Teaching Statistics to Information Technology Students

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1.   Introduction

The Bachelor of Information Technology is an interfaculty course offered by the Faculties of Applied Science and Business at Swinburne Institute of Technology. The programme is part of a Commonwealth Pilot Scheme in Information Systems which was developed in cooperation with industrial and commerical organisations to help overcome the shortage of Information Technology specialists in Australia.

The course is concerned with the design, implementation and management of computer systems in all types of business organisations. It differs from Computer Science courses in that it places more emphasis on the use of computers in business and industry and aims to equip graduates with an appropriate grounding in management education. All students admitted to the course receive a scholarship from a fund to which over forty companies contribute.

2.   Course structure

The programme is conducted as a full-time course of three years' duration. Students are actively engaged for an average of 44 weeks each year.

The course consists of:

> *Core Units*: comprising computing units and supporting disciplines relating to the needs of business.
> *Specialist Studies:* four units selected from computer related areas.
> *General Electives*: four units selected from non-computing areas.
> *Industry Based Learning:* building on the formal study programme and providing a practical understanding of computing in industry.

There is a total of eight segments in the course - four semesters, two summer terms and two twenty-week periods of industry-based learning. The statistics unit, Decision Analysis, is taught in semester two of the first year of the course.

3.   Synopsis of the statistics unit

The unit attempts to show how statistical data should be handled and analysed and how the results of this analysis can be used in decision making. To this end students are exposed to a variety of situations for which statistical analyses or quantitative techniques are required. Problem solving is considered a sound vehicle for studying this particular course and a genuine effort has been made to provide:

(i)   problems whose solution requires primarily a conceptual understanding of the material, and for which calculations are minimal;
(ii)   problems for which a requisite technique is expected to be mastered;
(iii)   problems from the business world.

It is hoped to demonstrate through exercises and assignments that the techniques developed during the course are not an end unto themselves but tools that can be used to assist the manager in becoming a more effective decision maker. In keeping with the main thrust of the course much of the analysis and presentation is done by using packages such as MINITAB, Lotus 1-2-3 and SPSSX.

The topics covered include:

(i)   traditional descriptive statistics, extending to exploratory data analysis including stem-and-leaf displays and box-and-whisker plots;
(ii)   accessing official data bases using CD-ROM; using SPSSX to access major data files held on the mainframe;
(iii)   introductory survey methods and secondary data files;
(iv)   discrete and continuous probability distributions;
(v)   estimation and hypothesis testing;
(vi)   regression and correlation;
(vii)   introductory time series analysis;
(viii) financial analysis including NPV, IRR and project evaluation.

4.   Group profile

In 1989 the intake into the course was fifty. All but two of the students had completed their high school studies in 1988. Females have previously comprised about thirty percent of the intake which was the exact percentage in 1989. Although only one branch of year twelve mathematics is a prerequisite for the course, it was interesting to note that sixty percent of the 1989 intake had passed two subjects in mathematics at year twelve level. Of the passes obtained, thirty percent were A's, forty-five percent were B's and twenty-five percent were C's. The expectations that high achieving school leavers would comprise the bulk of the entry was vindicated to some extent by their year twelve

assessment in mathematics. It should be noted that there was no difference between sexes on entry performance.

5. Teaching methods

The teaching methods adopted tend to be fairly traditional. There are two one-hour lectures and one two-hour practice/tutorial session. The unit is divided into financial analysis, data bases and statistics. This particular unit is a joint teaching venture shared by the two faculties and there are three lecturers involved. The statistics component comprises half the teaching time of the unit. Each lecturer involved also conducts the tutorial/practice sessions for his particular section of the unit.

Although some of the salient points concerning computer packages used in the course are discussed in lectures, students are expected to acquire a working knowledge of the packages in their own time. The Mathematics Department has been running very successful short courses in Statistics using MINITAB and SPSSX for a number of years. The short course notes which were written for clients with no previous computer experience are made available to the students. Also the students have used Lotus 1-2-3 fairly extensively in some of their semester 1 units.

The prescribed reference books emphasise a business/economic flavour to statistics. In reality, however, the course was really still in an embryonic stage of development and many of the topics were not adequately covered by the references. As is the case in most new courses, it has been necessary to supplement lectures by comprehensive handouts.

6. Teaching/learning environment

In 1989 the students had a very strong group identity. They had been encouraged from the outset to mix socially. There were organised social events which it was expected they would attend. The students appeared to be very conscious of the fact that the course they were undertaking was a potential flagship for the faculties and in some sense the group had developed an elitist attitude which may have been encouraged unconsciously at the commencement of the course by the emphasis that was placed on selection and previous academic performance. There even appeared to be a certain element of smugness in many within the group and for some the lecture provided a vehicle for yet another social meeting or event. It took a very firm approach to get the message across that there needed to be a code of behaviour for lectures. This was particularly difficult due to the fact that there were three different lecturers involved. Part of this message was also reinforced in tutorial time.

Another surprise was that although the majority of the group had results in mathematics superior to typical business students, their knowledge of statistics was still fairly basic and in some cases quite poor. The difficulty was to gently quash the group smugness without alienating individuals and destroying individual self-confidence. Particular emphasis was placed on exercises which not only called for mastery but which also presented a challenge beyond the normal expectations of a first year economic statistics course. This had the desired effect of both clinching the salient aspects of the

topics and signalling to the group that there was scope for new learning even for the very able students. It also provided an avenue for meaningful discussion in tutorial sessions which centred on making the learning experience not only relevant and incremental, but also enjoyable.

The tutorial was also used as a platform to "sell" the relevance of the subject matter to their career choice. There appears to be a traditional dislike for statistics units in business courses whereas the typical attitude of applied science students is generally one of reluctant acceptance on the basis of "Well, if it's in the course I suppose we have to know it". I suspect that the group had a mix of the above attitudes with a small minority enjoying the subject because of its mathematical flavour. The strategy of presenting statistics as a useful way of dealing with business problems, whilst warning students against the misuse of statistical methods, was only partially successful. Only sixty-one percent rated the subject as acceptable in answer to the question whether the subject was relevant to their career choice. This figure is fairly consistent with other evaluations of quantitative courses in Business degrees.

Computing, particularly genuine interactive statistical computation, has been a godsend for introductory statistics especially in the areas of exploratory data analysis, probability sampling, regression and time series analysis. It was planned to use MINITAB for the purpose of this interactive computation and the development of concepts in the tutorial/practice sessions. However, the Institute was having very serious teething problems with its new mainframe computer, to such an extent that many students and departments were avoiding using the mainframe. My planned usage of a new PC laboratory was upset to some extent by a delay in the completion of the laboratory and the time that negotiations took before MINITAB was installed. The conjunctive aspect of the early exposure to the mainframe, plus units taken in the first semester, provided a real bonus in teaching this particular group. The students were able to work on the mainframe terminals in their own time with very little assistance apart from handouts. They brought hard copies of exercises to the tutorial. To some extent this offset the disappointment of not being able to provide "hands on" tutorial work. I doubt if this approach would have worked with traditional business students at Swinburne.

As previously suggested, the work covered in the unit was far in excess of the course content of traditional business statistics conducted at Swinburne, particularly in the development of discrete and continuous probability distributions, hypothesis testing and regression analysis. Although there was some negative reaction if it was thought that too much statistical theory was discussed, one did not have to resort to the black box treatment of some topics that is often the case with teaching statistics to social science students.

7.   Formal student feedback

An important avenue of student feedback centered on panel meetings. There were three student representatives who met with staff twice during the semester to evaluate the progress of the subject. It was evident from these meetings and the other frequent contact during the semester that students were conscious of the general progress of the group and expected performance of each other. These factors, together with the strong

group identity, did help to decide a lecturing pace that was appropriate for the group.

The first panel meeting suggested that a list of statistical concepts that could be considered as entry knowledge would have been appreciated. Although comments on lectures and lecture handouts were generally favourable, the following points were raised:

(i)   Lecture handouts would have been better as one booklet.
(ii)   Reading guides should be more specific.
(iii)   Lecturers should be tougher on the talkers. If students do not wish to listen then they should be asked to leave.
(iv)   It may be better if some of the worked examples in handouts were actually worked out during lectures as a fill-in exercise.
(v)   The practice of having compulsory hand-in weekly exercises was generally appreciated.

The second panel meeting produced a very positive reaction to the fact that, apart from (i), suggestions arising from the first meeting were put into practice. However, there was some anxiety about the examination and the fact that the course assignments towards the end absorbed most of the possible study and revision time. It should be noted that although fifty-six percent thought that the workload of this particular subject was acceptable when compared to other subjects, the other forty-four percent thought that the work load was either high or very high. The panel also expressed justifiable concern about the lengthy delay in the marking of a particular assignment.

In other formal course evaluations eighty-four percent thought that topics were covered sufficiently well to understand them. The evaluations also produced pleasing outcomes in the main areas of course presentation, ability to explain concepts/ideas in a clear manner, ability to motivate and stimulate interest, lecturer's concern about student progress, lecturer's receptiveness to teaching performance, and the ability to understand and respond to student problems. It was a new and interesting experience in the teaching of statistics.

References

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