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Encouraging Tutorial Attendance at University did not Increase Performance

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Encouraging Tutorial Attendance at University did not Improve Performance

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Abstract

When tertiary education is subsidized the cost of poor student performance in university subjects falls not only on the individual student but also on society in general. Society therefore has an interest in promoting student performance. There is evidence in the literature that absenteeism from university classes is widespread and that absenteeism adversely affects student performance. In this paper I describe an incentive scheme that increased attendance of business and economics students in an introductory statistics subject at a typical Australian university. Like other authors I find a strong positive association between attendance and academic performance, both in the presence and absence of the scheme. However, there is no evidence that the incentive scheme caused student performance to improve. Although students attended more classes they did not perform better than students in the previous year's class who had the same observable characteristics and attendance levels but who were not exposed to the scheme.

Key words: class attendance, class absenteeism, academic performance

JEL codes: A22, I21

I. INTRODUCTION

Both in North America and Australia substantial numbers of university students regularly skip classes. Romer (1993, p. 167) described absenteeism in economics subjects at three “relatively elite” U.S. universities as “rampant”, having found that approximately one third of students were absent from class on a given day. Absenteeism among Romer’s sample of students was higher in large classes than in small classes, lower in classes with a substantial mathematical content than in non-mathematical classes, higher in core subjects than in noncompulsory electives, and lower in classes taught by experienced academic staff than in classes taught by casual lecturers. Devadoss and Foltz (1996) observed students studying agricultural economics and agribusiness and found that class attendance was positively related to the ability and motivation of the student. Several other results also emerged from Devadoss and Foltz’ study. Students financing their own studies through work or student loans had better attendance records than students on scholarship or students who were financially supported by their parents. Classes taught by lecturers who had won teaching awards and classes taught by lecturers who used an interactive teaching style were better attended than other classes. Classes scheduled between 10am and 3pm were better attended than classes scheduled either earlier or later.

Most academics believe intuitively that students benefit from attending classes. This is not simply egotism on the part of academics; there is evidence to suggest that attendance does matter for academic achievement.

Devadoss and Foltz (1996) found that students who attended all classes in agricultural economics and agribusiness achieved (on average) a full letter grade higher than students who attended no more than 50 percent of the same classes. Durden and Ellis (1995) reported a nonlinear relationship between attendance and performance: missing a few classes seemed not to matter but students who missed more than four classes in a one-semester principles of economics subject performed at a significantly lower level than students who attended all classes. Romer (1993) found that attendance had a significant, positive impact on students' performance in a one-semester intermediate macroeconomics subject. An average-GPA student in Romer's sample who attended all classes was predicted to score a B+, compared with a C+ for a student who attended 25 percent of classes. Park and Kerr (1990) found that attendance was significant in determining the odds of avoiding a D grade in a money and banking subject. Schmidt (1983) analyzed performance of students taking macroeconomic principles and found time spent in lectures and time spent in discussion groups had a significant, positive effect on performance. None of these studies *proves* that a causal relationship exists between attendance and performance but they document a strong association and are consistent with the hypothesis that such a causal relationship exists.

Given the evidence that absenteeism is common and that it may impede performance, it is worthwhile considering ways to encourage class attendance. Compulsory attendance is difficult to enforce although Romer (1993, p. 173) reminds us that a generation ago attendance both *in principle*

and in practice was mandatory in some U.S. universities. Short of compulsion, incentives of various types, such as points for class participation or unannounced quizzes that contribute to the final grade, can be used to discourage absenteeism. Devadoss and Foltz (1996) found that incentives of this sort have a significant, positive impact on attendance.

Monitoring attendance poses logistical problems for large classes. In Australian universities, large lectures are common, particularly for subjects at the 100 level.[1] Small classes tend to be associated with lectures in elective subjects, many of which are offered at the 200 or 300 level, and with tutorials, which typically are conducted as small discussion groups. Australian academic staff and students seem to regard tutorial attendance as at least as important as lecture attendance, possibly because tutorials offer a greater opportunity for student participation. This paper examines the effectiveness of one method used by the author to encourage small-group tutorial attendance at a typical Australian university. In Section II the incentive scheme is described along with the circumstances in which it was used. The effect of the incentive scheme on attendance rates is examined in Section III. In Section IV the incentive scheme is evaluated as a mechanism for improving performance. Section V summarizes the conclusions of the study.

II. DESCRIPTION OF THE INCENTIVE SCHEME

The incentive scheme described in this paper was used in the late 1990s in a one-semester, introductory statistics subject taught to undergraduates at a

medium size Australian university. Approximately 85 percent of the several hundred students in the class each semester are undertaking a Bachelor of Commerce degree (specializing in business or economics) and for these students the subject is compulsory. Most of the remaining 15 percent of students are enrolled in an Arts degree, for some of whom the subject is compulsory while for others it is not. At the time of this study there were three 50-minute lectures per week for 14 weeks delivered to the class as a whole. Each student was also required to attend one 50-minute tutorial in each of Weeks 2 through 14. Tutorial groups consisted of 20 or fewer students. Students were instructed to attempt a problem set prior to each tutorial. The problems involved the application of material covered in lectures in the preceding week. Nine of the 13 tutorial meetings were held in a regular classroom where a tutor presented the answers to as many of the problems as time permitted and responded to students' questions. Students were not required to submit their answers for marking but they could mark their own work using an answer key, which was made available at the beginning of the week following the tutorial in which the problem set was discussed. The remaining four tutorial meetings were held in a computer laboratory where students, with the help of their tutor, learned how to use a statistical package to generate output with which to solve statistical problems.

Under the incentive scheme each student's mark for the subject as a whole was reduced by one percentage point for every tutorial missed in excess of two. (No penalty was applied for an absence if the student

submitted written documentation, such as a medical certificate, in evidence of a legitimate reason for non-attendance.) An effort was made to ensure that students understood the incentive scheme: it was explained in the subject outline, copies of which were distributed in lectures and made available on the Web at the beginning of the semester. The scheme was explained to students during the first lecture and students were reminded of its existence on several occasions during the semester.

The efficacy of the incentive scheme is evaluated in Section III by comparing tutorial attendance rates in the semester when the scheme was used, with those of the same semester in the previous year when the scheme was not used. The two years are referred to below as the “trial year” and the “control year”, respectively. This methodology is valid only if the teaching environment is the same in both years. Before presenting the analysis, therefore, it is appropriate to compare the subject and its organization in the two years.

(a) The lecturer was the same in both years.

(b) The content and presentation of lectures was fundamentally the same in both years. The same topics were presented using PowerPoint slides. The only change made to lecture content was to update some of the examples.

(c) The method of assessment was the same in both years except for the incentive scheme. There were three tests during the semester, worth 15 percent, 10 percent and 15 percent respectively, and a comprehensive final examination, worth 60 percent. Tests had the same coverage of material,

were of the same duration and were conducted at the same time during the semester in both years. Test 1 was multiple-choice, Test 2 consisted of problems similar to those assigned as tutorial preparation and Test 3 assessed knowledge of the output generated by the statistical package used in the subject. The questions asked on the tests and the final examination were different in the two years but were intended to be of the same level of difficulty.

(d) The same head tutor was employed in both years. In the trial year the head tutor conducted seven of the eleven tutorial groups; in the control year the head tutor taught six of the eleven tutorial groups.[2] Accurate records of tutorial attendance were kept in both years. In the trial year students signed an attendance sheet; in the control year a roll call was taken in each tutorial.

(e) The problems assigned as tutorial preparation were taken from the textbook, which was the same in both years. All problems assigned in the trial year were also assigned in the control year but five of the 175 problems assigned in the control year were omitted in the trial year.

(f) Two weeks into the semester in the trial year there were 226 students in the class, 12.4 percent of whom later withdrew. At the same point in time in the control year there were 189 students enrolled in the subject, 12.1 percent of whom later withdrew.[3]

III. THE EFFECT OF THE INCENTIVE SCHEME ON ATTENDANCE

Data sets for the two years were constructed using official class lists and records of attendance kept by the tutors. Students who had withdrawn from the subject by the end of the second week were excluded from the analysis because these students did not seriously attempt the subject.[4] The analysis reported in the first part of this section was performed on the remaining students, including those who withdrew after the end of the second week. It was recognized that the incentive scheme might encourage students with a propensity to miss tutorials to withdraw from the subject altogether. If so, excluding these students from the analysis would lead to an under-representation of low-attendance students in the trial year and an upward bias in any observed improvement in the attendance rate compared with the control year. In fact, as already mentioned in Item (f) within Section II, the withdrawal rate was approximately the same in both years so this theoretical possibility does not appear to have been the case. The data set is referred to below as “All Students”.

Some of the students who eventually withdrew (13 in the year when the incentive scheme was used and 8 in the control year) attended no tutorials. Whether these students seriously attempted the subject prior to withdrawal is unknown. On the assumption that they did not, the analysis was repeated with these students excluded from it. This second data set is called “>0-Tut Students” below. Finally, for completeness, the analysis was repeated using

only students who remained enrolled until the end of the semester. This third data set is called “No-WD Students”.[5]

Each student’s attendance was determined from the tutor’s records. An absence that was excused for assessment purposes was not counted as an attendance for this study because an incentive scheme cannot be judged successful if it simply encourages students to document their absences rather than reduce them.

The percentages of students in the three data sets who attended 0, 1, 2, … 13 tutorials in the two years are presented in Table I. The percentage of students with “good” attendance records was higher in the year when the incentive scheme was used than in the control year. The percentage of “All Students” who attended all 13 tutorials in the trial year was 16.8 compared with 12.7 percent in the control year. Almost 35 percent of “All Students” missed no more than one tutorial in the trial year compared with 21.7 percent in the control year. Almost 50 percent of “All Students” missed no more than two tutorials in the trial year compared with 37 percent in the control year. The proportion of students with poor attendance records was lower in the year when the incentive scheme was used than in the control year. The percentage of “All Students” who attended six or fewer of the 13 tutorials in the trial year was 23.5 compared with 33.3 percent in the control year. Only among the chronically absent was attendance worse in the year when the incentive scheme was used: 7.5 percent of “All Students” missed all 13 tutorials in the trial year compared with 5.8 percent in the control year. Attendance-rate

differentials of similar magnitude between the two years apply to the ">0-Tut Students" and the "No WD Students". Wilcoxan Rank-Sum tests[6] performed on the three data sets in Table I all indicate that the distribution of attendance in the control year is located below the distribution of attendance in the year when the incentive scheme was used. These results are all statistically significant at the 0.1% level.

{Table I about here.}

The average attendance in the year when the incentive scheme was used was 10.079 (out of 13) tutorials, compared with 8.899 in the control year. I now examine whether the increase in attendance can be explained by differences in the nature of the students in the two years. Descriptive statistics for students in the two groups are shown in Table II.[7] The average mark on other subjects taken in the same semester as my class is a proxy for the ability of the student. The number of credit points taken until the end of the semester and the number of credit points dropped during the semester reflect the students involvement in university study.[8] These variables, as well as full-fee paying status[9] and the time at which the tutorial was held, were found to be important determinants of attendance in the Devadoss and Foltz' study that was discussed in the introduction to this paper. First-year status[10], gender and type of degree undertaken are also considered. The only differences between the two years that are significant at the five percent level are mean tutorial attendance and mean number of credit points recorded at the end of the semester.

{Table II about here.}

By how much did the attendance of a typical student increase as a result of the incentive scheme? Table III reports the results of an OLS regression analysis of the effect of the incentive scheme on attendance (see Columns 1 and 2) and the marginal effects from a Tobit estimation (see Columns 3 and 4). The OLS and Tobit results are very similar. The effect of the incentive scheme is to increase attendance by approximately one tutorial, a result that is highly statistically significant. Only three other coefficients in the attendance equation are statistically significant: other things equal, students with high average marks in other subjects taken during the same semester have higher tutorial attendance rates, first-year students attend more tutorials than later-year students, and males skip more tutorials than females. Having a tutorial either early or late in the day had no significant effect on attendance, probably because students selected their own tutorial times. Being a full-fee-paying student had no significant effect on attendance. Students who dropped credit points during the semester had much the same attendance as students who maintained the same workload throughout the semester.

{Table III about here.}

IV. THE EFFECT OF THE INCENTIVE SCHEME ON PERFORMANCE

If attending tutorials increases learning then the reduction in absenteeism documented in this paper is to be applauded. A causal link

between attendance and performance is difficult to identify statistically because students *choose* whether to attend class. Missing class could be a rational act by a student who is unable to assimilate information aurally and substitutes study for class attendance. Alternatively, absenteeism could constitute self-destructive behaviour resulting from lack of motivation, a high time preference for leisure or poor time-management skills. These underlying factors are difficult to incorporate into a formal analysis of the relationship between attendance and performance because they are difficult to measure. If each student's attendance could be set using a random process then a regression of performance on attendance (and other relevant variables) would be able to detect a causal relationship, if one exists. In the absence of such an experiment, I examine (a) the *association* between the tutorial attendance and performance in both years and (b) the association between the incentive scheme and student performance at various levels of attendance.

The incentive scheme can be viewed as a mechanism for increasing the marginal benefit of attending tutorials but its efficacy depends upon the nature of the performance-attendance relationship for the two groups of students.[11] The performance-attendance relationship in the control year can be used to estimate what the performance of students subjected to the incentive scheme would have been, had the incentive scheme not been used. An upward shift in the relationship between the two years would indicate that the scheme was successful. That is, performance would have increased beyond what could be attributed to increased exposure to the subject matter

associated with increased attendance. This could occur if students discover that Statistics is interesting and devote more effort to studying the material. If the performance-attendance relationship is strictly increasing and the same in both years then the scheme could also be judged a success in the sense that it increased performance via the additional exposure to material associated with attending an additional tutorial. However, a downward shift in the relationship between the control year and the trial year would indicate that the incentive scheme was unsuccessful. Under the latter scenario, students attend more tutorials as a result of the incentive scheme but do not perform better because of a negatively compensating reduction of effort.

To produce a measure of academic performance for this paper that is not directly affected by the incentive scheme I added back on to the final marks of students in the trial year any marks that were deducted for absenteeism. When this was done, there was no significant difference between the mean marks of 52.92 in the year when the incentive scheme was used and 53.59 in the control year.

Table IV reports the results of a regression analysis of the effect of tutorial attendance on performance. The two years of data were pooled and a dummy variable was used to indicate the presence or absence of the incentive scheme. Attendance was represented by 13 dummy variables, the omitted category being perfect attendance. Interactions between the dummy variable for the incentive scheme and the dummy variables for attendance were included, thereby allowing the performance-attendance relationship to

differ for the two groups of students (see columns 1 through 4 in the top section of Table IV).[12] Columns 5 and 6 list the differences between the coefficients in the two years and the P-values of the differences.

{Table IV about here.}

Like the studies reported in the introduction to this paper, the results in Table IV depict a direct relationship between attendance and performance in both years. This is evident in the negative and statistically significant, coefficients on the attendance dummies in each year. In the control year, students with 1, 2 or 3 absences performed approximately the same as students who attended all 13 tutorials but students who missed 4 or 5 tutorials scored approximately 12 fewer marks than students with perfect attendance. An additional 10 to 12 marks were forfeited by students absent from 6 or 7 tutorials. In the trial year, the first three absences “cost” the student approximately eight marks each. In both years students who attended five or fewer tutorials scored approximately 30 fewer marks than students with perfect attendance.

Four of the six independent variables included in the regression are statistically significant at approximately the five percent level or lower. The first independent variable, the student’s average mark (out of 100) in other subjects taken during the same semester as my subject, is a proxy for ability but it probably also reflects attendance in those other subjects. Assuming attendance is correlated across subjects, the inclusion of this variable is likely to result in an under-estimate of the effect of tutorial attendance on

performance in my class.[13] The second independent is a dummy variable for students in their first year at university. Assuming the transition from high school to university requires some adjustment it was hypothesized that first-year students would perform at a lower level than later-year students. This hypothesis is supported by the data: first-year students, on average, scored 6.3 marks lower than later-year students. The third independent variable is a dummy variable for students who pay full fees. The assumption is that these private students are more motivated or perhaps better prepared academically than students whose tuition is subsidized. The results support this hypothesis; full-fee paying students scored four marks higher than their subsidized counterparts. The fourth independent variable is the number of credit points taken by the student in the current semester. Assuming that more motivated students take more credit points, this independent variable is expected to be positively related to performance. This expectation is confirmed by the positive coefficient on current credit points. No significant differences were found between the performances of males and females, nor between the performances of students undertaking a Bachelor of Commerce degree and those enrolled in other degrees.

An assessment of the efficacy of the incentive scheme in increasing learning requires a comparison of the performance-attendance relationships of a typical student in the two years. The relationship is implicit in the coefficients of the attendance dummies in Table IV. An explicit example is provided in Table V, which has been constructed using the coefficients in

Table IV and the assumption that a typical student has an mean mark of 57 on other subjects taken in the same semester, is not in first-year, is not paying full fees, is enrolled in 24 credit points at the end of the semester, is female and is enrolled in a Bachelor of Commerce degree. Profiles of students with other characteristics that are included as independent variables in Table IV would differ from the profile in Table V only by the addition, or subtraction, of a constant to performance at each level of attendance.

{Table V about here.}

Was the incentive scheme successful in increasing performance? Apparently not! There is certainly no upward shift in the performance-attendance relationship from the control year to the year in which the incentive scheme was used. The two profiles are statistically indistinguishable at all attendance levels except ten, where the penalty applied, and eleven, where the penalty did not apply (see Column 6 of Table IV). At these two attendance levels performance was significantly lower under the incentive scheme. This suggests that there were students in the trial year who attended eleven rather than ten tutorials in an effort to avoid the penalty, but who learned no more than they would have done if they had attended only ten tutorials. This behaviour resulted in a decrease in the performances of students with attendances of ten and eleven, compared with students in the control year.

V. CONCLUSIONS

The evidence presented in this paper is that tutorial attendance in an introductory statistics class improved by approximately one tutorial under an incentive scheme that imposed a small penalty for missing more than two out of 13 tutorials. A priori, it was not known whether students would respond to the incentive scheme. They may not have believed that the penalty for not attending tutorials would actually be applied, they may not have cared enough about their academic grades for the penalty to matter, or the penalty may have been too small to be effective.

There was a positive *association* between tutorial attendance and performance of students both in the year when the incentive scheme was used and in the previous year when the incentive scheme was not in force. This is consistent with the evidence from U.S. universities. Nevertheless, the incentive scheme did not improve students' performance. Students attended more classes but did not perform better than students with the same characteristics and attendance levels in the previous year when the scheme was not used. At some attendance levels, students performed worse. Clearly, attendance *per se* does not ensure that learning takes place. Physical presence and intellectual involvement are quite different phenomena. My results suggest that there are no "easy fixes" in dealing with absenteeism but they do not rule out the possibility that other types of incentives may be effective in increasing both attendance and performance. More information is needed on why students skip classes and how they utilize the time so gained.

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Table I

Tutorial Attendance Rates (%)

No. of Tutorials Attended	All Students		>0-Tut Students		No-WD Students	
	Control Yr	Trial Yr	Control Yr	Trial Yr	Control Yr	Trial Yr
0	5.8	7.5	1.7	1.9	1.8	2.0
1	3.2	1.8	3.3	1.9	1.8	1.0
2	5.3	2.2	5.5	2.3	5.4	1.5
3	6.9	3.5	7.2	3.8	4.8	1.5
4	4.2	2.7	4.4	2.8	3.0	1.0
5	5.8	4.0	6.1	4.2	6.0	3.5
6	2.1	1.8	2.2	1.9	2.4	2.0
7	5.8	5.3	6.1	5.6	6.0	6.1
8	6.3	3.5	6.6	3.8	6.6	4.0
9	7.4	8.4	7.7	8.9	8.4	9.6
10	10.1	9.3	10.5	9.9	11.4	10.6
11	15.3	15.0	16.0	16.0	17.5	17.2
12	9.0	18.1	9.4	19.2	10.2	20.7
13	12.7	16.8	13.3	17.8	14.5	19.2
Wilcoxan Rank-Sum Tests						
No. of Students	189	226	181	213	166	198
Mean Rank	190.2	222.9	177.1	214.8	162.2	199.5
Approx Z-statistic	-2.7694		-3.2765		-3.3649	
P-value	0.0028		0.0005		0.0004	

Table II

Descriptive Statistics

Variable	Control Year	Trial Year
Mean (Standard Deviation)		
Number of tutorials attended	8.899*** (3.540)	10.079*** (2.947)
Average mark on other subjects in the same semester (%)	57.061 (15.498)	57.415 (14.538)
Credit points at end of semester	21.522*** (4.770)	23.068*** (3.816)
Credit points dropped during semester	0.591 (2.081)	0.545 (1.857)
Proportion		
In 1st-year	0.403	0.455
Paying full fees	0.321	0.246
Male	0.629	0.618
Not in B.Com degree	0.176	0.131
In a tutorial between 9.30am & 3.30pm	0.566	0.581
In a tutorial at 8.30am	0.063	0.073
In a tutorial at 4.30pm	0.277	0.272
In a tutorial at 5.30pm	0.094	0.073
No. of observations	159	191

*** Significantly different from each other at the 0.1 percent level of significance.
** Significantly different from each other at the 1 percent level of significance.
* Significantly different from each other at the 5 percent level of significance.

Table III

Effect of the Incentive Scheme on Attendance[+]

Variable	Coeff (OLS)	P-value	Marg Effect (Tobit)	P-value
	(1)	(2)	(3)	(4)
Intercept	2.168	0.001	1.154	0084
Incentive Scheme = 1, 0 otherwise	1.107	0.000	1.041	0.000
Average mark on other subjects in the same semester	0.119	0.000	0.115	0.000
1st-year student = 1, 0 otherwise	1.036	0.000	1.113	0.000
Full-fee paying student = 1, 0 otherwise	0.340	0.284	0.277	0.384
Credit points dropped during semester	-0.109	0.132	-0.105	0.141
Male=1, 0 otherwise	-0.710	0.014	-0.615	0.034
In a tutorial at 8.30am = 1, 0 otherwise	-0.622	0.270	-0.443	0.441
In a tutorial at 4.30pm = 1, 0 otherwise	-0.134	0.681	-0.139	0.670
In a tutorial at 5.30pm = 1, 0 otherwise	0.310	0.555	0.270	0.608

[+] The dependent variable is the number of tutorials attended out of 13.

Sample Size = 350 (159 in the control year and 191 in the trial year)

OLS Regression

R^2 = 0.387, Adjusted-R^2 = 0.370, F-statistic = 23.81 (P-value = 0.000),

Breusch-Pagan's chi-square statistic (with 9 degrees of freedom) = 13.15 (P-value = 0.156). The null hypothesis (homoscedasticity) is not rejected.

Tobit Estimation

Limits = 0 and 13, sigma = 3.003, (P-value = 0.000).

Marginal effects are calculated at the means of the independent variables.

Table IV

The Effect of Attendance on Performance[+]

Variables interacting with the dummy for the incentive scheme	Control Year		Trial Year		Difference Trial Yr – Control Yr	
	Coeff	P-value	Coeff	P-value	Coeff	P-value
	(1)	(2)	(3)	(4)	(5) = (3) – (1)	(6)
Intercept	16.795	0.026	19.240	0.012	2.446	0.442
12 tutorials = 1, 0 otherwise	-4.694	0.335	-7.701	0.012	-3.007	0.591
11 tutorials = 1, 0 otherwise	0.141	0.964	-14.907	0.000	-15.048	0.002
10 tutorials = 1, 0 otherwise	-3.968	0.276	-23.820	0.000	-19.851	0.001
9 tutorials = 1, 0 otherwise	-12.567	0.011	-19.309	0.000	-6.742	0.301
8 tutorials = 1, 0 otherwise	-12.064	0.106	-28.684	0.000	-16.620	0.094
7 tutorials = 1, 0 otherwise	-22.228	0.027	-33.353	0.000	-11.125	0.324
6 tutorials = 1, 0 otherwise	-24.500	0.023	-21.306	0.049	3.194	0.833
5 tutorials = 1, 0 otherwise	-31.092	0.000	-32.985	0.003	-1.893	0.880
4 tutorials = 1, 0 otherwise	-41.140	0.000	-37.585	0.000	3.556	0.793
3 tutorials = 1, 0 otherwise	-34.268	0.000	-33.780	0.000	0.488	0.969
2 tutorials = 1, 0 otherwise	-31.581	0.000	-46.260	0.000	-14.679	0.212
1 tutorials = 1, 0 otherwise	-16.667	0.159	-19.773	0.002	-3.106	0.792
0 tutorials = 1, 0 otherwise	-48.692	0.000	-40.816	0.000	7.876	0.224

Independent variables without Interactions	Coeff	P-value
Avg mark on other subjects taken in the same semester	0.628	0.000
1st-year student = 1, 0 otherwise	-6.309	0.001
Full-fee paying student = 1, 0 otherwise	4.026	0.053
Credit points at end of semester	0.735	0.001
Male=1, 0 otherwise	-2.662	0.139
Not B.Commerce =1, 0 otherwise	-0.424	0.883

[+] The dependent variable is performance out of 100.

Sample Size = 350 (159 in the control year and 191 the trial year).

R^2 = 0.592, Adjusted-R^2 = 0.550, F-statistic = 13.91 (P-value = 0.000),

Breusch-Pagan's chi-square statistic (with 33 degrees of freedom) = 77.678 (P-value = 0.000).

Standard errors have been corrected for heteroscedasticity using White's consistent estimator (see Greene, 1998, p.291).

Table V

Performance - Attendance Profiles of a Typical Student[+]

Attendance	Mark (100) Control Year	Trial Year
13 tutorials	70	73
12 tutorials	66	65
11 tutorials	70***	58***
10 tutorials	66***	49***
9 tutorials	58	53
8 tutorials	58	44
7 tutorials	48	39
6 tutorials	46	51
5 tutorials	39	40
4 tutorials	29	35
3 tutorials	36	39
2 tutorials	39	26
1 tutorials	54	53
0 tutorials	22	32

[+] These profiles have been constructed using the coefficients in Table IV. A typical student has an mean mark of 57 on other subjects taken in the same semester, is not in first-year, is not paying full fees, is enrolled in 24 credit points at the end of the semester, is female and is enrolled in a Bachelor of Commerce degree.

*** Significantly different from each other at the 0.1 percent level of significance.

** Significantly different from each other at the 1 percent level of significance.

* Significantly different from each other at the 5 percent level of significance.

FOOTNOTES

[1] Australian university degrees require three years of full-time study. Students enrolled in a given subject typically attend the same set of lectures, whereas in many American universities a number of small sections are scheduled for the same subject. For further description and a comparison of Australian and U.S. undergraduate study, see Siegfried and Round (1994) and Lee, Burgess and Kniest (1996).

[2] In the year when the incentive scheme was used two casual tutors took two tutorial groups each. In the previous year two casual tutors took three and two groups, respectively. Different casual tutors were employed in the two years but in each year one of the casual tutors had tutored in the subject at least once before.

[3] In the control year, for the convenience of part-time students, each lecture was repeated at 6.30pm on the same day it was first delivered and one tutorial per week was held at 7.30pm. There was no repeat lecture or associated tutorial in the year when the incentive scheme was used. Unfortunately, the roll book for the 7.30pm tutorial in the control year was mislaid so no record of attendance for its 19 enrollees is available. The enrolment count for the control year of 189 and the analysis presented here excludes these 19 students. I contend that their omission does not bias the results of the analysis for the following reason. This subject in introductory statistics is taught in both semesters at my university and in the year when the incentive scheme was used the repeat lecture was given in the semester taught by another lecturer. Assuming that part-time, mature students take the subject in the semester when the repeat lecture is offered then the 19 students in the 7.30pm tutorial in the control year are likely to behave differently from the students in the following year's class. (Indeed, 17 of the 19 students were part time and only one was in his first year at university.) Thus, their exclusion is likely to increase the similarity between students in the two classes.

[4] In the first two weeks of each semester a considerable amount of "subject sampling" takes place as students finalize decisions about which subjects to take. Students can drop subjects and avoid fees until the middle of the fifth week of the semester; they can drop without having an F recorded on their academic transcript prior to the end of Week 8.

[5] There were three students in the control year and four in the year when the incentive scheme was used who did not withdraw yet attended no tutorials. These students are included in all three data sets analyzed here.

[6] The null hypothesis is that the relative-frequency distribution of attendance in the control year is not located to the left of the relative-

frequency distribution of attendance in the year when the incentive scheme was used.

[7] Table II was constructed using 191 of the 198 “No-WD Students” in the data set for the year when the incentive scheme was used and 159 of the 166 “No-WD Students” in the data set for the control year. Seven students from each data set were excluded because they were enrolled in no other subject and consequently have no observed “average mark on other subjects in the same semester”. The analysis in Section IV is also based upon these 350 students.

[8] The normal load is 24 credit points; 30 credit points constitute a heavy load. A student taking fewer than 18 credit points is considered to be part-time.

[9] In the Australian context at the time of this study most full-fee-paying students were international students.

[10] First-year students were identified from class lists by the first two digits of their identification numbers, which indicate the first year of enrolment.

[11] I thank an anonymous referee for his or her suggestions as to how to assess the efficacy of the incentive scheme.

[12] Separate regressions for the two years found no statistically significant differences between the coefficients of the control variables so the interactions between the incentive-scheme dummy and the independent variables were not included in the model reported in Table IV.

[13] This point is made by Romer (1993, p.172) and by Park and Kerr (1990, pp.105-108).