

# Flexible Learning – Maximising Flexibility in a Subject With Large Student Numbers

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## Abstract

In providing the introductory computing subject (topic) Information Technology 1A to approximately 800 students per annum in three different modes, a number of delivery mechanisms have been used to give additional flexibility to the way in which students can learn. In particular the components of the subject materials have been presented in five different formats with the students able to use a combination of formats that best suits their needs. In this paper the formats used are discussed, then the issues involved in producing the materials in these five formats, and finally the evaluation of the materials by the students.

*Keywords:* evaluation of teaching, flexible delivery, flexible learning, IT education, undergraduate teaching

## 1 Introduction

There is a large body of research on flexible learning and distance education. Much of the research has centred on students studying in distance mode (Burns 2001) or in providing a flexible learning environment for students, (Lynch et al 2001), or providing different materials within a subject according to the needs of the students (Atchison 2001). Bryant (Bryant et al 2001) compared the performances of students using a range of materials in one subject and using a traditional approach in another similar subject. The students have not had the option to choose the approach they prefer.

This paper investigates flexible learning in the context of providing students, in a subject with large student numbers, options in the way in which they learn a set curriculum by producing the learning materials in a number of formats and allowing the students to choose the format(s) they use.

There are many reasons why materials used for university subjects should be produced in a number of formats. Lecturers can no longer assume that all the students in their classes will be available at the same time every week. Many students do shift work to support themselves

and their rostered shifts change from one week to the next.

Many students try to juggle work, family and study commitments. The requirement that a subject can be done between 9am and 4pm is common for parents with younger children, while students in full time or part time work often want to be able to complete a subject by studying after 5pm.

Some students have state and national sporting commitments involving travel and at times are away from University for a week or more during semester. They want and need to be able to catch up missed work on return.

Travel time and cost is an issue for some students who live a considerable distance from the University and they want to be able to do as much work at home as possible and limit their time on campus to less than five days per week.

Students studying introductory IT subjects at University come from a wide range of backgrounds. Some have never used a computer, others have passed a matriculation IT exam and some have worked in the IT industry for a number of years. To meet these different needs by providing a range of materials and structuring a subject so that students can proceed at their own pace is desirable.

These reasons are similar to the list of potential benefits or drivers of distance education in Burns et al 2001.

The HECS fees for each subject provide an added incentive for making it possible for students to pass even when they cannot consistently attend classes.

Thus producing flexible learning materials that provide students with what they need, when they need it, where they need it and in the format they need it is an important consideration in planning any subject.

Other issues include the concerns of the Federal Government and University administrations at the failure rates in subjects and pressure on academics to ensure higher pass rates without a drop in standards.

A number of Australian University subjects are also being offered overseas and materials must be produced in a format suitable for use by tutors in those countries.

Subjects may also be offered in intensive mode in summer or winter to cater for a number of situations.

Students with prior University studies sometimes need a prerequisite subject to start their major. Students want to complete their degrees as quickly as possible or wish to lighten their semester workload. In some cases the subject is required in the degree structure but students cannot fit it into their study program during the semester.

Producing materials that can be easily repackaged to cater for semester, intensive and distance modes of teaching is now necessary for many subjects.

The major constraint on producing material in a variety of formats is staff time. The production of flexible materials can lead to greatly increased preparation times for the lecturers involved. If care is not taken there may be discrepancies in the content of the material in the different formats. Ways need to be found to add flexibility to materials and hence teaching effectiveness with minimal additional effort.

This paper outlines the methods used in the preparation of the materials for the introductory computing subject at Flinders University which meet all of the requirements outlined and reviews the evaluation of the materials by the students.

## **2 The subject**

Information Technology 1A is the introductory subject for all students taking Information Technology majors offered by the School of Informatics and Engineering at Flinders University. It is also a compulsory subject in a number of other degrees and is taken as an elective subject in many of the other degrees by students wishing to enhance their employment prospects. (Flinders University actually uses the term topic for subject but subject will be used in this paper.)

The subject is offered three times each year, once in intensive mode in February, in the standard lecture/practical mode in semester 1 and then in modified mode (non traditional) in China starting in September. Thus the subject must meet all of the requirements outlined in the introduction to this paper.

The number of students taking the subject in intensive mode has risen steadily from 60 in 2000, when it was first offered in this mode to 100 in 2003. Only a few students do not complete intensive mode each year.

The number of students taking the subject during semester 1 is around 700 students at the start of the semester dropping to around 550 students by the examination period.

Currently about thirty students take the subject in China. This number is presently low as it is the first intake in a pilot program. The number is expected to grow considerably in the next few years.

The subject has to cater for students with a wide range of prior computing knowledge. Some students have passed Information Technology Studies at Matriculation (year 12) level with a high score. Others have never used a computer.

In attempting to meet the diverse range of requirements the subject material is presented in five different formats giving students choices in the ways in which they study by selecting the best combination of options that meets their needs on a weekly basis.

## **3 The five formats**

The five formats are: traditional face to face teaching (lectures and practical sessions), a subject manual of printed materials containing lecture outlines and practical notes, a CD ROM, videotapes and a web site.

Thus a student taking the subject has available a number of sources of material and may utilise different combinations of those materials as they progress through the subject.

The theory can be studied by attending lectures, watching the lectures later on videotape or using the lecture outlines in the subject reader to guide their study of the text book. The lecture material and supplemental material can also be found on the website and the CD ROM.

All students in the semester version sit a theory exam in the normal University examinations period. The intensive mode students sit the theory exam at the end of the three weeks of study.

Practical work can be done either in the laboratory or at home. The details of each practical are available in the printed lecture/practical notes, on CD ROM and on the web site. The files needed for practical work are on the CD ROM and the web site. Each week's practical work must be marked by the due date by attending at least part of an allocated practical session. Students doing their practicals at home need only attend long enough to get their practical work marked. The ongoing requirement for students to present their material in scheduled classes, combined with a supervised practical examination at the end of semester, encourages students to do their own work.

### **3.1 Lectures**

For the large class in semester 1, lectures are presented in a traditional lecture theatre setting. Three lectures are given each week in the morning and each lecture is repeated in the afternoon.

A relay link to a second lecture theatre provides overflow capability until the students distribute themselves more evenly across the two times. Guest lecturers provide insight to the use of computers in business and industry. Material presented by guest lecturers, (which is examinable) is made available on videotape and on the web site after the lecture.

Attendance at lectures is not compulsory and the number of students attending usually drops off towards the end of semester.

The first two lectures of each week, which cover the theory, are generally presented from PowerPoint slide shows or using a web browser and linked web pages, or overhead projector and visualiser materials. (eg when appropriate, pieces of equipment are dismantled on the

visualiser so students can be shown the various components.)

The third lecture each week takes the form of a workshop. It includes a review of the practical material for the following week, revision of key issues in lectures and sample exam questions on the work previously covered in lectures. Various combinations of print materials, slide shows, working out problems on paper and computer software are used in these sessions.

### 3.2 Videotapes

The morning lecture is videotaped. The lecture may be retaped in the later session if necessary. The output to the beam projector from the visualiser and the computer and the output from the radio microphone used by the lecturer are recorded on videotape. The lecturer giving the lecture is responsible for the videotaping. This approach is cost efficient as the lecturer can start the recording at the start of the lecture.

Several years ago, in the first year of videotaping, the face of the presenter was recorded in the top right hand corner of the screen necessitating the presence of an operator and subsequent higher costs. Quality of the tapes using the new approach is about the same and the students and staff prefer using the whole screen for the material being presented.

The videotape is viewed mid afternoon by students (usually 20 – 30 students) who cannot attend either lecture. A student, who regularly watches the videotape, organises this session. This session also provides a check on the quality of the videotape. If the students indicate the sound quality is poor or parts were not recorded due to an equipment malfunction the lecture is retaped at the later lecture.

The videotapes are then placed on reserve in the library. Students may then view the videotape as required during the rest of the semester. Library borrowing figures indicate a usage rate of about 15 viewings per videotape. This figure appears low as only actual borrowings are recorded. Students are able to watch the videotapes in the library in groups without borrowing them and more than one student may view a videotape on one borrowing. As the subject is taught in China later in the year the videotapes can then be used for support material for this program.

The current approach to videotaping lectures is proving to be very effective and cost efficient. Feedback from students who regularly view the videotapes indicates they think the videotapes are a suitable substitute for attending lectures or viewing missed lectures.

### 3.3 Printed materials

The lecture notes, the practical notes and supplementary support material are combined into a typically 250 page subject manual for purchase by students. The subject manual is wire ring bound allowing easy folding back of pages to facilitate student use in lectures and in practical classes.

The printed lecture notes are generally close to the text displayed in lectures. It provides the structural framework for the lecture. Most lectures are referenced to a chapter in the text book. Some lectures cover material not included in the text book.

Diagrams in the slide show are not included in the lecture notes. All diagrams referred to in lectures can be found on the CD ROM and in many cases in the text book. (Permission was given by the publisher to incorporate the diagrams on the CD ROM provided the text book was a compulsory purchase.) Ample white space is left in the notes for the addition of student notes. Blank lined pages are provided for guest lectures and the Thursday workshops.

The practical notes for each practical session are detailed enough for the students to complete the work on their own. The practicals are either application software practicals from the Word, Excel and Access books purchased with the text book or subject specific practical exercises developed internally.

Each practical session contains two or three checkpoints, compulsory tasks to be completed and marked by demonstrators, during laboratory sessions and then recorded on the local computer system. Students who choose to work at home must attend part of a practical session every one or two weeks to get their practical work marked.

All administrative material related to the topic is included in the subject manual.

### 3.4 CD ROM

The CD ROM, which accompanies the subject manual, contains all of the printed materials for the subject ie. the lecture notes and the practical notes. Additional materials on the CD ROM include copies of past theory exams, the files needed to do the practical work, graphics used in lectures and additional multimedia material supplied by the publisher of the text book. All text files are in pdf format.

The CD ROM materials can be accessed using a web browser.

### 3.5 Web site

The web site contains all the materials on the CD ROM and additional materials that become available during the semester. Notices and copies of guest lecturer material are linked to the web site.

## 4 Minimising the effort

Preparing the range of materials used in the subject clearly involves more effort than just preparing a traditional lecture and printed practical notes. There are also the issues of co-ordinating the efforts of the staff involved, usually three, in the preparation and teaching of the materials to ensure the materials are produced on time and in a consistent style.

Time constraints are also a factor. All printed materials must be produced between the end of semester 2

activities and two weeks before the start of intensive mode to allow sufficient time for printing and binding. In most years no more than four weeks are available for printed material preparation. Thus the production of the materials must be well co-ordinated.

At the start of each preparation period the previous offering of the subject is reviewed to determine what changes should be made.

To facilitate access to materials used in previous years and to ensure a complete set of the materials is available for new lecturers in the subject a shared workspace is used to store all materials from previous years and as a repository for completed new materials.

The CD ROMs from previous years provide a useful backup of most of the materials.

To ensure consistency between materials prepared by lecturers and to minimise work arising from editing; templates with defined styles, for slide shows and documents are available in the shared directory.

#### **4.1 Preparation of lecture materials**

Feedback from students has indicated that most want the text in the slide show used for the lecture to match the printed lecture notes. The first time the flexible delivery materials were produced, 1999, the materials used in lectures the previous year were the starting point. These materials, created by various lecturers taking the subject, were a mixture of slide shows, printed material and overhead projector slides. It was a major task the first time to convert them to the common format of slide shows. Once the slide shows had been created the text was exported to a word processor to prepare the lecture notes, and when complete also saved in pdf format.

As the material used in lectures is mostly generic, with emphasis on key concepts, changes in subsequent years have been relatively minor. The standard approach has been to update the lecture notes files during preparation of the flexible delivery material. The slide show is then modified to match the lecture notes prior to giving the lecture. A change in text book or the edition of a text book may require an update of some of the graphics in the slide shows and chapter references in the printed lecture notes. Software upgrades require some changes to the lecture notes.

The most recent major change was the introduction of a lecture on electronic business in 2002. In this case the lecture notes were produced first then the slide show.

The use of generic material can be justified on a number of grounds:

- The subject covers fundamental Information Technology Concepts and these tend not to change whereas the technology may have changed considerably by the time students graduate.
- A change in text book does not require a major rewrite of the material.

#### **4.2 Preparation of practical materials**

The practical materials generally require some changes each year due to software changes or upgrades. Again the key concepts have been emphasised in the practical work. Thus each software upgrade usually needs only an update of the screen captures and a review and revision of the practical exercises selected.

The additional practical support materials which include commonly used unix and HTML commands, rarely need more than minor changes.

All practicals are tested in the computer laboratory prior to printing as sometimes there is an unexpected consequence of a hardware or operating system change such as feature enhancement in upgrades.

#### **4.3 Administrative materials**

All the administrative details for the subject are updated and included in the subject manual.

These materials include, subject outline, lecture outline, assessment details, due dates for practicals and contact details of the staff.

#### **4.4 Web site**

Once the printed materials have been finished, the web site is set up. The web site contains all the printed materials in pdf format, the files used in the practical work, copies of previous years' exam papers and additional multimedia materials supplied by the book publisher.

The web site is thoroughly tested by the lecturers in the subject and used in intensive mode before being used as the starting point for the subject CD ROM.

#### **4.5 CD ROM**

Two weeks before the start of semester 1 a master CD ROM, which is a copy of the by now thoroughly tested web site, is made. Copies for all students are made once the semester enrolment numbers are known. The intensive mode students, by their own choice, rarely do practical work at home and hence do not need the CD ROM. If required a copy is burnt in house or they are given one from the previous year.

#### **4.6 Communication**

Large student numbers and twenty to thirty demonstrators for the practical work necessitates a good communication system. Putting all of the administrative details information in the subject manual has minimised questions about the subject from demonstrators and students. Most communication relates to missing due dates for practical work because of illness.

The students and demonstrators are encouraged to use email in communicating with the subject co-ordinator and lecturers. A response within twenty four hours is usual.

If a number of similar emails is received, answers to the emails are also posted as a notice on the web site and discussed in the Thursday workshop lecture.

To ensure consistency, extensions to due dates for practical work can only be granted by the subject co-ordinator. Demonstrators only mark overdue practical work if the student can display an email from the subject co-ordinator granting the extension.

## 5 Evaluation

To determine if the extra work involved in providing the materials was worthwhile additional questions relating specifically to the materials were asked on the subject evaluation form. The results are shown in figures 1 to 5.

It should be noted that the survey is completed in the last lecture of the semester. Thus students who used the flexible learning materials exclusively were unlikely to be included in the survey. Hence the data is likely to be skewed towards the negative end of the scale, ie the data shows the various forms of the material being used less than they actually are.

Figure 1 shows the response to the question

The teaching materials (e.g. handouts, study guides, reading list etc.) were helpful.

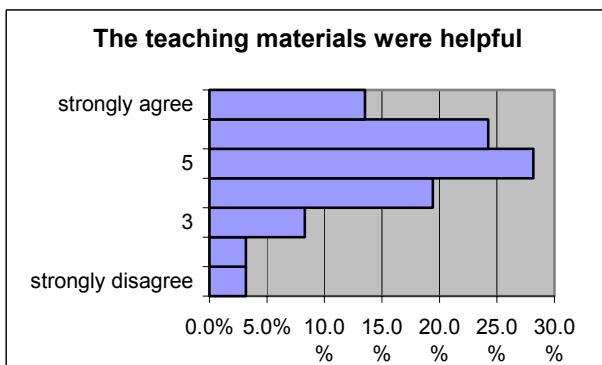


Figure 1

The response to the question shows that overall the students found the materials provided were very helpful.

Figure 2 shows the response to the question

The lecture/practical notes were ...not at all useful ... very useful.

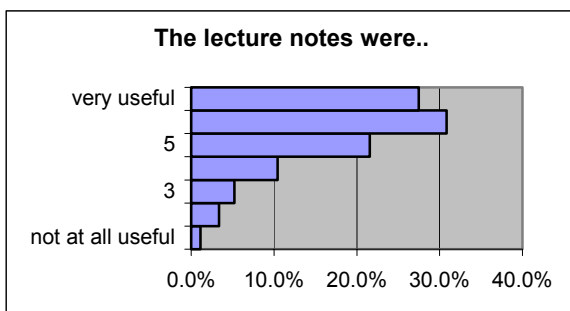


Figure 2

It appears most students used them (as expected) and that most found them between moderately useful and very useful.

Figure 3 shows the response to the question

The videotapes of lectures were ... not at all useful ... very useful.

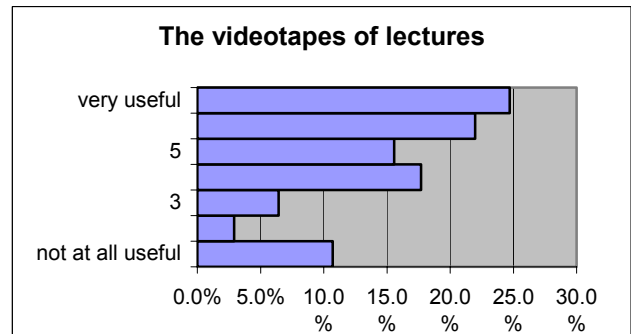


Figure 3

Given that those students who used the videotapes almost exclusively were not surveyed (it is estimated that 20 to 30 students used the videotapes exclusively) the data indicates 113 of the students surveyed answered this question. Most of the students who used the videotapes found them to be moderately to very useful. The students who answered **..not at all useful..** were most likely students who incorrectly filled out the survey form and should have ticked not applicable for this question.

Figure 4 shows the results for the question

The CD ROM.was ...

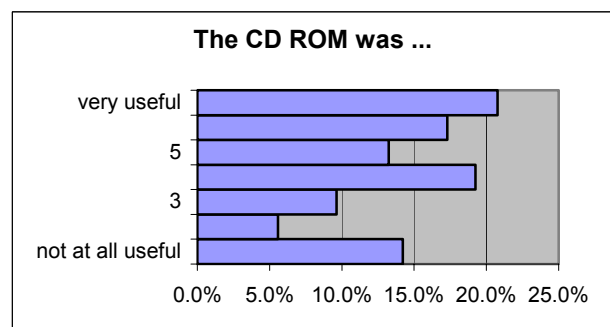


Figure 4

This question was answered by 139 of the students. The students thought it was moderately to very useful. Again the students who answered **..not at all useful..** were most likely students who incorrectly filled out the survey form and should have ticked not applicable for this question

Figure 5 shows the results for the subject website.

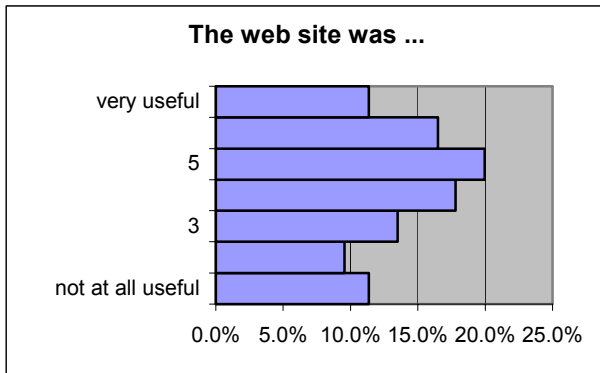


Figure 5

Of the students surveyed 131 found the website to be moderately to very useful.

Other benefits noted are that the drop out rate during semester 1 has fallen from around 27% prior to the production of the support materials to 20% in 2003 and the failure rate from 25% to 15%.

## 6 Conclusions

The results indicate that the effort put into preparing the materials in a number of formats is worthwhile for students as many students find the variety of forms useful. The printed materials were considered the most useful.

The approach used to prepare the materials has proven to be efficient and deadlines for the preparation of the materials have always been met.

Other benefits include;

- the materials can be used for intensive mode teaching
- lecturer preparation time is minimised during the semester
- current and new lecturers have ready access to all of the subject materials for the current and past years
- materials can be used by tutors in the offshore teaching program.
- communication with the subject co-ordinator is reduced and is now mainly by email. The communication is usually a request for an extension for practical work on medical grounds. Queries on administrative and procedural matters are now minimal.

It is also apparent that the majority of the students preferred face to face contact in lectures and practicals.

## 7 Future work

A more detailed survey of the students and the outcomes is needed. In particular all students should be surveyed, including those who fail the subject, to determine if student performance is affected by the learning approach

used. The reasons why particular materials were used should also be determined.

Information about which components of the website and CD ROM are used by students would also be valuable.

An evaluation of whether the present subject meets the requirements of each of the identified categories of student would also be useful for future development of the subject.

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