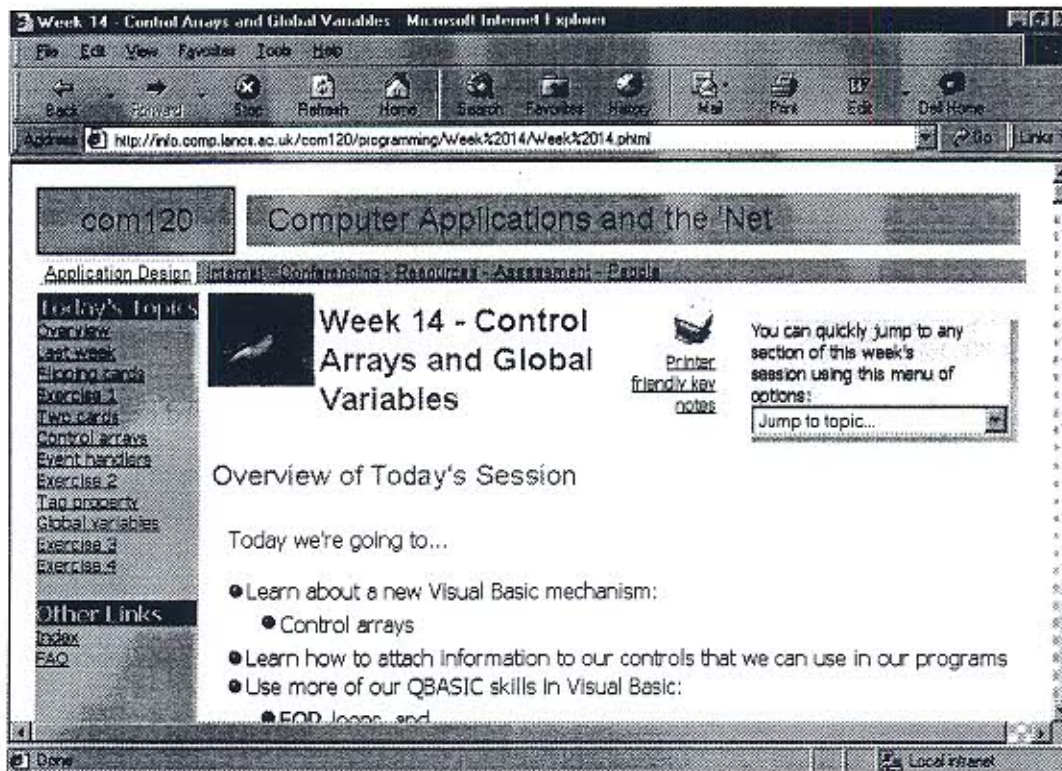
Figure 1 – A typical page taken from the Visual Basic module of the course.

The exercises are such that most students can complete them within the two hour session. We have occasionally run additional workshops to help students with the more demanding work.

Our on-line course material is intended to be self-explanatory. For each week, we also provide a link to "printer friendly key notes". These can be printed out and taken away to act as an *aide memoire*. They are also used by some students to help overcome the problems of having to keep switching between windows on the screen.

We have provided a comprehensive on-line index and a frequently asked questions (FAQ) page. Both systems are now driven from a database server to reduce the burden on authors and allow dynamic page generation.

3.2 Course Preparation

Self-explanatory course material requires considerable development time. A single week involves the development of:

- Appropriate topic(s)
- Supporting exercises – coursework, solutions, description, submission instructions and assessment criteria (~8 hours)
- Illustrative ideas and demonstrations
- Authored material (a conservative estimate is that it takes ~10 hours to produce the material for a session, once the topics and exercises are complete)
- Additions to the FAQ and indices (this takes ~2 hours), though the introduction of the database driven pages has reduced this publishing overhead

This effort is per stream (i.e. half the effort) and does not include course administration and development of the on-line support systems. There are two lecturers on each stream. As we

become more adept at Web page authoring and as the structures and supporting systems become more streamlined, we expect development times to reduce in the future.

3.3 On-line Support Systems

The COM120 course makes use of a number of on-line systems:

1. Intranet Web server
2. Questionnaire system
3. Course conferencing/ coursework submission system (university administered)
4. FAQ system
5. Course index
6. Mark dissemination and progress checking system
7. E-mail (university administered)

Initial development of each of the above can take as much as one working week. However, once running, the systems reduce the burden of administration. For example, publishing a new questionnaire now takes around 1 hour, roughly equivalent to the time taken to select the questions for a paper-based questionnaire. Moreover, the on-line systems can be used to support statistical analysis of questionnaire responses, etc. The weekly attendance registers are currently the only paper-based mechanism on the course.

3.4 Reflective Practice

The on-line feedback system (a questionnaire, completed and submitted anonymously on-line is available after each module) has facilitated the timely adaptation of the course to address students' concerns. We have access to many responses as they actually arrive, and can thus respond to valid concerns almost immediately.

For example, in response to last year's student feedback, we introduced the printer friendly key notes, mentioned earlier. We then discovered from the student feedback questionnaires that many students were unaware of their existence. We took steps to increase awareness of the notes. Feedback shows that many students are now using, and appreciating, these notes.

3.5 The Hybrid Teaching Sessions

The hybrid teaching style has been very successful. Reducing the time between teaching topics and applying them in practice has significant advantages; and we are able to assess the students' assimilation of the material by observing them tackling related problems. A previous version of the course, reflecting a traditional separation of lectures and practical classes, resulted in students experiencing difficulties in applying concepts from the lectures in their practical work. Urban-Lurain & Weinshank (1999) and Rodger (1996) use similar hybrid approaches for related reasons.

In the hybrid session the teacher must alternate between delivering material and tutoring individual students. Managing these transitions is challenging, as students are often so engrossed in their tasks they can miss key points being made. It is important to focus the attention of the whole group at these mode switches. Moreover, each student is actually seated at his or her own workstation, and is linked to the internet, and can easily become distracted and pay insufficient attention to the delivered material.
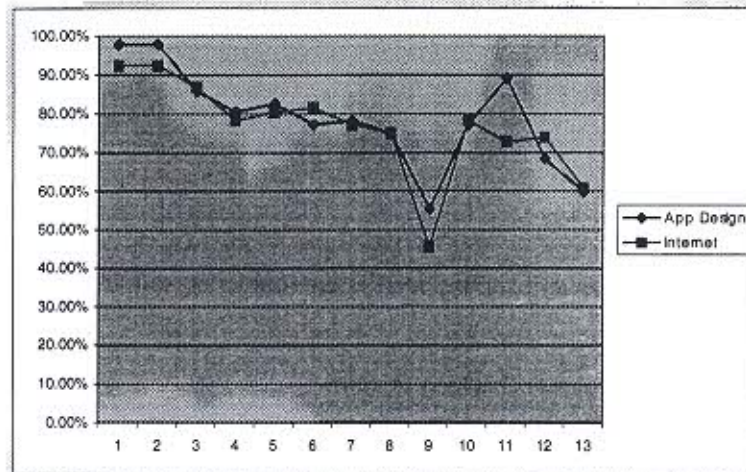
Figure 2 - Com120 attendance pattern for Michaelmas 1999 and start of Lent 2000

Our approach does require considerable staff-student contact time. However, delivering three essentially identical sessions per week has one significant advantage. As a tutor, one often perceives shortcomings in one's delivery of the material that can be quickly addressed in subsequent sessions that week.

Student attendance has been very good, compared to that for "traditional" lectures at this university. Figure 2 illustrates this year's attendance levels. Attendance is generally good, but dips slightly towards the end of the Michaelmas term. Attendance levels are not recorded for the equivalent first year Computer Science major lectures, but are known to tail off significantly. COM120 compares favourably with attendance of major students in practical laboratory sessions, despite the fact that COM120 students know that all material will be on-line and accessible outside of the timetabled sessions.

One negative aspect of the sessions relates to the physical set-up of the laboratory. The lecturer is situated in the middle of four or five rows of students. Students are more used to traditional lectures, for which the behavioural parameters are well defined. Lecturing from amongst the students makes it harder for them to detect when the lecturer is about to make an important point. It also means the lecturer has his/ her back to some of the students for much of the time. Certain students have become accustomed to ceasing work on the computer and attending to the projector screen when they see the lecturer walk towards the presentation workstation. For the lecturer, this is gratifying, as it is obvious that he or she has the attention of such students.

4. The Student Experience

4.1 Student Feedback

The students' response to this method of teaching has been generally favourable. Figure 3 shows the responses to the first three questionnaires in the "Overall category", covering the Michaelmas terms for 1998 and 1999. Direct comparison is difficult because we have restructured the course this year (QBASIC reduced from 10 weeks to 5, 5 more weeks being spent on Visual Basic).
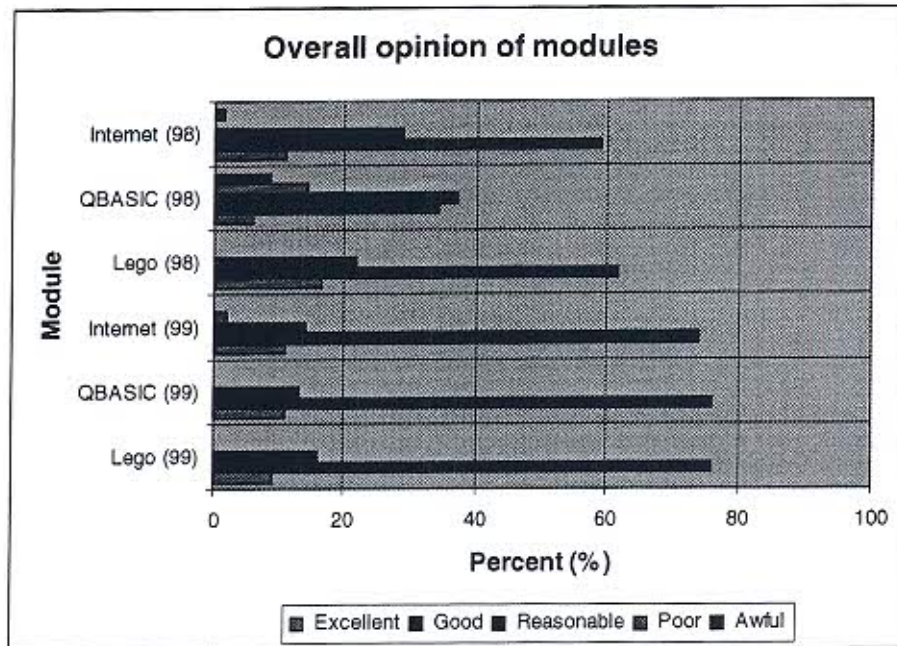
Overall opinion of modules

Figure 3 – Comparison of student opinion 1998-1999

From Figure 3 we see that over 70% of the students (who filled in the questionnaire[1]) rate the course as "Good" overall.

The students' responses in the optional 'comments' fields of the questionnaires is very instructive. Selected comments from this year's questionnaires, both positive and negative, are presented in Table 1[2].

Opinion on Content	although the basic programminhg skills we have been working towards are what I expected I was surprised, though pleased to see that we would be learning them in such a unique way, by using those highly advanced lego models.
	Need more one to one tuition.
	I found it was presented to us too quickly in the sessions so some of the practicals were harder to carry out because I hadn't fully understood the explanation.
Opinion on sessions	It's more motivating to be able to do both at the same time - lecture and practical.
	system okay but difficult to get help outside lab sessions
	The practical "hands on" aspect combined with a lecture works well.
	It was much easier to see what we had to do then go do it... It also kept the classes fluent and uninterrupted
	They weren't boring although they lasted 2 hours.

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[1] Note that most questionnaires were returned by 70 or more students (from 91 registered on the course). QBASIC (99) was only completed by 46 students, we attribute this partly due to the low attendance at the end of the Michaelmas term.

[2] Comments are taken directly from the questionnaire system without editing.

	It was much more enjoyable than your "traditional" lecture style.
Opinion on Internet Stream	Much more difficult than I expected. Didn't seem to be for beginners at all.
	a lot better!!! I loved the way we could design our own web pages!!
	I've enjoyed the course and it has certainly enhanced my internet usage.
	I thought it would just be the basics of design but it went into much more detail than I expected, which was good.
	I feel that more time could be dedicated to designing our own personal web page.
Opinion on QBASIC	I am really enjoying it and I have definately become more confident using a computer
	Fun and interesting, but each section (e.g. lego, qbasic) finishes when I want to carry on and learn more.
	It isn't very interesting.

Table 1 – Sample comments from the student feedback questionnaires

These comments are typical of those found in the questionnaires – one student will find the course interesting and challenging, another will express a completely opposite view. The majority of the responses are positive. Some comments bring problems to our notice. The facility for students to check their own progress, and the need to tell students about the key note pages (these were described above), both arose from student comments.

4.2 Student Commitment

For many of our students, COM120 represents a unique learning experience resulting in the acquisition of novel skills. Many of the students express surprise and delight that from early in the course they are creating their own Web pages, using email, and learning to program. Many students comment that though they find COM120 challenging, they actually derive more pleasure from it than from their major subject. Several students have expressed a desire to study further computing-related topics; currently, this avenue is not available to COM120 students, though a plan to offer COM120-style minor courses is currently being formulated.

There is no doubt that COM120 is a challenging course. For most of the students, effective learning requires full, or almost full, attendance, at the scheduled sessions, and at least two hours a week additional work. Thus, at least six hours of practical work is required. Students who miss sessions *can* catch up with the work, and we give them every possible opportunity to do so, particularly if there are good reasons for their failure to attend. Moreover, as noted above, the material is available on-line, and thus a student can ensure that they cover any missed topics before the next session.

Clearly, students who have Internet facilities at home are better equipped for working as and when they like (for example, at holidays). However, at Lancaster, most first year students live on campus, and so can take advantage of the 24-hour access provided for the COM120 laboratory.

5. Conclusions

In this paper we have described our experiences of creating, delivering and running a paper-less intranet based introductory Computer Science course. Our experience suggests that this approach facilitates effective learning, but it relies on supplementing the Web-based material by tutoring and practical supervision. As on-line material encourages readers to skim the content, then a human tutor is indispensable for directing the learners' attention.

The on-line teaching and administration of the course suggests that such a course is easier and less resource-intensive to establish than a more conventional lecture based course. Our finding is that the converse is true; the taught material is more time consuming to produce and has resulted in the need to develop a number of supporting systems. The lecturing team have also been required to acquire a new range of authoring skills for presenting the course on the intranet. We suspect that some of the additional loading of the lecturing team is as a result of a redistribution of work from the department's administration and the students themselves.

We have gained a great deal of valuable experience about how we can design and prepare courses for on-line consumption. The first year taught us a number of valuable lessons and as a result we have almost completely rewritten the course in its second year. We believe that the material, its structure and the supporting on-line systems are now nearly stable and will run with only minimal modifications next academic year. The response from the students has been overwhelmingly positive – it is hard to imagine how we could hope to teach the same set of skills, using a traditional lecturing paradigm.

Acknowledgements

References

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Urban-Lurain, M. & Weinshank, D.J. (1999) "I do and I understand": mastery model learning for a large non-major course, In *Proceedings of the Thirtieth SIGCSE Technical Symposium on Computer Science Education*, 150-154, March 24 - 28, 1999, New Orleans, LA, ACM.

Links

For the interested reader, the COM120 pages can be found on the Internet:
http://info.comp.lancs.ac.uk/com120/