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Does a Link Exist Between Examination Performance and Lecture Attendance for First Year Engineering Students ?

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Abstract

The objective of this study is to examine if a link exists between lecture attendance and examination performance of Level 7, Year 1, Electrical Engineering students at Dublin Institute of Technology in the Electrical Systems subject. Lecture attendance was monitored and analysed over four academic years (2007-8, 2008-9, 2009-10 and 2010-11). The average lecture attendance for students in the three academic years from 2007-10 was 55%, increasing noticeably in the 2009-10 academic year. A statistically significant weakly positive correlation between lecture attendance and examination performance was established. Each 10% increase in student attendance at lectures improved both Module 1 examination and terminal examination performance by approximately 3% on average, a finding similar to that reported in other studies.

1. Introduction

The Level 7 Batchelor of Engineering Technology degree in Electrical Engineering at Dublin Institute of Technology (DIT) consists of three undergraduate years of study. Level 7 programmes were traditionally labelled as technician programmes; candidates apply for such programmes (in common with all higher education programmes) in the Republic of Ireland through the Central Applications Office (CAO), in which points are given for examination results in six subjects taken in the Irish Leaving Certificate, or equivalent. The maximum point score possible for a candidate is 600, with 55% of candidates scoring more than 300 points in 2008, for example (CAO, 2008a). Minimum points levels for programmes are set by student demand for the limited number of course places; in common with worldwide trends, student demand for technology courses is decreasing, leading to, for example, a minimum points level for the programme of 75 in 2008, with a median points level of 290 (CAO, 2008b). Though there is some debate as to whether the points scored by candidates in an examination process dominated by a terminal examination is the best predictor of subsequent success on an engineering programme, nevertheless it is clear that many, if not most, of the students entering the programme have lower academic ability when compared to their wider peer group.

The link between lecture attendance and examination performance was investigated with students on the Electrical Systems subject in the first year of the Level 7 degree programme. The author has had responsibility for development, instruction and assessment in this subject since 2005. The subject is divided into two thirteen-week semesters; in each semester, students attend two hours of lectures and two hours of laboratories in the subject each week. Since 2005, the subject is assessed in the following manner:

- Terminal examination (50% of subject mark), based on the full year's work, held after the completion of the second semester. This examination has a compulsory question and five other questions, three of which are to be attempted.
- Laboratory work (25% of the subject mark); this is assessed continuously over both semesters.

- Individual student project work (12.5% of the subject mark), assessed in the middle of the second semester.
- Module 1 examination (12.5% of the subject mark); this is a multiple-choice examination, held after the completion of the first semester; students are required to attempt all questions.

Good attendance is one marker of student engagement with a programme of study; in the first two academic years in which the author taught the subject (2005-6 and 2006-7), it was observed that many students had poor lecture attendance in the subject, impairing their ability to take part in active learning of the material with their peers. The objective of this paper is to examine if a link exists between lecture attendance and examination performance (module 1 and terminal examinations), using data gathered over three academic years for the terminal examination (2007-8, 2008-9 and 2009-10), with data from the 2010-11 academic year additionally included for the module 1 examination.

2. Literature review

A body of work exists suggesting that there is a statistically significant relationship between student lecture attendance and examination performance. Gatherer and Manning (1998), for example, suggest that there is a statistically significant weakly positive correlation between lecture attendance and examination performance for a first year biological sciences student cohort ($n=152$, $p<0.0005$, $r=0.341$). Similar results are reported by Newman-Ford et al., (2008) who suggest a statistically significant positive correlation between learning event attendance and academic attainment for a number of cohorts of first year humanities students ($n=1968$, $p<0.0001$, $r=0.377$). Lockwood et al. (2006) analyse if compulsory attendance would improve student grades and suggest that there is a statistically significant strongly positive correlation between lecture attendance and exam performance for agricultural science students ($n=60$, $p<0.001$, $r=0.60$), though the student year on the programme is unclear. Other work reports variations of these results (e.g. Hammen and Kelland (1994), Cohn and Johnson (2006), McCarey et al. (2007)).

In the context of experiences in the Republic of Ireland, the papers by Maloney and Lally (1998), Kirby and McElroy (2003), Purcell (2007) and Delaney et al. (2011) are of particular interest. Maloney and Lally (1998) suggest that there is a statistically significant weakly positive correlation between lecture attendance and examination performance for a third year economics student cohort at University College Galway ($n=121$, $r=0.39$). Kirby and McElroy (2003) examine the relationship between attendance and grade, controlling for other factors, in first year economics courses at University College Cork. Interestingly, the authors find that the average attendance rate is 47%, a figure much lower than comparable US student cohorts, a point also made by Maloney and Lally (1998). Purcell (2007) finds a relationship between lecture attendance and examination performance for a second year and a third year cohort of civil engineering students at University College Dublin, reporting that the mean attendance rate is 68%. However, engineering student attendance rates can be low; Kolari et al. (2008), for example, reference studies at a Finnish university suggesting that engineering students are present at 39% of their lectures and 41% of their laboratory exercises. Finally, Delaney et al. (2011), in a working paper, examine the relationship between lecture attendance and grades, across multiple subject areas, at University College Dublin, concluding that there is a positive and statistically significant relationship between lecture attendance and grades, which is robust to the inclusion of control variables across six different specifications.

In these previous Irish studies, students are reading for honours bachelors degrees (Level 8 programmes), which are typically four years in duration, and generally recruit students with a high level of attainment at the Leaving Certificate, as measured by the minimum and median CAO points level. The present study is the only study, of which the author is aware, to examine the relationship between lecture attendance and examination performance of students on an Irish Level 7 programme, where, in addition, levels of prior attainment are lower.

3. Methodology

The study population was composed of students in the 2007-8, 2008-9, 2009-10 and 2010-11 academic years (n = 33, 33 and 27, respectively, for the terminal examination in the first three academic years). Lecture attendance, recorded by means of signed attendance sheets, was taken for most lecture sessions; for example, in the 2009-10 academic year, attendance was taken for 41 of 48, or 85%, of lecture sessions. The students were informed that the taking of attendance data was for the purpose of the study, and no penalty was attached to non-attendance at lectures. The calibre of each student cohort, as measured by the CAO points score, is summarised in Table 1, together with cohort data from one previously comparable investigation (Purcell, 2007).

Table 1: Summary of calibre and number of students

Student cohort	Median points	Number of students	Reference
Civil Engineering, Level 8, Year 2, 2005-6	500	63	Purcell, 2007
Civil Engineering, Level 8, Year 3, 2005-6	480	73	Purcell, 2007
Electrical Engineering, Level 7, Year 1, 2007-8	245	33	This study
Electrical Engineering, Level 7, Year 1, 2008-9	290	33	This study
Electrical Engineering, Level 7, Year 1, 2009-10	265	27	This study

The average percentage attendance for each Level 7 student cohort was calculated and compared with data from comparable studies. The average mark attained by each student in the Module 1 and terminal (end-of-year) examination was calculated, and correlated with the corresponding percentage attendance for that student. A regression analysis of the data was undertaken using MATLAB.

4. Results

Table 2 shows mean terminal examination performance and lecture attendance for the same student cohorts examined in Table 1. Interestingly, mean lecture attendance has increased in the 2009-10 academic year, and was comparable with data recorded by Purcell (2007), though the reason for this increase has not been explored. However, mean terminal examination performance did not increase in tandem with mean lecture attendance.

Table 2: Summary of attendance record and examination performance

Student cohort	Mean % terminal exam mark	Mean % lecture attendance	Reference
Civil Engineering, Level 8, Year 2, 2005-6	65	69	Purcell, 2007
Civil Engineering, Level 8, Year 3, 2005-6	55	67	Purcell, 2007
Electrical Engineering, Level 7, Year 1, 2007-8	45	49	This study
Electrical Engineering, Level 7, Year 1, 2008-9	43	49	This study
Electrical Engineering, Level 7, Year 1, 2009-10	43	68	This study

Figures 1 and 2 show that there is a statistically significant weakly positive correlation between lecture attendance and terminal examination performance for the Level 7 cohort over the 2007-10 period (n=93, p=0.0013, r=0.33), and lecture attendance and Module 1 examination performance for the cohort over the 2007-11 period (n=128, p<0.0005, r=0.40). These results are similar to those found by Gatherer and Manning (1998), for example. Examination of Figure 1 shows that the pass mark of 40% (in the terminal examination) may be obtained with lecture attendance level of 38%, on average.
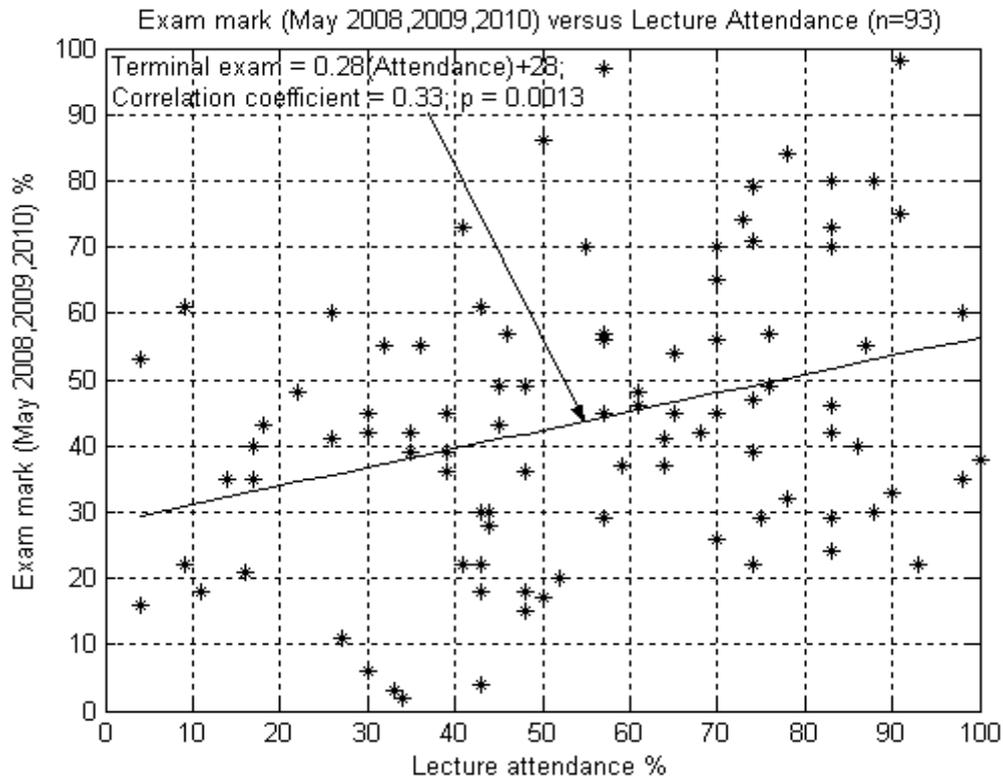
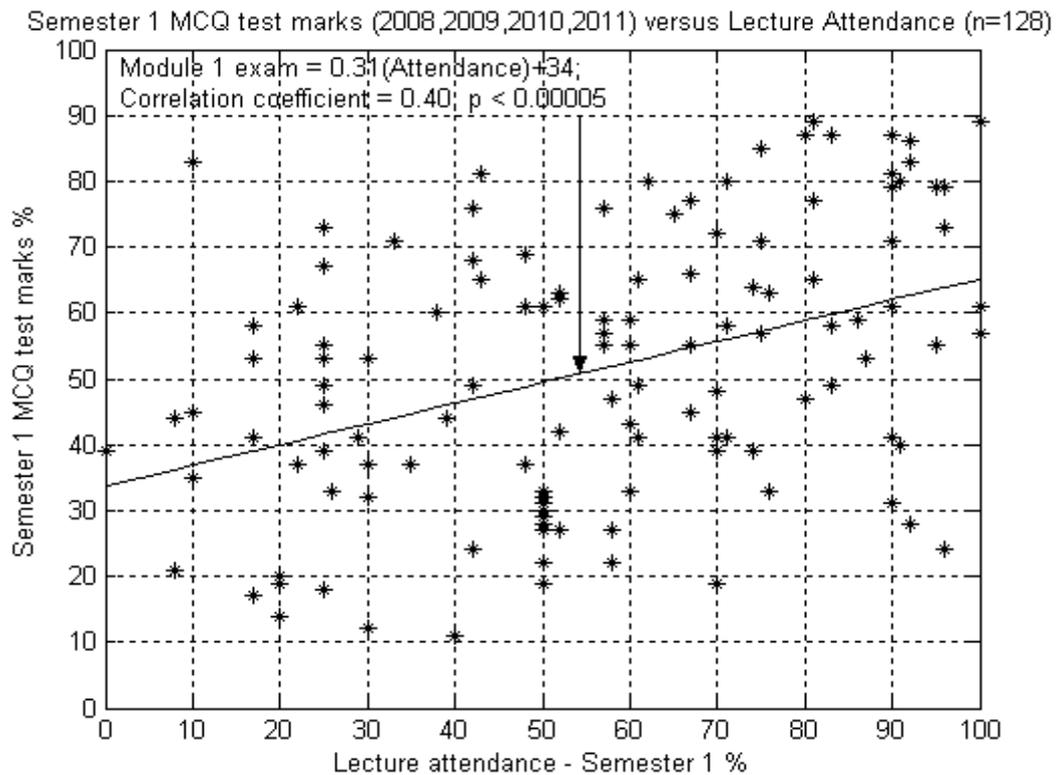Figure 1: Performance of students in the terminal examination 2007-10

Figure 2: Performance of students in the Module 1 examination 2007-11

There are, of course, other ways to view this data. One simple view, as suggested by Lockwood *et al.* (2006), is to determine the variation in final mark (on average) calculated for no lecture attendance compared to compulsory lecture attendance. Data is summarised in Table 3.

Table 3: Effect of compulsory lecture attendance on student scores (on average)

	Average mark (assuming no attendance)	Average mark (assuming compulsory attendance)	Value added by attending lectures (%)
2007-10, Terminal exam	28	56	28
2007-11, Module 1 exam	34	65	31

However, as Lockwood *et al.* (2006) suggest, it may be erroneous to suggest that compulsory lecture attendance would improve examination outcomes, as the relationship could also be the result of other factors such as student motivation, interest and aptitude. As an alternative, the % improvement in examination performance (on average) for each lecture session attended is given in Table 4.

Table 4: % improvement in examination performance (on average) for each lecture attended

	% improvement
2007-10, terminal exam: each lecture hour attended	0.6
2007-11, Module 1 exam: each lecture hour attended	1.3

The % improvement figures are broadly compatible with the 0.9% and 0.8% improvement figures deduced from the work of Purcell (2007), for Irish engineering students in Years 2 and 3, respectively, of a Level 8 programme.

5. Discussion and Conclusions

As mentioned, the results of this study are broadly similar to those in comparable studies, both in Ireland and internationally. It is clear that students who have chosen to attend lectures more regularly perform better in their examinations than students that have chosen to attend lectures less regularly. The best fit equations ($y = 0.31x + 34$, for the Module 1 examination, and $y = 0.28x + 28$, for the terminal examination), are remarkably similar to the best fit equations found by Purcell (2007), for Level 8, Year 2 ($y = 0.31x + 44$) and Level 8, Year 3 ($y = 0.32x + 34$) student cohorts. Thus, as with the results of Purcell (2007), the equations indicate that each 10% increase in lecture attendance result in an approximately 3% improvement in examination performance, on average.

In the past, attendance at lectures and laboratories was mandatory at DIT, with a 75% attendance threshold required for students to sit examinations; this reflected a belief that the applied nature of many programmes required such attendance levels. However, as class sizes increased in the 1990's, attendance at lectures became voluntary, partly because of the difficulty of recording attendance on a regular basis, and partly because of the introduction of a more student-centred learning paradigm. Attendance tends to be more rigorously monitored in laboratory classes, with many laboratory classes having a formal mark for attendance, reflecting the belief mentioned above; attendance is also easier to record in these classes, as numbers are smaller than in typical lecture classes. Attendance is likely to remain voluntary at lecture classes at DIT, though a recent staff survey, taken as part of the review of the effectiveness of the quality assurance procedures, reported that 39% strongly agreed and 29% agreed with the statement: "Mandatory attendance thresholds for classes should be introduced" (n=505). In a personal initiative, the author has used the results of this research to communicate to first year students the benefit of attending lectures.

In future work, the author intends to examine the relationship between lecture attendance and examination performance for a Level 8, Year 1 cohort of students for whom he has recently assumed academic responsibility. In addition, for the Level 7 cohort of students which is the subject of this paper, the author intends to report, in a subsequent publication, the relationship between (a) the examination and continuous assessment results for the Electrical Systems subject (b) the terminal examination results in Electrical Systems and the related subjects of Mathematics and Engineering Science (Physics) and (c) how to engage the students more deeply in their learning, using short multiple-choice quizzes attempted as formative assessments in the classroom at the end of each topic explored in the subject.

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