USING STUDENT PERFORMANCE INDICATORS TO IDENTIFY STUDENTS IN DIFFICULTY

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Abstract: The first author is Adviser of Studies for 136 aerospace engineering undergraduate students and is responsible for academic guidance and more general pastoral advice and support.

A system for monitoring class attendance, for first and second-year students, has been implemented to give early warning of students potentially in difficulty. At various points in the semester, students with high absence rates were called for a discussion with the Adviser. This had the advantage, in some cases, of bringing serious personal problems to the attention of the Adviser. However, subsequent attendance rates for these students varied widely with both improvements and declines.

Analysis of attendance and exam results data has shown interesting features. Moderate correlations ($r = 0.6$) have been observed between class attendance and average marks in first and second year. Of the students who failed first semester exams, a high proportion (75%) had been called to meetings regarding their poor attendance. Strong correlations exist between students’ average marks in first and second year, and between second and third-year averages ($r = 0.8$).

Effort has been made to present some of this information to new students during enrolment week to encourage a more conscientious approach to study. The attendance monitoring system has been in place for only three years but initial evidence suggests that, for a particular class, a strong correlation exists between their attendance rates in first and second years. Changing student behaviour is challenging but it is believed that taking an active interest in their progress is appreciated.

Keywords: attendance, exam results, correlation, performance indicator.

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1. INTRODUCTION

The aerospace engineering degree programmes at Queen’s University Belfast include a three-year BEng programme, a four-year MEng programme and associated sandwich programmes (one year spent on industrial placement). Since 2009/10, each year of study counts towards the final degree mark. The relative weightings for Stages 1, 2 and 3 of the BEng degree are 10:30:60 while the corresponding weightings for each year of the MEng degree are 5:15:30:50. The first author is Adviser of Studies for all the aerospace engineering students (136 students in the 2011/12 academic year) and is therefore responsible for academic guidance and more general pastoral advice and support. As part of this duty, a system for
monitoring class attendance, for first and second-year students, has been implemented to give early warning of students potentially in difficulty.

Class attendance was found to be the best known predictor of academic performance following a meta-analysis of data from 90 independent samples representing over 28000 students (Credé, 2010). Moderate correlations were observed between attendance and both performance in an individual course (correlation coefficient, $r = 0.44$) and college final result ($r = 0.41$). The relationship was stronger for science classes ($r = 0.49$). It might be expected that this pattern would be explained by an underlying variable such as student motivation – highly motivated students would attend more classes and achieve better marks – but, surprisingly, relatively weak correlations were found between attendance and student characteristics such as conscientiousness and academic motivation. While urging caution regarding these latter observations given that only a few studies investigated the role of student characteristics, the authors explain the importance of attendance by the importance of extensive contact with information and repeated practice for effective learning. Interestingly, the review concluded that class attendance remains important with no decline in correlation between attendance and grades in recent years even though more and more teaching resources are available online.

A study of 650 students at a UK university also discovered that attendance rate was the strongest predictor of degree result and that absence rates were significantly higher for male students (Woodfield et al., 2006). The evidence highlighted a moderate correlation between student conscientiousness and attendance but it was concluded that greater conscientiousness did not itself lead to better academic results – there was value added within the teaching sessions. Unfortunately, the sample analysed contains students from many different degree programmes and the attendance data refers to seminars and workshops but not lectures.

Romer (1993) agrees that a causal relationship exists to some extent between attendance and performance. His study of economics students at US colleges also showed that attendance was higher in smaller classes and in classes with a significant mathematical component. Incentives to encourage attendance may be considered given the potential impact on academic performance. Rodgers (2002) describes a scheme implemented in a large class of about 200 business and economics students. A student’s module mark was reduced depending on the number of tutorials missed. There was a strong association between attendance and performance. However, with the incentive scheme in place, attendance improved but exam performance did not.

In addition to attendance, Massingham and Herrington (2006) investigated the influence of depth of learning in a third-year commerce module. Students were classified based on the quality and quantity of their participation in class discussion. While a clear association existed between good attendance and a high final mark, the association between class participation and final mark was stronger. The importance of an appropriate study technique was also illustrated by Kember et al. (1996) in their investigation of mechanical engineering students’ study behaviour. Greater class attendance did lead to a higher average score in that year of the degree but the association was not particularly strong.

For engineering students in Ireland, a similar relationship between attendance and academic performance was detected (Purcell, 2007). The attendance data seems to refer to a range of modules across the second and third years of the degree, average attendance being about 68% in both years. The author speculates that the students with poor attendance would benefit
through support in time management and study techniques rather than by making lecture attendance compulsory. Indeed, Moore et al. (2003) observed better attendance and grades when empirical evidence of the importance of attendance was emphasised weekly to a large class of first-year students.

A more limited study of engineering students in a single module demonstrates a strong correlation ($r = 0.69$) between lecture attendance and exam marks, despite lecture notes being available online (Nyamapfene, 2010). This class featured interactive exercises within the lectures; the results seem to indicate the importance of meaningful student engagement during classes. Aldosary (1995) noted that final mark was more strongly correlated with homework performance ($r = 0.62$) than attendance ($r = 0.43$) and therefore suggests focusing on homework and assignment performance to identify students needing academic support.

This paper reports our experiences of monitoring class attendance and using this information to highlight students in difficulty. Correlations between class attendance and module results are presented and students’ attendance rates and results in different years of their degree are investigated. The paper considers whether students benefited from the interventions prompted by the attendance figures.

2. METHODOLOGY

The attendance monitoring system has been in place since 2009/10. Attendance at lectures and tutorials / exercise classes is recorded across a range of modules in the first and second years of the degree. In practice, attendance is not usually recorded when the aerospace students form a subset of a much larger class or when the class is being taught by a lecturer from another School who may be unfamiliar with our system. However, a large data set has been gathered each year. In 2009/10, attendance was recorded at 74% of classes (258 classes) for Stage 1 students and 61% of classes (150 classes) for Stage 2 students. In 2010/11, records were obtained for 51% of Stage 1 classes and 48% of Stage 2 classes. In our courses, marks are not normally awarded for attendance.

In 2009/10, there were 31 students in Stage 1 and 28 students in Stage 2. The corresponding class sizes in 2010/11 were 29 and 32 students respectively. Attendance is not monitored beyond Stage 2. The students who have progressed into third year should be well settled into the university system; also, it is good for their personal development to give them increasing freedom to manage their studies with minimal input from the Adviser of Studies.

Attendance is generally recorded by having students sign a register in class. Clearly there is potential for inaccuracy in the records – a student may sign in an absent friend. In my teaching experience, this happens only to a small degree and the attendance records give a reasonably accurate picture.

The data on the registers is entered, as they become available, into a central spreadsheet and the Adviser of Studies has access to students’ overall attendance rates and attendance records in particular modules as the semester proceeds. Typically he will intervene formally once or twice during the semester, emailing poor attenders and requesting they meet him to discuss their situation. More informal interventions may occur as appropriate, offering advice by email, for example.
3. ATTENDANCE MONITORING – OBSERVATIONS AND EVALUATION

3.1 Correlations between attendance and academic results

Figures 1 – 4 present the average marks and attendance rates for first and second-year students in each semester in 2009/10 and 2010/11. In each case, there is a clear trend – students with high attendance rates tend to achieve high marks and those with poor attendance rates often gain a low average mark – although the data also display much scatter. For example, Stage 1 students in 2009/10 attending 80% of classes obtained first semester averages over the wide range 47% – 76%.

The correlation can be described as moderate. The correlation coefficient, r, was generally in the range 0.56 – 0.64 although an unusually high value (r = 0.80) was observed for Stage 1 in 2010/11. All eight correlation coefficients are statistically significant at the 1% level (and some are significant at the 0.1% level) when considered against the null hypothesis that no correlation exists. Therefore, we can be very confident that a positive correlation exists between academic performance and attendance. While reiterating that correlation coefficient gives a measure of the association between the two variables and doesn’t imply a causative relationship, the trends observed give credibility to the use of attendance records to warn of students at risk of failing exams.

Figure 1: Average mark and attendance rate for Stage 1 students in 2009/10.

Figure 2: Average mark and attendance rate for Stage 2 students in 2009/10.
Figure 3: Average mark and attendance rate for Stage 1 students in 2010/11.

Figure 4: Average mark and attendance rate for Stage 2 students in 2010/11.

3.2 Student attendance and performance in different years
Table 1 lists the class average attendance rate for each semester in 2009/10 and 2010/11. In both years, the new, first-year students demonstrate initial keenness, attending about 80% of classes in the first semester. Their behaviour soon changes with the attendance rate dropping to about 70% in the second semester and continuing at this level through second year.

<table>
<thead>
<tr>
<th></th>
<th>semester 1</th>
<th>semester 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009/10</td>
<td>Stage 1</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Stage 2</td>
<td>73</td>
</tr>
<tr>
<td>2010/11</td>
<td>Stage 1</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>Stage 2</td>
<td>71</td>
</tr>
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</table>

Table 1: Average attendance rates in 2009/10 and 2010/11.
Figure 5 plots attendance rates in first and second year for individual students – those who started Stage 1 in 2009/10. A strong correlation \( (r = 0.83) \) exists showing that a student’s attendance behaviour in first year is likely to be repeated in second year. During the induction day talk to Stages 1 and 2 students in 2010/11, the Adviser of Studies presented the average mark – attendance graphs from the previous year to emphasise the correlation between attendance and results. However, in this particular class, the absence rates of seven students are much worse in their second year while four students have made a good improvement since first year.

Figures 6 and 7 display average marks in different years of the degree for a group of 66 students who started first year during 2006 – 2008. Strong correlations occur between Stages 1 and 2 averages and between Stages 2 and 3 averages \( (r \approx 0.80 \text{ in both cases}) \) demonstrating that a student’s academic achievement does not vary dramatically from one year to the next.

3.3 Interventions based on attendance data

The main purpose of collecting the attendance data was to allow early identification of students potentially in difficulty. Typically, students’ attendance rates were reviewed after week 4 of the first semester and the worst attenders were invited to meet the Adviser of Studies to discuss their situation. An absence rate above 30% made a student likely to be called although the Adviser also used his judgment to determine which and how many students to investigate. It was aimed to have this initial review and offer advice early enough to give students opportunity to recover from their poor start to the semester. A further review and series of meetings occurred after week 8. In the second semester, there was typically just one review of attendance data (at around week 7) due to the Adviser having a greater workload.
About 29% of Stage 1 students and 25% of Stage 2 students didn’t attend the meeting with the Adviser of Studies. Some of those who did attend expressed surprise that their absence rate was so high while others admitted they were missing too many classes. Some stated they had no excuses; others highlighted the impact of extra-curricular activities and part-time work. A few commented that they believed their academic work was under control. Some appreciated the Adviser showing interest in their progress. Importantly, the meetings brought some serious personal problems to the Adviser’s attention. Some students are reticent to take the initiative in seeking help for their problems. The attendance monitoring system and meetings gave opportunity for students to receive advice and support earlier than they might otherwise have done.

Figure 8 examines the change in attendance rate for students who met the Adviser having been identified as poor attenders early in the first semester (week 4). A positive change means their attendance improved in the following weeks of the first semester. A wide variety of reactions occurred – while some seemed to heed the advice, others were perhaps unwilling or unable to change their approach to attending class.

![Figure 8: Change in attendance rate following meeting (positive means improvement).](image)

Table 2 gives the numbers of students invited to meetings with the Adviser due to their poor attendance and subsequent performance in the first semester exams. The number of students failing at least one exam, yet never identified as a poor attender, is very small (numbers in bold in Table 2). This shows that the monitoring system is generally effective in predicting students at risk of academic failure. Of those students noted as poor attenders and called to meetings, around a third to a half go on to fail at least one exam. However, they have been alerted to their detrimental behaviour and have had opportunity to avail of assistance.

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>at least one fail</th>
<th>no fails</th>
</tr>
</thead>
<tbody>
<tr>
<td>called to meeting</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>not called to meeting</td>
<td>4</td>
<td>44</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage 2</th>
<th>at least one fail</th>
<th>no fails</th>
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</thead>
<tbody>
<tr>
<td>called to meeting</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>not called to meeting</td>
<td>1</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 2: Numbers of students in 2009/10 and 2010/11 called to meetings due to poor attendance and subsequent performance in first semester exams.
4. CONCLUSIONS

This paper has reported on a system for monitoring class attendance, for first and second-year students, which aimed to give early warning of students potentially in difficulty. At various points in the semester, students with high absence rates were called for a discussion with the Adviser of Studies. Moderate correlations ($r = 0.6$) were observed between class attendance and average marks in first and second year. Of those students never identified as poor attenders, only a very small number went on to fail an exam. These results suggest that attendance monitoring is an effective means of highlighting students at risk of failure. The system was also beneficial in alerting the Adviser to personal problems experienced by some students. While attendance rates for students receiving advice subsequently varied widely with both improvements and declines, the students have at least been warned and have had opportunity to receive support. Changing student behaviour is challenging – indeed, a strong correlation exists between attendance rates in first and second year for a particular class.

5. ACKNOWLEDGEMENTS

The authors state their appreciation for the work of Mrs Lorna Martin and Mrs Karen Agnew in maintaining the attendance records spreadsheets over the academic year.

6. REFERENCES


