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**HOW WELL PREPARED MATHEMATICALLY ARE OUR
ENGINEERING STUDENTS WHO TRANSFER FROM AN ORDINARY
DEGREE INTO AN HONOURS DEGREE
SUBJECT: TECHNOLOGY EDUCATION**

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ABSTRACT: Students who have received a C3 (55%) or higher in Higher level mathematics in the Irish Leaving Certificate (the terminal secondary examination in Ireland) may enter directly onto a 4-year Honours degree in engineering. Students who have not achieved this level of mathematics have the option of entering onto a 3-year Ordinary degree (Level 7). Upon completion of this students may progress to the third year of the Honours degree. Relatively little work has been done on the transition (articulation) from an Ordinary degree to an Honours degree and in particular the mathematical preparedness of these students. In the third and fourth year of many Honours engineering courses within the DIT it is not unusual to have 30-50% of the students coming from an Ordinary degree background. The majority of these students come from within the DIT while others transfer in from other Institutes of Technology in Ireland. Previous work has shown that students from an Ordinary degree background are more than twice as likely to fail mathematics in their third year of the Honours degree when compared with students who have proceeded directly through an Honours degree programme. In this study we analyse students' performance across all subjects and examine if there is a relationship between mathematical performance in the final year of the Ordinary degree and overall performance across all subjects in the third and fourth year of the Honours degree. In addition, a similar comparison is made with these students mathematics grade on entry to first year and whether this is a determining factor in their success in the in the Ordinary degree and their ability to transfer to the Honours degree.

Keywords: Engineering mathematics, honours degree

INTRODUCTION

There are two distinct routes to an Honours degree (Level 8) in engineering in the Dublin Institute of Technology (DIT). Students with a C3 (55%) or higher in Higher level mathematics in the Irish Leaving Certificate (the terminal secondary examination in Ireland) may enter directly onto a 4-year Honours degree. Students who have not achieved this level of mathematics but have a pass in ordinary level mathematics may enter onto a 3-year Ordinary degree (Level 7). Students who successfully complete this award may apply to progress to the third year of the Honours degree. Up until relatively recently an upper merit (60%) was the minimum required to make this transition. In recent years this requirement has been relaxed with many students with lower marks being offered the possibility of transition upon successful completion of an interview.

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- Selection and peer-review under responsibility of the Organizing Committee of the conference

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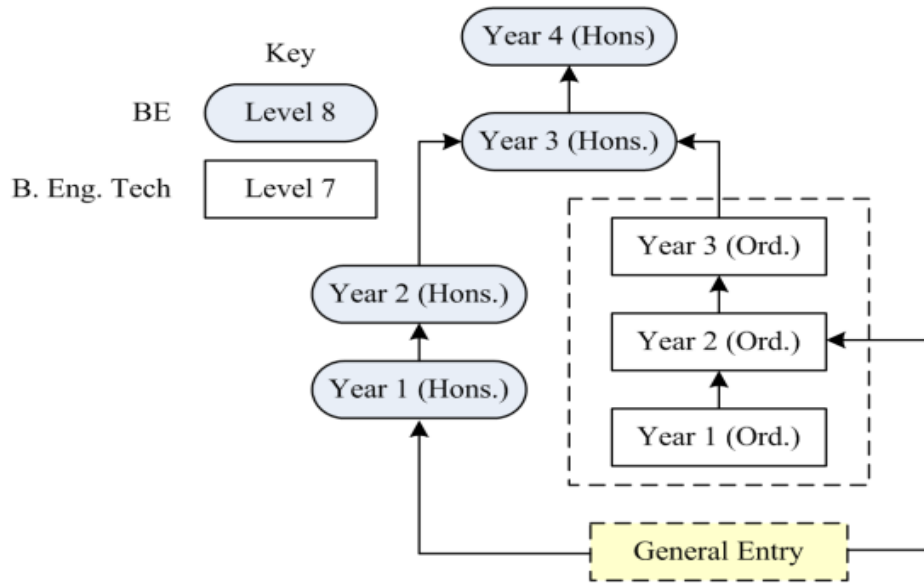


Figure 1: Schematic of the alternative routes to an Honours degree in Engineering in Ireland

Previous work has shown that students from an Ordinary degree background are more than twice as likely to fail mathematics in their third year of the Honours degree when compared with students who have proceeded directly through an Honours degree programme (Carr 2013). In this study we examine the performance of the group of students from the Ordinary degree in mechanical engineering who entered the third year of the honours programme in 2007 and 2008 and who subsequently graduated in 2009 and 2010 respectively.

RESULTS

Table 1: Comparative Performance Of Students Who Transfer Onto An Honours Degree Programme And Those Who Enter Directly From Secondary School

2009 and 2010	Direct Entry to level 8	Entry via Level 7 course
N	85	33
Average mark (Standard deviation)	53.4(18.8)	62.1(8.1)
Number with grade of more than 60%	37/85	27/33
Graduated on time(Complete pass)	62/88	32/33

In table 1 above we show a combined analysis for the combined mechanical engineering classes of 2009 and 2010. There were a total of 85 students who graduated who came from an Honours degree background i.e they had entered the course directly from secondary school. In contrast 33 students graduated who had entered the Honours degree programme after having completed the 3 year Ordinary degree. The average mark of the direct entry students was 53.4 % with a standard deviation of 18.8. In contrast the students who had entered via the ordinary degree had an average of 62.1% with a standard deviation of 8.1%. A two sample t-test was applied to this data and the average mark of the Ordinary degree students was found to be significantly different with $p=0.000$.

In addition we measured the proportion of students who achieved a 2.1 degree or higher. Of the direct entry students 37/84 achieved a 2.1 degree or higher in comparison with the ordinary degree students where 27/33 achieved a 2.1 degree or higher. This difference was found to be significant using two proportion test ($p=0.000$) and the Fisher exact test ($p=0.000$).

Of the students who entered from the ordinary degree background 32/33 graduated on time in comparison with 62/88 who had come through the direct entry route. Again this is significantly different using both the two proportion test($p=0.000$) and the Fisher exact test($p=0.002$)

Maths results

The original motivation for this study was the failure rate in the 3rd year Honours mathematics module. We now show the performance of these students in the mathematics module.

Results for the 2009 and 2010 graduating class

Correlation Coefficient(R^2)	3 rd Level 8 maths R^2 (p value)	4 th Level 8 Maths (p value)	4 th Level 8 Overall (p value)
3 rd year Level 7 Maths	0.139(0.454)	0.533(0.001)	0.57(0.001)

Table 2: Correlation Between 3rd Level 7 Maths Grade, 3rd Level 8 Maths Grade, 4th Level 8 Maths Grade And 4th Year Level 8 Overall

What we see here is little or no correlation between the 3rd year level 7 maths grade and the third year level 8 maths grade with a correlation coefficient of $R^2=0.139$ and $p=0.454$. This is rather worrying. But when we look at the relationship between the 3rd year level 7 maths grade and the 4th year level 8 grade we see a strong correlation ($R^2=0.57$), that is highly significant ($p=0.001$). We are also seeing a strong relationship between the 3rd year level 7th maths grade and their overall performance in the 4th year ($R^2=0.57$, $p=0.001$).

Maths grade as a predictor of success.

Given the strong correlation we see between the maths grade and the overall grade in fourth year should we use the 3rd year Level 7 maths grade to select students for entry onto the honours programme. In this section we compare whether we should use the overall 3rd Level 7 average grade, 3rd year Level 7 maths grade or the 3rd year Level 7 project grade. We see from table 3 below that the 3rd year level maths grade is as good a predictor of overall success in the honours degree as the 3rd year level 7 overall grade.

Correlation Coefficient(R^2)	3 rd Level 7 maths R^2 (p value)	3 rd Level 7 Overall (p value)	3 rd year Level 7 project (p value)
4 th year Level 8 overall	0.57(0.001)	0.585($p=0.000$)	0.308($p=0.08$)

Table 3: Correlation between overall 4th year performance, 3rd year level 7 maths grade, 3rd year level 7 overall grade and 3rd level 7 project mark

CONCLUSION

Several researchers in the U.S. have identified a phenomenon known as “transfer shock” (Cejda, 1994; Lanaan, 2001; and Hills, 1965). Through transfer shock, community college students who transition to a university typically experience a drop in grades for the first semester or two immediately after transfer. Grade point averages will typically recover by the time that students graduate and the dip in grades is typically attributed to the effort it takes to transition from one educational setting to another. We seem to be observing a similar phenomenon in the DIT, whilst there is a temporary dip in the performance of transfer students in the first semester these student quickly recover and there is a very strong correlation between their performance in the ordinary degree and their final performance. The American literature recommends that well-defined articulation agreements between the community college and the university as being critical to transfer student success. At DIT, the faculty teaching the ordinary and honours programs are typically in the same department and, in fact, most faculty teach in both programs. Thus, it appears that conditions are ripe at DIT for successful transition of students between the programs.

In addition we have noticed that these transfer students are outperforming their direct entry comparators, both in overall grade and the percentage who complete the course on time. Further work is required in this area and we hope to follow up this work with focus groups of students who have articulated in the past, along with a focus group of staff who have taught these students on both the ordinary and honours programmes.

REFERENCES

- Carr, M., Ni Fhloinn, E., & Bowe, B. (2013). Core skills assessment to improve mathematical competency, , European Journal of Engineering Education, pp1-12
- Carr, M., Ni Fhloinn, E., Murphy, E., & Bowe, B. (2013). Addressing continuing mathematical deficiencies with advanced mathematical diagnostic testing. M. Carr, E. Ni Fhloinn, E. Murphy & B. Bowe *Teaching Mathematics Applications* 32 (2): 66-75.
- Cejda, B. D. (1994). Reducing transfer shock through faculty collaboration: A case study. *Community College Journal of Research and Practice*, 18, 189-199.
- Hills, J.R. (1965). Transfer shock: The academic performance of junior college transfer. *Journal of Experimental Education*, 33, 201-215.
- Lanaan, F. S. (2001). Transfer Student Adjustment. *Transfer Students: Trends and Issues. New Directions for Community Colleges, Number 114. The Jossey-Bass Higher and Adult Education Series*, pp. 5-13.