

TEACHING STATISTICS TO BUSINESS STUDENTS: MAKING IT A SUCCESS

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For many lecturers, teaching statistics to business students is considered a notoriously difficult task and a dreaded experience and they would prefer to avoid this at all cost. The difficulty seems to involve deep psychological problems that many students have with the subject material combined with the large class environment for teaching. In some universities, high school mathematics is not a pre-requisite for enrolling in business studies which results in a group of students with varying mathematical background in the business statistics classes. Consequently, teaching statistics to business students is a real challenge and developing innovative ways to get over the anxieties experienced by many business students is of crucial importance. This paper discusses our experience in overcoming the challenge of teaching statistics to business students.

INTRODUCTION

Teaching statistics to first year business students is considered by most economics/statistics lecturers as a dreaded experience and a real challenge for a number of reasons. The difficulty seems to involve deep psychological problems that many students have with the subject material combined with the large class environment for teaching. Business students at most universities seem to have a feeling that statistics subjects are irrelevant to their disciplines, very difficult, 'dry' and unattractive (or boring). In almost all universities, at least one semester statistics unit is compulsory for business students - that is, they enrol not by choice. It would seem that many of the students experience a mental block and anxiety about the subject matter. In some universities, high school mathematics is not a pre-requisite for students enrolling in business studies which results in a group of students with varying mathematical background in the business statistics classes. In this paper, we discuss our experience over the last 20 years in overcoming the challenge of teaching statistics to business students. We believe that some of the approaches we use as discussed below, have worked well with our students and hope to share these experience with other lecturers working in the area.

Our regular Student Teaching Evaluations surveys of various statistics subjects reveal that there are two factors involved in meeting the challenge of teaching statistics to business students. One is the performance of the teacher and the other is the way the statistics subjects are being taught. We have found that the major hurdles in meeting the

challenge of teaching statistics to business students can be overcome if the teacher can, (1) convince the business students that statistics is very relevant and important to their discipline and future; and (2) make the learning of statistics more enjoyable. Our experience shows that both teacher performance and approach to teaching play an important role in accomplishing the above tasks.

PERFORMANCE AS A TEACHER

Our performance as a teacher plays an important role in making the teaching of statistics a success. Our experience shows that using a three-phase approach of Planning, Implementation, and Evaluation, the **PIE** approach, is an effective strategy for maximising teacher performance.

Planning

The starting point to succeed at any desired goal is very good planning. The main purpose of the planning phase is to present the lecture/tutorial material in a simplified form so that students can easily understand it. Hence allocating sufficient time for preparation of every single lecture/tutorial is crucial. Some material may look obvious to us but this is not the case for the students. To overcome this problem, we use a number of in-class practical problems, additional hand-outs for circulation and video materials in class so that the presentation of the lectures/tutorials can be done in an organised manner and the allocated time can be used most efficiently. Even though planning the in-class exercises appears simple, it requires a lot of thought from the lecturer in identifying suitable exercises which can be used effectively in a large class situation, while maintaining student interest.

Another aspect of planning is setting up weekly homework problems/ assignments. A lot of attention should be given to making sure that the problems chosen for the tasks are interesting and the level of questions should range from low → medium → high so that even struggling students can get a positive feeling of being able to complete some of the homework/assignment problems as well as getting an idea of their level of achievement.

Implementation

In the implementation phase, a lot of attention should be devoted to the quality of the presentation. We found that the distribution of the handouts and the use of video materials for complicated topics tends to improve the quality of our presentation as well as making the students feel more comfortable because they have some additional learning aids to complement the lecturer's presentation.

We also found that, in the implementation phase, starting every lecture with a brief summary of the previous lecture and closing with an introduction to what is to come in the next lecture together with the necessary references tends to help the students especially if they miss the preceding or subsequent lecture. Furthermore, at the beginning of each lecture/tutorial the lecturer should outline the aim(s) of that particular session and, during the session, from time to time repeat the aim(s) and finally at the conclusion of the session, explain how the aim(s) has(have) been achieved. This approach guides the students through a specific plan and they will be able to easily identify what was achieved in that session. Past experience from student surveys show that students tend to rate well-planned lectures very highly.

Evaluation

This is the difficult part of the three phases of the PIE approach. To see whether the students understand the material from the beginning of the semester we encourage student participation (even in large class teaching) by giving the opportunity for the students to ask questions during class. We found that this approach is an effective way of keeping the class alive and everyone alert. We have found that most students like this approach as they feel involved in the learning activity and can consolidate their understanding of the topics during the session. The other technique we use is to select 3 to 4 students every week in the class and talk to them informally about their progress and how they find the lecturing style, hand-outs, tutorial classes, contents of the subject etc so that adjustments can be made on a regular basis to improve the delivery, and hence the understanding, of the subject.

As mentioned earlier, since high school maths is not a pre-requisite for some of the business courses, the business student population enrolled in the statistics subjects are non-homogenous. Teaching these students in the same class is always a challenge. When we teach at medium level, students with good maths background will complain that the standard is too low while students with no maths background will not be able to cope with

the subject. Usually, this problem leads to students losing interest in the subject and increases the drop-out rate. We implemented an important counselling remedial process to overcome this problem. During the first half of the semester, based on the mid-semester exam results, we identify the poor students (students who performed badly) of the subject and meet with them individually. The purpose of this meeting is two-fold. First our experience shows that talking to students individually tends to increase their self confidence and give them assurance that we are here to help them. The second reason is that through these meetings we try to identify the reason(s) for the poor performance of the students and the difficulties they face. At these meetings, we suggest ways to overcome their difficulties and fix times for at least two more follow up meetings with these students. We found this resulted in many poor students performing much better by the end of the semester.

Since most first year business statistics teaching involves large classes, it is important to ensure proper coordination between lectures and tutorials. We believe that the lecturer should teach at least one tutorial in the subject. This is very useful in making sure that there is full coordination between the lecture and tutorial activities. Also, this gives an opportunity for the lecturer (of a large class) to talk to the students in a small class situation and receive feedback on the tutorial and lecture on a weekly basis.

Finally, the end-of-semester Teaching Evaluations are the most important feedback that can be obtained from students on an anonymous basis. These evaluations give an indication of the strengths and the weaknesses of both the subject and its delivery from the students' perspective and are very useful for improving the teaching performance and subject organisational aspects for the following year. However, this method of evaluation and the subsequent improvements usually benefit only the students coming into the subject in the following year and not the current students. With this in mind, and realising that the characteristics and strengths and weaknesses of students vary between groups, we introduced a mini-Teaching Evaluation during the middle of the semester to facilitate improvements tailored to the current students. The first 2 years of this approach has received favourable reaction from the students in the end-of-semester evaluations.

METHODS OF TEACHING STATISTICS

In relation to the subject matter, our experience shows that improving the confidence of the students and making the learning of statistics enjoyable are the two key

ingredients for success. We use a two-frontal approach to achieve these aims. They are, namely,

1. Application based learning
2. Flexible mode learning

Application Based Learning

The Subject Evaluations of the business statistics subjects collected in earlier years show an overwhelming request from the students for us to incorporate real-life applications in the subjects. Over the years, we have steadily increased the number of real-life business applications in our subjects. Before teaching a particular statistical technique, we introduce a business application and set the scene for the need of a particular statistical technique. This helps the students to understand the reason(s) why we selected a particular technique and shows the relevance of statistics to their discipline. When we reviewed the applications approach, we also noticed that student interest and participation level increased even more when we use mostly Australian based applications. Even the students who normally do not like statistics start to at least participate in the discussion of the problem and are slowly drawn into the discussion of the statistical aspects of the problem. We incorporated our experience later in a text book form (Selvanathan et al., *Australian Business Statistics*, Thomas Nelson Australia, 1994) which is currently being used by a number of Universities in Australia.

Another dimension of the applications approach is the use of statistical/spreadsheet packages to solve practical problems with large data sets and to provide an understanding of some of the different theoretical concepts with minimal difficulty through application. Three years ago we shifted from the use of proper statistics/econometrics software such as MINITAB, SAS, SHAZAM and SPSS to the spreadsheet package EXCEL to assist with teaching the first year statistics subject. We found that the use of statistical packages such as SAS complicated the learning of basic statistical concepts. For those students struggling to learn statistics, learning how to use MINITAB/SAS/SHAZAM/SPSS is an additional burden. While recognising the limited statistical capabilities of EXCEL, we see a number of advantages using it at the first year level. Some of these advantages are (1) business students find EXCEL easier to use than other statistical packages; (2) most students have easy access to EXCEL via their home or work computers which is not the case with other packages; (3) most of the students have gained a familiarity with EXCEL at high school or in the workplace before coming to the

University; (4) using EXCEL in the first year statistics subject meets most employers' expectation that students are familiar with at least one spreadsheet package at the time of employment; and (5) a user-friendly package gives us more time to discuss the output and learn the concepts.

Flexible Mode Learning

We also experimented with a number of flexible modes of teaching to improve learning outcomes. We found that with the introduction of fees at Australian Universities as well as an increase in the number of full-fee paying students, a large proportion of students work part-time to support themselves financially. Consequently, some students do not attend lectures on a regular basis. To help these students and those who miss a lecture/tutorial for other valid reasons, a complete set of lecture notes is made available after every week's lecture in the library (currently we are planning to make these notes available on the World Wide Web). While we do not encourage students to skip lectures, we make this facility available to encourage students to participate even when unable to attend class. We have found this works very well.

As part of the introduction to flexible mode of delivery, we recently introduced a windows based computer managed learning package called *The Learning Manager (TLM)*, earlier known as CML. TLM assesses the student's performance through various test objects in a number of modules and prepares a student progress report for each test. The student will select a module, print the test, prepare the answers for the test and key-in the answers. Instantaneously, TLM will mark the test and present a report to the student. After the student has achieved a certain level of understanding of the topic, the system will allow the student to do more review questions or, if preferred, proceed to the next module; otherwise, the student will be instructed to contact his/her tutor to discuss his/her performance. The benefits currently experienced by students are summarised in the following table:

<i>Before introducing TLM</i>	<i>After introducing TLM</i>
<ol style="list-style-type: none"> 1. Students were limited in the number of questions they were given for practice tests. 2. Manual marking of assignments took a long time, especially in large classes. Delays in returning the assignments to the students, did not help students in preparing for the next assessment item. 	<p>Students have the option to do any number of practice tests they like until they are satisfied with their performance in a particular module.</p> <p><i>TLM</i> marks the tests instantaneously and presents a summary report to students which includes comments on student's performance for each question.</p>

3. Tests/assignment questions given were the same for all students.	<i>TLM</i> generates tests by randomly selecting the questions from the test bank, which means that each student gets a different question paper.
4. There is no teacher-student communication except a few written comments by the marker.	The mail option available in the <i>TLM</i> system allows for teacher-student communication.

CONCLUSION

Many business students seem to feel that statistics subjects are irrelevant to their discipline, very difficult, unattractive and boring. In this paper, we outlined the approaches we use to overcome these problems which we consider on the whole work well with our students. We have demonstrated that a good teaching style combined with various methods of delivery can help to overcome the challenges associated with teaching business statistics successfully.