

Heterogenous clientele and product differentiation: teaching economics in a changing environment*

Mohammed Alauddin & John Foster, Heterogenous clientele and product differentiation: teaching economics in a changing environment. Discussion Paper No. 340, July 2005, School of Economics, The University of Queensland. Australia.

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Abstract

The increasingly diverse student clientele that we now have has significantly changed teaching and learning environment in universities. Correspondingly, the academic focus of courses and programmes has shifted. Understanding this transition is essential if programmes are to be effective, relevant and attractive to students.

This paper examines the process of teaching business and economic statistics in the presence of a highly heterogenous student clientele. Employing non-parametric techniques and multivariate analysis, including discriminant analysis, it is argued that product differentiation, epitomised by a diversified portfolio of instruction strategies and methods, is a sine qua non for addressing the needs of a heterogeneous student clientele.

A two-pronged strategy of problem-based and individual need-based learning, underpinned by flexible consultation, delivery and presentation, lecture handouts both in hard copy and on the web, a semester project, computer lab sessions and tutorials in the traditional mode, was examined. Evidence, based on student perceptions, supports the hypothesis that the overall satisfaction rate in such a statistics course compared favourably with seemingly more attractive economics and non-economics courses. The paper also identifies factors affecting learning and derives implications using a game theoretic analysis.

EPrint Type: Departmental Technical Report

Keywords: Heterogeneous clientele; Product differentiation; Problem-based learning; Non-parametric tests; Discriminant analysis; Non-cooperative game; Dionysian-Apollonian pedagogical spectrum; Diversified portfolio of teaching.

Subjects: 340000 Economics;

ID Code: JEL Classification A2, I2

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* A thoroughly revised version of the paper presented at the Second Biennial Developments in Business and Economics Education (DEBE) Conference, Edinburgh, 15-16 September 2003. Special thanks are due to Dr Mark Bahr for statistical analysis in Section 3 and Mr Rodney Beard for useful comments and assistance with the game theoretic analysis in Section 4. The authors also wish to thank the conference participants and Dr Bruce Littleboy for useful comments on an earlier draft. The usual *caveat* applies.

Heterogenous clientele and product differentiation: Teaching economics in a changing environment

1 INTRODUCTION

The teaching environment at the university level has undergone profound and far-reaching changes in Australia and elsewhere in the developed world. These are:

- A globalized economic environment in which many graduates have to face competition from graduates outside the geographical boundaries of their country of origin.
- Changing public policy goals that are characterised by: (a) the introduction of ‘user pays’ at least to partially cover the cost of higher education; (b) significant deregulation of the higher education sector, allowing providers to charge differential fees for different degree programmes; (c) increased commercialisation of the higher education sector through the provision of full-fee paying places in order to boost university income and, in effect, using educational programmes as export goods; and (d) integration of primarily teaching institutions into the mainstream university system.
- Expectations of greater applicability of classroom learning to real world issues have resulted in a greater demand for professional and vocational orientation.
- Recognition of excellence in teaching has become an integral part of performance assessment in universities.
- Increasing interest in teaching among academic economists¹.

While this is not an exhaustive list, it is comprehensive enough to capture the major forces at work. Closely related to the above are significant manifestations of the diversity of the student clientele. Economics teaching in this changing environment, therefore, has to cater for an

¹ In 1988, only a couple of sessions at the annual meeting of the American Economic Association and Allied Social Sciences were allocated to economics teaching. The bottoming out of economics degrees in the late 1990s corresponded to the ‘beginning of an explosion to double-digit numbers for sessions devoted to the teaching of economics at the annual meetings in the new millennium, where attendance in these sessions on teaching economics were also among the highest of all sessions regardless of area specialization’ (Becker 2004, pp.6-7).

increasingly diversified clientele determined *inter alia* by career aspirations, academic backgrounds, social and cultural values and exposure to English language. Especially in the case of overseas students, English language competencies and cultural values, that influence social expectations concerning their academic performance, are significant features. Understanding this transition is essential if programmes are to be effective, relevant and attractive to students.

While the changing teaching environment has greatly challenged teachers of economics, teaching quantitative courses, such as economic statistics, poses special problems. This is because significant psychological barriers and anxieties are associated with learning statistics which, to many students is somewhat akin to learning a 'foreign language'. The available literature provides ample evidence of the prevalence of 'statistics anxiety' among students (Onwuegbuzie 2000; Onwuegbuzie et al 1997, 1999; Ziedner 1991). Onwuegbuzie (1998) states that the proportion of graduate students experiencing 'uncomfortable' levels of statistics anxiety could range between two thirds to four-fifths. Schacht and Stewart (1990, p.52) argue that "statistics is perhaps the most anxiety-provoking course in any sociology department's curriculum." While Blalock (1987) suggests that statistics anxiety may, in part, stem from mathematics anxiety, Cruise et al. (1980) argue that statistics anxiety and mathematics anxiety are the same. Onwuegbuzie et al (1997a), while acknowledging a positive association between mathematics anxiety and statistics anxiety, do not feel that mathematics anxiety is necessarily a precursor to statistics anxiety (see also Onwuegbuzie 2000, p.323).

Against the above background, examines the process of teaching and learning introductory economic statistics. This is a postgraduate course designed primarily for business, commerce

and economics students. It does not presuppose any prior training in statistics and is designed to provide a solid understanding of the basic quantitative concepts applicable to various courses in economics, business and finance and as a foundation to higher-level quantitative courses in the relevant disciplines.²

The central idea canvassed in this paper is that product differentiation, epitomised by a diversified portfolio of instruction strategies, methods and, above all, the identification of individual needs, is a *sine qua non* for addressing the needs of a highly heterogeneous clientele in courses of quantitative nature. Section 2 conceptualises the process of transforming a homogeneous product to a differentiated involving several stages. Section 3 presents materials and methods. Section 4 presents and discusses empirical findings. Section 5 presents concluding overview and comments.

2 MATERIAL AND METHOD

Hypotheses

In light of the preceding discussion, it is hypothesised that:

- The overall satisfaction rate in the learning process in statistics is unlikely to differ significantly from that in any other economics course the student was concurrently enrolled in, i.e. there is no intra-disciplinary variation in satisfaction rate

² The vast majority of the students (more than 70 per cent) were from non-English speaking background. For nearly half the students, the medium of instruction prior to the current degree enrolment was a non-English language. These students were mostly enrolled in non-economics degrees. However, a significant percentage of the students had previous exposure to statistics. One noteworthy feature of the clientele in this course was that 70 per cent suffered from statistics anxiety. On a 1-5 scale nearly 45 per cent of them suffered from a high level of statistics anxiety (4-5 range) while an equal percentage displayed a moderate anxiety level (a score of 3). For a detailed analysis see Alauddin and Butler (2004a).

- The overall satisfaction rate in the learning process in statistics is likely to differ significantly from that in any other non-economics course the student was concurrently enrolled in, i.e. satisfaction rate varies across disciplines
- The overall satisfaction rate is a function of a multitude of factors including student perception of overall teaching quality, students' own study habits, lecturer's feedback, course content and the learning environment characterised by students' accessibility to the lecturer and his/her willingness to help students.

The Data

The basic data for this study were derived from primary surveys in economic statistics at a leading Australian university for three consecutive semesters. In all 163 (=n) students participated in the survey [$n_1=48$ ($N_1=53$) + $n_2=48$ ($N_2=63$) + $n_3=67$ ($N_3=82$)]. Thus the overall sample represented 82 per cent of the total population of ($N=198$) students. The collected data which were primarily ordinal in nature related to the students' perception of following aspects:

- Overall satisfaction rate in the learning process in a comparative perspective
- Instruction strategies, teaching materials, contents, assessment, delivery and presentation
- Adequacy, relevance and practical application of the topics, assessment procedure and teaching quality.

3 FROM A HOMOGENEOUS PRODUCT TO A DIFFERENTIATED PRODUCT: TOWARD A CONCEPTUALIZATION OF THE PROCESS

It is now well documented in the recent literature that enrolments in economics majors have been in decline in Australia and elsewhere in the developed world (Siegfried and Round 2001; Millmow 2004; Becker 2004)³. The applied nature of business disciplines, such as finance and marketing, has attracted and continues to attract many students who might otherwise be inclined to major in economics. The contents and teaching styles of these disciplines are significantly different from those in economics (Azzalini and Hopkins 2002). Economics schools typically have resorted to introducing new degree programmes such as business economics majors, international economics and finance majors, business strategy majors both at undergraduate and postgraduate levels (see, for example, Bloch and Stromback 2002) and have achieved some measures of success in attracting students. These are typical strategic moves away from a homogeneous product aimed at an undifferentiated clientele toward significant product differentiation geared to the needs of an increasingly heterogeneous one. This might be called a firm-level (school-level) product differentiation resulting in differential degree orientation.⁴

While the above school level strategy is rational in conception, its success critically depends on the extent to which product differentiation is practised at the plant-level (course-level). The major findings that emerge from the present study are the critical importance of product differentiation. The essential elements of product differentiation at the course-level can be

³ Since 2000 there has been slight improvement in economics degrees in the USA (Siegfried 2004).

⁴ This has been a trend across all degree programmes internationally since the early 1970s while universities such as Sussex in the UK and Griffith in Australia fit this description. PhD graduate market the trend is one of greater specialisation

conceptualised as a number of stages as illustrated in Figure 1. The central message embodied in Figure 1 warrants further elaboration.

Stage 1: A lecture of certain duration that introduces a topic and its central features embodying theory and probable applications illustrated with examples. The product supplied is relatively homogeneous even though the target audience consists of different groups of students with different degree destinations and, different learning habits, aptitudes and abilities. The supply of a relatively **homogeneous** product is likely to satisfy the audience to differing degrees. Given the practical difficulty of pitching the lecture to satisfy individual needs, it is, of necessity, pitched to the median group. This can potentially alienate and may even disenfranchise two groups of students: (1) intellectually less capable and/or slow learners needing more examples and illustrations and (2) intellectually challenging students who require more theoretical underpinning of the examples and illustrations. This stage is less interactive with specific individual needs largely unsatisfied.

Stage 2: Tutorials/lab sessions embody a more interactive process with a significant emphasis on student participation and discussion of individual needs and issues. Students might be encouraged to raise problems from their own discipline to see how the course in question can be relevant to the needs of their discipline of origin. Illustrations and case materials can be used. Individual needs can be significantly addressed and satisfied in this Stage. Product orientation is more heterogeneous than in **Stage 1**.

Stage 3: Consultation sessions with the lecturer primarily designed to address specific individual needs that cannot be addressed in **Stage 1** and **Stage 2**. This stage (**Stage 3**) represents a critically important and intensive phase of the teaching and learning process in addressing individual needs. **Stage 3** requires that students themselves take **Stage 2** seriously

and undertake self-study and identify their specific needs. In this stage most individual needs can be satisfied with a higher degree of product diversity achievable⁵.

Stage 4: Lecturer's feedback on written work(s) such as mid-semester test and major assignment is critically important. Individual students must be encouraged to discuss their written work to identify their strengths and weaknesses in the comprehension of theoretical matters and understanding their applications to a range of settings. At this stage potential sources of errors and the environmental differences writing an assignment/project and the exam room contexts. **Stage 4** ensures that product delivered in **Stage 1** is transformed to attain maximum possible differentiation satisfying individual needs.

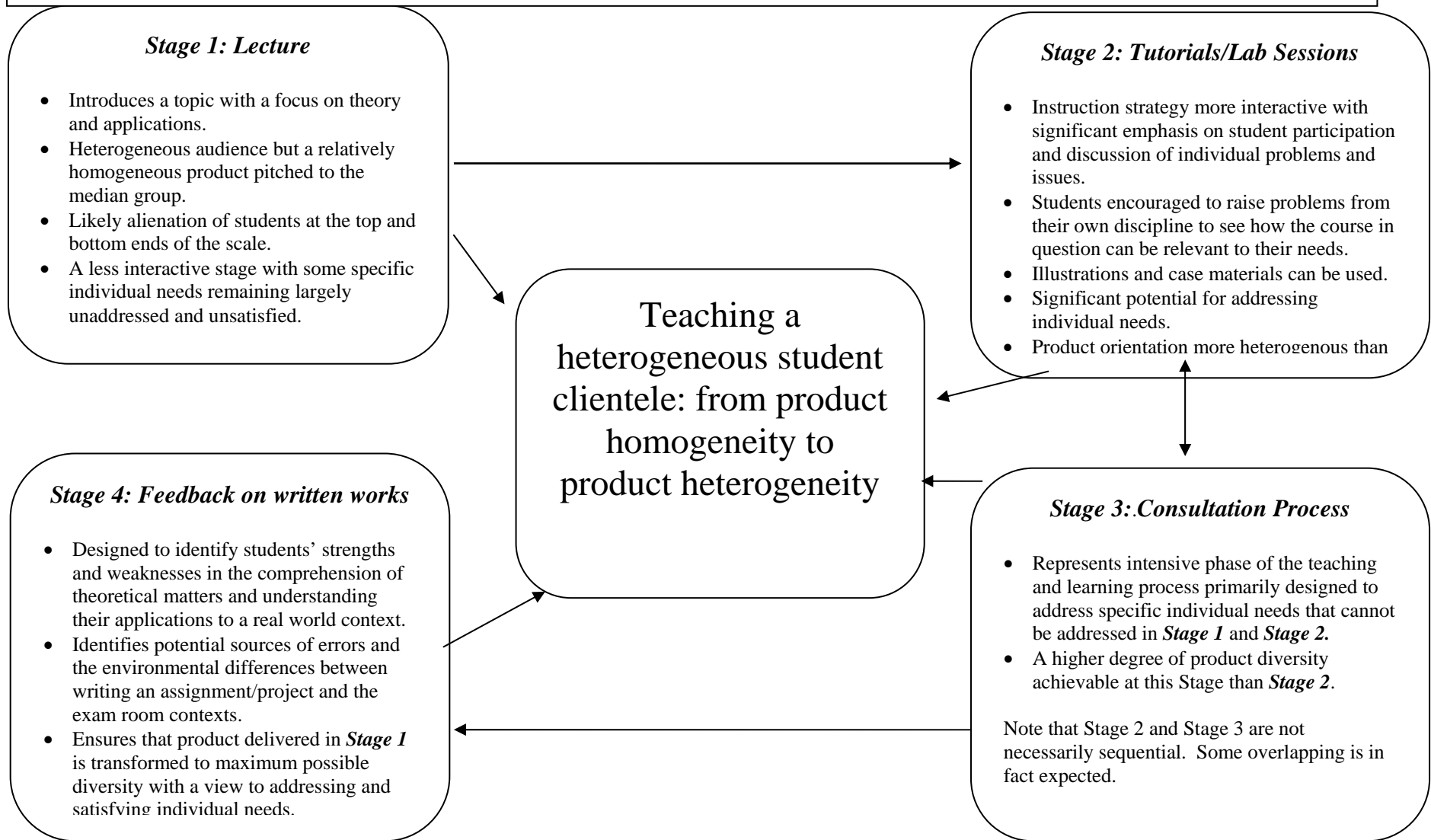
At every stage both stakeholders, teacher and the student, need to show flexibility in the entire process. While the student must approach the teacher with clear identification of his/her individual needs, the teacher must ensure an environment for addressing individual problems.

The process of transforming a homogeneous product to a differentiated one at every stage requires that both stakeholders, the teacher and the student, display flexibility and cooperation. While the student must approach the teacher with clear identification of his/her individual needs, the teacher must provide an environment whereby students can freely raise their specific individual needs and problems.

The above can be analysed in a game theoretic perspective. Consider a non-cooperative game played between the teacher and the student in which the former choose a collaborative versus uncollaborative teaching style and the students choose between a collaborative and uncollaborative attitude to learning. Assume that there are two types of students: High Quality Student (HQS) and Low Quality Student (LQS).

⁵ Note, however, that Stage 2 and Stage 3 are not necessarily sequential. Significant overlapping is possible.

Figure 1: Essential elements of micro-level product diversification in teaching a significantly heterogeneous clientele: Stages and Sequences.



Given this, the teacher has some probability of encountering a HQS and some probability of encountering a LQS. These probabilities correspond to the proportion of HQS *versus* LQS students in a cohort. Students are graded on a scale of 1 to 7, with 7 being the highest. The teacher is graded on a scale of 1 to 5 with 5 being highest. We ignore grades of staff below 2 and student grades below 3. This gives us enough spread to consider failing grades for both the teacher and the student without getting stuck on the details of different degrees of failure. Different degrees of success are still of interest because this is probably the norm. The normal form payoff matrices are set out in Table 1.

Table 1: A Game-theoretic perspective of teaching to a heterogeneous clientele

		High Quality Student (HQS)	
		Collaborative (C)	Uncollaborative (UC)
Teacher	Collaborative (C)	(5,7)	(3,4)
	Uncollaborative (UC)	(3,4)	(4,5)

		Low Quality Student (LQS)	
		Collaborative (C)	Uncollaborative (C)
Teacher	Collaborative (C)	(4,6)	(2,3)
	Uncollaborative (UC)	(2,3)	(3,4)

Each of the constituent games here possesses two pure strategy Nash equilibria: (C, C) and (UC, UC). The constituent games are coordination games. Note that if the population of students were homogenous so that there is only a single student type, then student evaluation of teaching will typically result in a bimodal distribution. This is in contrast with the usual statistical interpretation of teaching evaluations which suggests that bimodality stems from students being drawn from different populations. In a strategic setting bimodality may simply be reflecting multiple equilibria in a homogenous population.

Returning to the heterogenous population case, we first consider the case of sequential game in which the teacher moves first. To consider this we represent the above game of incomplete information in extensive form as set out in Figure 2. In this form of the game, play starts at the centre with the teacher being the first mover. The top part of the diagram portrays the situation in which the teacher encounters a HQS and the bottom part of the diagram the situation in which the teacher encounters a LQS. Students know their own type. What should the teacher do? If the teacher decides to be a 'nice guy' and collaborate when he encounters a HQS, the student should respond by collaborating because that will give the student a payoff of 7 rather than 4. If on the other hand, the teacher decides to be 'mean' and does not collaborate then the student observing this should respond by not collaborating and giving the teacher a lower teaching evaluation score in return for receiving a 5. The teacher knowing this would, however, never move to the right and choose an uncollaborative teaching style when they could receive a score of 5 if they collaborated. So the equilibrium is (C, C).

What if a teacher encounters a LQS? If the teacher moves left and chooses to collaborate then the low quality student will also choose to collaborate in order to gain a grade of 6 and will give the teacher a score of 4. If the teacher should choose to move right and teach in an uncollaborative manner the student observing this will also choose to be uncollaborative to secure a grade of 4 and reward the teacher with a teaching evaluation score of 3. The teacher would have been better off moving left and collaborating all along. The equilibrium in this case is also (C, C).

The lesson from this is that revealing information about the examination strategy prior to teaching evaluations is a means of attaining a collaborative outcome. Note, however, that the

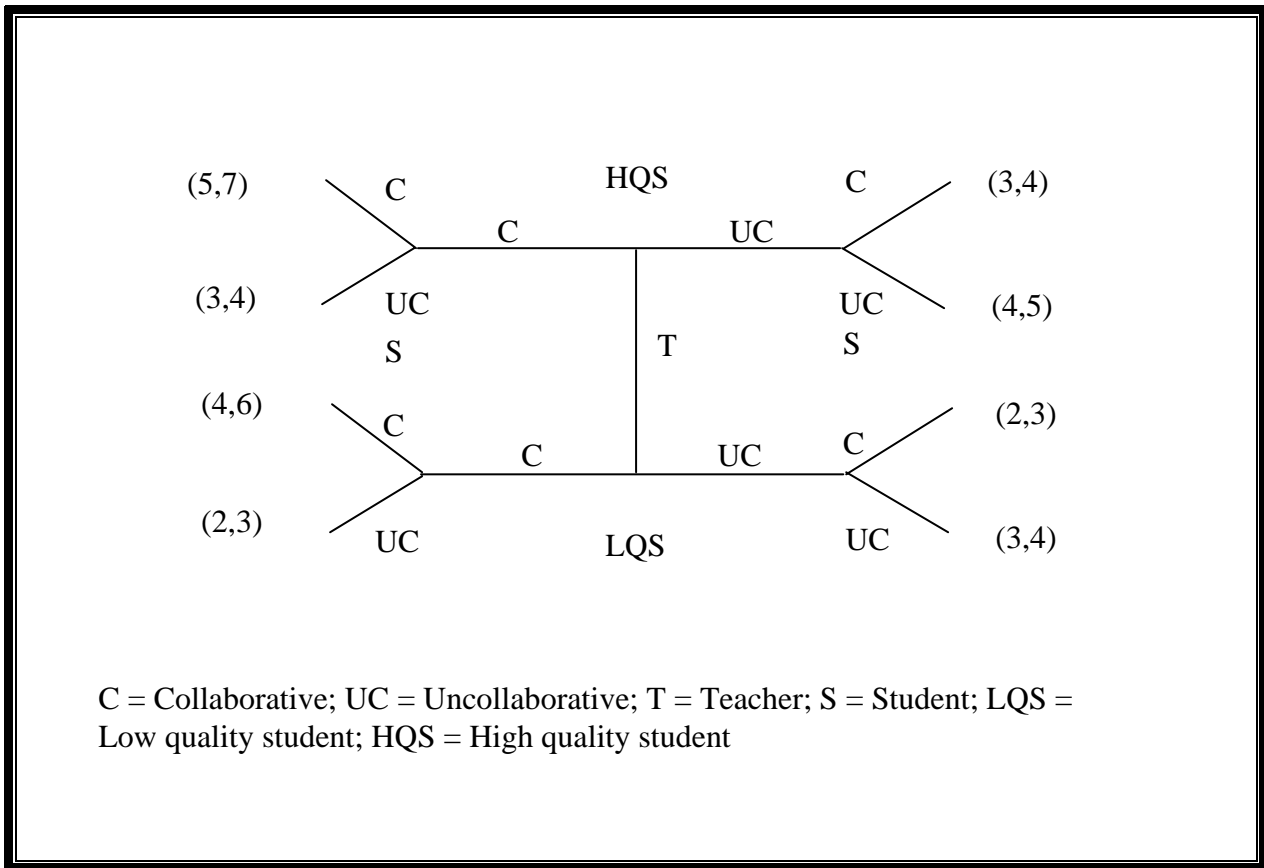


Figure 2: Extensive form of game involving incomplete information

evaluation score of staff. With a 50-50 mix between HQS and LQS the average score for the teacher would be 4.5. If the class consists of predominantly LQS, say two thirds of the class population, then the average score falls to 4.3. If student quality falls further teaching scores will further drop towards 4, even with both the teacher and the student acting in good faith. This is a situation that should be familiar to most readers.⁶

⁶ The game theoretic approach is somewhat analogous to the ‘Apollonian and Dionysian’ pedagogical spectrum of teaching coined by Elzinga (2001, p.255). ‘Apollonian teachers identify with their discipline. Dionysian teachers identify with their students. Apollonian teachers want to be respected by their students. Dionysian teachers want to be liked by their students. An Apollonian teacher lectures with rectitude and understatement; a Dionysian teacher with flair and exaggeration. The Apollonian’s examples are just outside the student’s current experience. The Dionysian’s examples are hip and relevant. ... Good teachers come in all styles and points along the Dionysian-Apollonian pedagogical spectrum’ In the context of this paper to a student a collaborative strategy of the teacher is closer to the Dionysian end of the spectrum while non-collaborative strategy is closer to the Apollonian spectrum. Location along the spectrum corresponds to a mixed strategy in the game theoretic approach.

Against the above background the remainder of this paper turns to a detailed examination of the process of teaching and learning in economic statistics by subjecting the survey data to rigorous analysis.

4 THE TEACHING AND LEARNING PROCESS

Recent studies in the literature identify three student demand curves in an economics course (see, for example, Alauddin and Valadkhani 2003; Alauddin and Butler 2004b) in terms of the theory-application blend. These preferences can be stated as follows:

Category 1: Primarily theoretical (at least two thirds theoretical)

Category 2: Primarily applied (at least two thirds applied)

Category 3: A 50-50 blend of theory and applications.

Consider the information in contained in Table 2 which suggests that there is an overwhelming dominance of the Category 2 and Category 3 type of students. These come into sharper focus if one considers the postgraduate clientele which is significantly dominated by non-economics students.

Two important factors, amongst others, determined the instruction strategies, teaching techniques and initiatives in the course. First, postgraduate students, especially from non-economics programmes, overwhelmingly prefer applications. Second, equally overwhelming is the preference of the administrators of client schools, for the provider school to supply courses that emphasize greater application to real world issues (Alauddin and Butler 2004b; Millmow 2002; Hillier et al 2004).

Table 2: Student preference of the course content in terms of theory-application blend

Preference type	Combined sample (Relative frequency of preference %)		Postgraduates only (Relative frequency of preference %)	
	1998	2002	1998	2002
Category 1 (Primarily theoretical)	11.7	13.3	1.9	4.1
Category 2 (Primarily applied)	32.4	37.2	42.3	49.0
Category 3 (50-50 blend)	55.9	49.6	55.8	46.9

Source: Based on Alauddin (1999; 2003).

Given the student profile and the class size, the instruction in the course employed a portfolio of techniques focussing on problem-based learning. Essential components of the initiatives, strategies and methods are set out in Table 3. As can be seen, the process of teaching and learning statistics provided maximum flexibility and real world focus within the broad parameters of maintaining academic standards⁷.

Presentation and Delivery of Course Material

The presentation and delivery of course materials centred on overhead transparencies, extensive use of white board and the distribution of hard copies of lecture notes. Materials were also posted on the appropriate website. Comprehensive solutions to tutorial problems sets were also made available to students sometimes during and sometimes at the end of the tutorial sessions.

⁷ On a scale of 1-5, students were asked to rate their perception of academic standards maintained in the course. The distribution of responses were as follows: 1-2 (very low to low standard, 3.1 per cent); 3 (moderate standard, 18.1 percent); 4-5 (high to very high standard, 78.8 per cent); Median score: 4 (Modal value = 4).

Table 3: Essential components and their salient features of the initiatives, instruction strategies and methods

Component	Objectives	Relative roles of the lecturer and the student
Lecture (two-hour) per week	<ul style="list-style-type: none"> To introduce the theoretical underpinnings of techniques To illustrate applications of the techniques through problem solving 	<ul style="list-style-type: none"> Primarily lecturer
Tutorials (One hour per week)	<ul style="list-style-type: none"> To complement instruction efforts at lectures To go through problems Stage-by-Stage To clarify and conceptual issues To reinforce real world applications of techniques To actively engage students in 	<ul style="list-style-type: none"> Interactive Initial stages –lecturer more active than the student Subsequent stages the role is reversed
Tutorials in traditional mode (about a third of the total number of tutorials)	<ul style="list-style-type: none"> Devoted to tasks where the lecturer/tutor took a more active role and went through problems Stage by Stage. The students were strongly encouraged to actively participate in discussions and ask questions. Students also solved one or two problems by themselves. 	<ul style="list-style-type: none"> Interactive but lecturer plays a marginally greater role
Collaborative problem solving (up to a maximum of one third of the total number of tutorials with 4-5 students forming a group)	<ul style="list-style-type: none"> To foster team spirit To make the students more independent in problem solving 	<ul style="list-style-type: none"> To engage students in solving problems with the active support of the lecturer Greater initiative by the student
Computer lab sessions (around a third of the total number of tutorials)	<ul style="list-style-type: none"> Problem solving in selected topics e.g. regression and time series analysis To provide the students with software literacy for subsequent use in completing a substantial assignment (the statistics project) 	<ul style="list-style-type: none"> Interactive but lecturer plays a marginally greater role
Semester project using EXCEL or SPSS	<ul style="list-style-type: none"> To test students' ability to think about a real world issue, To their ability to apply the analytical tools of statistics to real world problems and their ability to work independently. Focussed on regression analysis with three discernible components: (a) descriptive statistics; (b) basic regression analysis, involving the simple linear regression model; and (c) extension of basic analysis to multiple regression, forecasting or prediction, examining the underlying assumptions of the regression model and the consequences of their violations. 	<ul style="list-style-type: none"> Primarily student initiative with support from the lecturer on a need-to know basis

The Ten-Hour Formula

The lecturer underscored the importance of working regularly at around ten hours per week including lectures and tutorials. Given the diversity of the clientele, the students were regularly reminded that the two-hour lecture was unlikely to cater for all the individual needs. While some of them might be more interested in theory with a view to pursuing higher level quantitative courses in the future while others may be more interested in applications to real world problems straightaway. This typified a pattern of differential individual needs all of which cannot be addressed to the satisfaction of every student during the two-hour lecture. Therefore, any individual needs that were not addressed during the lectures could be catered for during tutorial and consultation hours.

Feedback

In two distinct phases the teaching and learning process underscored the critical importance of adequate feedback on written work: (1) almost immediately after the mid-semester test; and (2) upon completion of marking the statistics project. The feedback sessions sought to:

- Identify potential sources of conceptual or computational errors and underscore the importance of theoretical soundness.
- Highlight the learning environment difference between the project on the one hand and mid-semester and final tests on the other, to warn the students not to expect the repetition of the same/similar distribution of marks in the end-of-semester test.

Given the high incidence of NESB and overseas students and because of their special needs (Watson and Barber 1997; Ballard and Clanchy 1992; see also Alauddin and Butler 2004a, p.204), the present study recognizes the critical importance of the lecturer assuming a more proactive role (collaborative style, first mover) in creating a learning environment whereby students can freely communicate their specific individual problems with learning.

5 RESULTS AND DISCUSSION

Student Perception of the Learning Experience in a Comparative Perspective

In light of the three hypotheses posited earlier, the objective of this section is to assess the overall satisfaction rate in the learning process in statistics in a comparative perspective. On a scale of 1-5, the students were asked to record their overall rating of the learning experience in economic statistics, another compulsory economics course and a non-economics course concurrently enrolled in. Table 4 sets out the summary results of students' perceived satisfaction. These are presented for the individual semesters as well for the combined sample. The distribution of scores in lowest (1-2), the middle (3) and the highest (4-5) range of the scale, as well as the values of the median scores, clearly suggest that students' perception of the overall satisfaction rate in economic statistics was as good as that for a non-economics course if not better. It also seems possible that the perceived satisfaction rates differed between economic statistics and another economics course.

Given the ordinal nature of the data and the related populations, it seemed appropriate to employ a non-parametric test such as the Wilcoxon signed ranks test or the sign test to examine intra-disciplinary and inter-disciplinary differences in the student perception of overall satisfaction. As reported in Table 5, both tests confirmed significant intra-disciplinary differences while no significant perception difference existed across disciplines. This is probably because the teaching and learning process in statistics was perceived to have incorporated enough illustrations and examples from the real world to which bulk of the student population were used to in their (non-economics) degree programmes.

Table 5: Student perception of learning experience in a comparative perspective: Statistics, another economics course and a non-economics course that the student was concurrently enrolled in.

Semester	Relative frequency of rating (on a 1-5 scale) (percentage)			Median score
	1-2 range	3	4-5 range	
Statistics for Business and Economics				
First Semester 2001	0.0	17.8	82.2	4 (4)
Second Semester 2001	8.5	23.4	68.1	4 (4)
First Semester 2002	3.1	16.9	79.1	4 (4)
All Semesters combined	3.8	19.1	77.1	4 (4)
Another economics course the student was concurrently enrolled in				
First Semester 2001	14.3	40.0	45.7	3 (3)
Second Semester 2001	20.5	26.5	53.1	4 (4)
First Semester 2002	10.3	28.1	61.5	4 (4)
All Semesters combined	14.3	31.0	54.8	4 (4)
A non-economics course the student was concurrently enrolled in				
First Semester 2001	7.5	22.5	70.0	4 (4)
Second Semester 2001	2.4	24.4	73.2	4 (4)
First Semester 2002	12.1	22.4	65.4	4 (4)
All Semesters combined	7.9	23.0	69.1	4 (4)

Notes: A score in the range of 1-2 means that the indicator is not perceived to be significant at all. A score of 3 implies that the indicator is perceived to be moderately significant while a score in the 4-5 range means that the indicator is perceived to be very significant. Figures in parentheses are the modal scores.

Factors Underlying Overall Outcome: Mutivariate Analysis

Discriminant analysis was conducted to investigate the constellation of factors that best predicted students' perception of satisfaction with the learning process. Students were grouped into two categories (extremes of satisfaction) according to their perceived scores on the satisfaction rate scale. This newly defined dichotomous variable had respectively a value of 0 for students who did not appear to have been highly satisfied (a score in the 1-4 range of the ordinal scale) and a value of 1 for those who did appear to be highly satisfied (a score of 5) This classification was used as the grouping variable in a subsequent discriminant analysis. Using SPSS with the analysis corrected for unequal group sizes, the discriminant

analysis revealed that one significant function discriminated between the two groups of students [Wilks' $\lambda = 0.665$, $\chi^2(10) = 42.833$, $p < 0.001$].

Table 6 sets out the results of the test of equality of group means, standardised canonical discriminant functions, and the structure matrix. It can be clearly seen that factors such as self-study and discussion with peers did not turn out to be statistically significant. Furthermore, they have a very large value for Wilks' λ . This is not surprising because they were student-induced factors and were unlikely to feature in the perceived satisfaction rating of the learning experience. On the other hand, teacher-induced factors such as the perceived teaching quality, lecturer's feedback, lecturer's willingness to help, lecturer's accessibility, classroom environment, project, lecture handout, and theory-application mix significantly discriminated between the two groups.

Table 5: Wilcoxon signed ranks test and sign test results

Wilcoxon Signed Ranks Test					
ANOTHER ECONOMICS COURSE- ECONOMIC STATISTICS			A NON-ECONOMICS COURSE-ECONOMIC STATISTICS		
Ranks	Frequency	Test-Statistic	Ranks	Frequency	Test-Statistic
Negative	47	Z = -3.680 Asymptotic significance =0.000	Negative	37	Z = -1.483 Asymptotic significance =0.138
Positive	18		Positive	33	
Ties	61		Ties	69	
Total	126		Total	139	
Sign Test					
ANOTHER ECONOMICS COURSE- ECONOMIC STATISTICS			A NON-ECONOMICS COURSE-ECONOMIC STATISTICS		
Differences	Frequency	Test-Statistic	Differences	Frequency	Test-Statistic
Negative	47	Z = -3.473 Asymptotic significance =0.001	Negative	37	Z = -0.359 Asymptotic significance =0.720
Positive	18		Positive	33	
Ties	61		Ties	69	
Total	126		Total	139	

It appears from the structure matrix presented in Table 6 that the four factors that made the most significant contribution to the student perception of satisfaction were: (a) theory-application mix (0.719); (b) lecturer's accessibility (0.617); (c) project (0.604); (d) lecturer's

willingness to help (0.532) and (e) teaching quality (0.524). Lecturer’s willingness to help, handouts, and feedback followed these. It is most likely that lecturer’s accessibility and lecturer’s willingness subsumed the effect of classroom environment. Therefore, classroom environment, and the two student-induced factors viz., self-study and discussion with peers were eliminated from subsequent analysis.

Table 6: Test of equality of group means, standardised canonical discriminant function coefficients and structure matrix.

Factor	Wilks’ λ	Significance	Coefficient	Structure matrix ^a
Self study	0.981	0.152	0.042	0.194
Teaching quality	0.879	0.000	0.120	0.524
Lecturer’ accessibility	0.839	0.000	0.418	0.617
Lecturer’s willingness to help	0.875	0.000	0.127	0.532
Lecturer’s feedback	0.919	0.000	-0.087	0.418
Classroom environment	0.939	0.009	0.045	0.359
Discussion with peers	1.000	0.963	-0.304	0.006
Project	0.845	0.000	0.418	0.604
Handout	0.911	0.001	0.004	0.440
Theory-Application mix	0.793	0.000	0.517	0.719

Notes: DF (1, 110).

^a Pooled within-groups correlations between grouping variables discriminating variables and Standardised canonical discriminant functions.

In light of the above, further discriminant analysis was conducted that involved the dichotomous variable defined above and the seven remaining discriminating variables: perceived teaching quality, lecturer’s accessibility, feedback, project, lecturer’s willingness to help, handout, and theory-application mix. This discriminant analysis revealed that one significant function discriminated between the two groups of students [Wilks’ $\lambda = 0.682$, $\chi^2(7) = 41.209$, $p < 0.001$].

Table 7 sets out the results of the test of equality of group means, standardised canonical discriminant functions, and the structure matrix of the reestimated discriminant function. The factors that seemed to have made the most contribution to students’ perceived satisfaction

were (a) theory-application mix (0.744), (b) lecturer’s accessibility (0.639), (c) project (0.628); (d) lecturer’s willingness to help (0.553); and (d) perceived teaching quality (0.548).

Table 8 presents Fisher’s linear discriminant functions for the two groups. The significant role of the discriminating variables is quite clear which suggest the relative roles of the teacher and the course content. Thus, one can discern two types of variables that are critical in determining the perceived rate of satisfaction. Perceived teaching quality, feedback and lecturer’s accessibility are teacher-induced factors while the project and theory- application blend are content-related factors. The two other two teacher-induced factors e.g., handouts and feedback, are probably subsumed in more dominant factors like perceived teaching quality, lecturer’s accessibility and willingness to help. This could be because feedback and handouts are taken by the students to be an integral part of the process and might be less inclined to give them the status of stand-alone factors.

Table 7: Test of equality of group means, standardised canonical discriminant function coefficients and structure matrix.

Factor	Wilks’ λ	Significance	Coefficient	Structure matrix ^a
Teaching quality	0.877	0.000	0.184	0.548
Lecturer’ accessibility	0.840	0.000	0.428	0.639
Lecturer’s feedback	0.919	0.002	-0.184	0.433
Lecturer’s willingness to help	0.875	0.003	0.141	0.553
Project	0.844	0.000	0.434	0.628
Handout	0.911	0.000	-0.009	0.458
Theory-Application mix	0.795	0.000	0.483	0.744

NB DF (1, 111)

^a Pooled within-groups correlations between grouping variables discriminating variables and Standardised canonical discriminant functions.

The project had the highest discriminatory power followed by theory-application blend. The other variables that feature in providing a fair degree of discrimination between the two groups are perceived teaching quality, lecturers’ accessibility, and feedback.

6 CONCLUDING OVERVIEW AND COMMENTS

The increasing diversity of the student clientele and an increased demand for programmes with a professional or vocational orientation have greatly challenged the teaching and learning environment at the university level. The present paper analyses the effectiveness of an approach that rests on a two-pronged strategy of problem-based and individual need-based elements in teaching statistics to students that are primarily from a non-English speaking background and are enrolled in non-economics degree programmes. The findings indicate that student perception of overall satisfaction with a carefully designed course compares favourably with a chosen economics course and is on a par with a non-economics course.

Table 8: Fisher's linear discriminant function: Classification function coefficients

Factor	Coefficients of the dichotomous variables	
	Did not perceive to be satisfactory (scores 1-4) (coded 0)	Did perceive to be satisfactory (a score of 5) (coded 1)
Project	4.957	6.000
Theory-Application mix	2.912	4.039
Teaching quality	3.401	3.821
Lecturer's willingness to help	2.149	2.426
Handout	1.777	1.757
Lecturer's accessibility	-0.281	0.482
Lecturer's feedback	0.838	0.478
Constant	-31889	-45.863

The factors underlying this outcome fall into two categories (a) the orientation of the course content in terms of theory-application mix and (b) teaching related factors. We find support for the hypothesis that course-level product differentiation is of critical importance to achieving a desirable outcome. This apparently points to the need for a market-oriented approach to teaching and learning: listen to your customer (Azzalini and Hopkins 2002; Keneley and Hellier 2001; Hellier et al. 2004). One needs, however, to exercise caution in an

uncritical application of this approach since it might potentially deprive the students vital knowledge of theoretical underpinnings of applications⁸. There are often long-run benefits from theoretical understanding that are not apparent to the average student. As teachers, we must ensure that we leave students with analytical structures that they can apply in a range of future settings. To this end, we must strive to use case studies and other application settings to highlight the generality of analysis and methods, as well as their uses in immediate contexts. Instinctively, students fear theory, especially in its mathematical outfit, so the great skill is to enable them to understand it without them really noticing – it is in this that the ‘diversified portfolio approach’ to teaching economic statistics comes into its own. Given that there is little alternative to a collaborative strategy, ‘what is *versus* what should be taught’ (content) and ‘the way economics is taught *versus* how it should be taught’ (perceived teaching quality) assume pivotal importance (see, for example, Becker 2004, p.7; see also Colander 2004a; 2004b).

⁸ While it might be tempting, one should be reminded that the applicability of the client supplier model in case of university teaching is limited for a variety of reasons (Alauddin and Tisdell 2000, p.15). For example, (1) ‘the system may be biased in favour of popularity relative to academic standards’; (2) ‘because of the asymmetry of information, student (client) may not be able to judge easily or immediately the value of the information imparted and market failure may result (Akerlof 1970)’; (3) ‘in contrast to the traditional client-supplier model, the client in this case of education directly contributes to the quality of the good (knowledge). ... the quality of knowledge imparted, among other things, critically on the effort by the recipient’.

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