The Role of Work-integrated Learning in Academic Performance:

Is there correlation between industrial placements and degree performance?

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Abstract

The significance of industrial work placements (i.e. the work-based component of sandwich degrees) on students' professional development and employability is widely accepted amongst many work-related learning professionals and academics alike. Indeed, the UK government-sponsored report by the Confederation of British Industry (CBI) validates such claims. However in recent times, many work-related learning professionals have begun to explore the assumption that work placements not only improve employability skills, but also academic performance.

This paper considers the view held by practitioners that students undertaking an industrial work placement often graduate with a higher degree classification. This paper builds upon results from more comprehensive longitudinal research from Mandilaras (2004) and Gomez et al. (2004). It also builds upon the previous statistical research compiled by the author as of 2007/8, on a similar but larger cohort of students. However, on this occasion, the statistical analysis is more rigorous so as to ascertain whether a true correlation exists between industrial placements and academic performance.

Using statistical tools such as regression analysis and t-tests, this paper assesses the results of an institutional study of engineering undergraduates at the University of Leicester, with the aim of exploring whether there is a relationship between placement students and higher final degree results.

The analysis offers evidence that suggests an association between completing an industrial placement and achieving a higher degree result in the final year of an engineering degree. However, it also indicates that there is another variable that has a greater impact on determining the degree result.

Introduction

The presence of work-related learning and employability themes within higher education has grown in prominence with the advent of successive government-backed reports. The most recent being *'Future Fit: Preparing Graduates for the World of Work'*, produced by the Confederation of British Industry Higher Education Task Force (2009) and sponsored by the Department for Innovation, Universities and Skills (DIUS). These reports have encouraged the development of work-related learning activity (e.g. industrial placements) in higher education as a means by which to develop students' employability and transferable skills.

In light of such interest, the correlation between industrial placements and students' employability has been comprehensively explored by practitioners such as Bowes & Harvey (1999) and Little & Harvey (2006) amongst others. However there remains a dearth of current literature and research exploring the correlation between placements and final degree attainment.

Amongst the germane literature, research by Mayo & Jones (1985) and the Council for National Academic Awards (Davies, 2003) substantiate claims of correlation. Additionally, the Confederation of British Industry's Higher Education Task Force (2009) reports on the analysis of research from the University of Hertfordshire that concluded with similar findings. The works of Mandilaras' (2004) and Gomez et al (2004) explore this area in greater depth. Using data from the Economics Department, University of Surrey, Mandilaras rigorously explores whether the industrial placement augments academic performance (i.e. increasing the likelihood of the placement student obtaining an upper second or first degree classification). Similarly, Gomez et al. investigate the impact of an industrial placement on Bioscience undergraduate performance at the University of the West of England, Bristol.

Mandilaras' study addresses a host of variables, including gender, nationality and prior study of mathematics and economics, that might otherwise undermine any assertion about correlation. Moreover, Gomez et al.'s study meticulously takes into account variables such as gender, pre-university qualifications and level 1, 2 and 3 aggregate marks (as percentages). Both studies suggest a correlation between placements and final degree results. Mandilaras concludes that

'the statistical analysis offers evidence that participation in the placement scheme significantly increases the chances of obtaining an upper second or higher degree class' (Mandilaras, 2004, p.39).

Whilst Gomez et al comment that

'On average, placement students gain an advantage of nearly 4% in their final year performance' (Gomez et al., 2004, p.373).

In exploring the possibility of correlation, this paper compares the final degree results of engineering placement students with those of their non-placement counterparts at the University of Leicester. The analysis section discusses these results and their implications.

Background: Engineering at the University of Leicester

The Department of Engineering at the University of Leicester is one of the largest departments in the University with approximately 500 undergraduate and postgraduate students and researchers, 40 academic staff and 30 support staff.

The Department has a well-established industrial placement programme giving undergraduates the opportunity to embark upon a full year in industry within the following degree programmes:

- General Engineering
- Mechanical Engineering
- Electrical and Electronic Engineering
- Communications and Electronic Engineering
- Embedded Systems Engineering

Each degree has a Bachelor of Engineering (BEng) course option, with three years of study at university, and a Master of Engineering (MEng) course option, with four years of study at university. The Master course satisfies the academic requirements for incorporation as

Chartered Engineer from the Engineering Council. The Engineering Department has long-standing relationships with a host of engineering employers who have offered placements to Leicester students. Past students have taken up industrial work placements with a host of blue-chip employers such as Toyota, Corus and Caterpillar. Students are assessed on the basis of an industrial placement report that must be submitted on completion of the placement. This assessment is marked on a pass/fail basis.

Methodology

Description of the dataset

The quantitative study maintains a comparable level of scrutiny to that of Mandilaras' work in so much that it takes into consideration important variables. Firstly, it scrutinises the varied academic abilities of students by accounting for their year 1 and year 2 aggregate marks (as percentages) from the degree. Secondly, it factors in the level of study undertaken (those taking degrees at BEng or MEng level). Thirdly, it explores the engineering disciplines studied (e.g. Mechanical Engineering, Embedded Systems, Electrical Engineering etc).

The output variable was the year 3 degree aggregate results and the comparisons of these results between the cohort of students who undertook a year in industry versus those who did not. The rationale for scrutinising year 3 aggregate marks relates to the fact that these are the results attained by students directly after the completion of the year in industry. As such, by comparing the year 3 aggregate marks between placement students and their non-placement counterparts, one can reasonably assume that any difference in attainment is directly related to the experience of a year-long placement. Naturally, it would be naive to assume the placement element could be the only factor in attainment between the two cohorts. This is why this study utilises other variables.

A frequent criticism levelled at research of this nature is the notion that students undertaking a placement year are already high achievers; hence their degree performance has less to do with their industrial year placement, and more to do with their previous academic performance. This study has attempted to counter such claims by including a spectrum of first

year attainment marks (both high and low marks in both groups of students) to counter skewed results.

The final variable was medical evidence. This translates as students who suffered extenuating circumstances such as a bereavement or exceptional financial hardship or any other personal and psychological factors that might interfere with their ability to achieve a good final degree result.

Statistical Approach

For this research, the statistical tools utilised were t-tests and a number of regressions. Distinctions between placement student from that of non-placement students in the statistical analysis were made on the basis of standard variable codes where 0= non-placement and 1 = placement.

The variables utilised for the t-test were that of placement versus non-placement students and the output data (the corresponding year 3 aggregate marks for each of the students). In the regressions, all 7 variables were included as seen in table 1.

Table 1 illustrates all the variables accounted for in the research methodology.

Variable number	Variable description	Regression analysis output or input
1	Year 3 degree aggregate marks (%)	Output
2	Year 1 degree aggregate marks (%)	Input
3	Year 2 degree aggregate marks (%)	Input
4	Degree level: BEng or MEng	Input
5	Placement student vs. non-placement student	Input
6	Engineering discipline (e.g. Mechanical, Embedded Systems etc).	Input
7	Medical evidence	Input

Population Sample

The population sampled comprised of the 2008 cohort of Engineering finalists and MEng pre-finalists; this provided a sample size approaching 60 students (58). Whilst acknowledging that this sample size was smaller than that of Gomez et al. (164 students), Mandilaras (124 students) and indeed our own earlier study over 2007/8 (80 students), the work aimed to build upon our existing study and scrutinise a single year cohort (2008) using more sophisticated statistical techniques (t-tests and regression analysis).

The number of the sample population undertaking a placement was 19, compared with 39 who were not undertaking a placement. In both groups, there was a fair representation of prior attainment. That is to say those whose prior attainment average equated to a 2.2 (50% <= average <59%), a 2.1 (60% <= average <69%) and a first class (>=70%).

Analysis

The t-test provided a breakdown of the group statistics; namely the mean average aggregate year 3 marks of placement students (as a group) and non-placement students (as a group). The t-test also tested the significance of the results.

Table 2 (i) and (ii) illustrates the results gained from the t-test.

Table 2 (i)

Placement (1) vs. non-placement (0)	Group number	Group mean year 3 marks as %
Variable 1 (yr 3 mark) 0	39	60.3359
1	19	71.5842

Table 2 (ii)

Variance assumptions	T-test for Equality of Means Significance (2-tailed)
Equal variances assumed	0.004
Equal variances not assumed	0.001

The purpose for using the t-test was to test the difference of the means of the two groups (placement students and non-placement students). The null hypothesis for this study assumes that the two groups' year 3 attainment/marks are roughly the same. Therefore it suggests that a placement will not improve academic performance.

From table 2 (i) it is observed that non-placement students' (group 0) mean average year 3 marks were 60%, whilst placement students' (group 1) averaged 71%. This illustrates a clear 11% difference in favour of placement students. However to assess whether these results are significant from a probability sense and not just a coincidence, the equality of means aspect

of the t-test needs to be scrutinised. Using the 'equal variances assumed' category (i.e. the null hypothesis), the 2-tailed significance p-value is 0.004. This result suggests strong significance as it is drastically below 0.05; 0.05 being the cut-off point that indicates strong significance. Therefore the t-test suggests that the null hypothesis should be rejected, as the result indicates that there is a genuine difference in the attainment of the two groups, which cannot be explained by pure chance or coincidence alone.

However the t-test did not account for other variables that might impact year 3 attainment. For this reason, a regression analysis was conducted to factor in other variables. The regression results reported in table 3 show that two variables were significant. Variable 3 represented year 2 degree aggregate marks. According to the regression analysis, this variable was the single most significant indicator of likely year 3 academic performance. A p-value of 0.00 was given.

Variable 5 represented placement students versus non-placement students. A p-value of 0.12 was given. Whilst this falls short of the 0.05 cut-off point of strong significance, it is close enough to suggest that some significance exists, but to a lesser extent than year 2 degree aggregate marks (variable 3). As such, both the t-tests and the regressions seem to conclude some degree of positive association between taking an industrial placement and degree performance in the final year. Whilst the rigour of the regression suggests that year 2 result is the most important factor, nonetheless the regression concurs that industrial placements have an impact also. These findings seem to corroborate earlier studies. The other variables appeared to have little/no significance in determining year 3 academic performance.

An area that has not been previously explored is the relationship between extenuating circumstances and students doing a year in industry. This study did not sample a large enough number of students encountering extenuating circumstances, and as such any conclusions drawn are very limited. However the results encourage further exploration in this area as the regression analysis suggested no significant or detrimental impact in attainment by students who encountered extenuating circumstances. This was the case for those who undertook a year in industry as well as those who did not. This might point to a host of plausible

explanations. For example, the University's pastoral support/counselling service is of good quality and thus enables the student to succeed at their studies in spite of challenging circumstances. However, at this interval no further analysis of these results will be explored as this sub-aspect of the research warrants a separate independent study from that which is being investigated in this paper.

Table 3 illustrates the results gained from the regression.

Variable description	P-value (Significance)
Year 3 degree aggregate marks (%)	0.58
Year 1 degree aggregate marks (%)	0.47
Year 2 degree aggregate marks (%)	*0.00
Degree level: BEng or MEng	0.18
Placement student vs. non-placement student	□□0.12
Engineering discipline	0.17
Medical evidence	0.42

(* below 0.05 = strong significance, □□ below 0.15 = significance)

Discussion

Having determined statistically the significance of completing an industrial placement on academic performance, there is justification in exploring the possible causes of this result.

The Confederation of British Industry's Higher Education Task Force (2009) stresses the significance of improved student confidence resulting from a year in industry. In their report they claim

'*increased confidence is widely mentioned by universities, employers and students as a beneficial outcome of work-related learning and formal work placements'* (Confederation of British Industry, 2009, p.17).

However this does not fully explain why a work placement student should go on to attain a better degree result. Others have postulated that metacognition (learning to learn) is responsible for the improved performance of the student returning to their final year of study after their placement. Raelin (2000) identifies metacognition as an inherent value-added trait of work-based learning. It is possible that the nature and environment of an industrial work placement (and contact with professional work colleagues) instils the meta-cognitive skills necessary for personal reflection, development and enriched independent learning. Therefore, on returning to university, the student transfers this new approach to her/his studies and excels.

Wallace (2002) deliberates over possible causes listing several possible reasons, including those undertaking a placement already having a different temperament and higher aspirations to begin with. He also postulates whether the year in industry alleviates the financial burdens, thus enabling the returning student to focus purely on one's studies in their final year. Another hypothesis is that put forth by Mandilaras (2004). Mandilaras identifies some potential explanations for the improved academic attainment of returning placement students. In his paper he asserts

'it is possible that the placement experience enables the students to mature more quickly than they otherwise would. Spending a year working in often competitive environments makes them realise that their future professional development is to an extent, related to their academic performance. Hence their ambition is stimulated, they come back to university more focused and determined to do well' (Mandilaras, 2004, p.48).

Clearly, there is a level of credibility associated with this hypothesis. Anecdotal evidence aside, the belief that a student fully immersed in a professional work context for the duration of a year might then return to their studies with a more mature outlook is highly plausible. Additionally, Gomez et al. (2004) provide further insights that might explain this phenomenon. Gomez et al. postulate

'One simple factor that may be important is that students returning from placement are tackling the rigours of the level 3 study one year older than they would otherwise be' (Gomez et al., 2004, p.382).

Here Gomez et al. suggests the academic improvement of the placement student may stem from the fact that the placement student will be completing their final year studies a year later. The assumption is that the older student is better equipped to perform well in the final year of their degree than their younger, non-placement counterparts. Gomez et al. goes on to say

'Quite often, a placement student undertakes a final year research project in a completely different area to that experienced during their placement, although some....skills will be generic. Therefore, it is more likely that the generic skills of team-working, communication, self-reliance and confidence, time keeping, etc., transfer to their approach to the project. Placement students may also benefit from seeing the practical applications of their studies outside the academic world and therefore relate to their studies with a greater insight (Gomez et al., 2004, p.382).

The insights provided by Mandilaras and Gomez et al. are supported by other areas of research that scrutinise the relationship between industrial placements and transferable/employability skills. For example, Knight & Yorke (2004) refer to the survey that sought the views of employers and recently appointed graduate employees. The findings from this study suggests overwhelming consensus from both cohorts that work placements are a major factor in the development of transferable skills and personal development. It is not difficult to recognise that the application of skills needed in a professional work environment may cross over to those necessary to excel in academia. Indeed, it has been reported by engineering academic staff at the University of Leicester that students returning from a year in industry display an enhanced level of maturity, focus and generic skills, thus giving some weight to the hypothesises put forth by Mandilaras and Gomez et al.

Whilst caution must be exercised concerning the results of this study, due to the dataset size on which they are based, these findings in conjunction with those of Gomez et al, Mandilaras and indeed Wallace (2002) give support for the presence and further development of work-based learning elements in the curricula of universities, not only as a means by which to enhance students' employability, but also as a mechanism by which to possibly augment academic learning.

Conclusion

By utilising data from the University of Leicester's Department of Engineering, this paper has examined the efficacy of industrial work placements on improving academic performance amongst engineering students. Evidently, the findings illustrate a positive association between placements and improved academic performance whilst also suggesting that year 2 academic performance is a better indicator of likely academic performance. The robustness of the statistical evidence is credible, given the use of statistical methods such as t-tests and regressions. However, the study is limited by the sample size. A sample population approaching 60 students leaves a larger margin for error than a larger population size of say 105 plus, when conducting research of this nature. As such, whilst the rigour and methods adopted are highly credible, one acknowledges that a larger population size is required in future to strengthen claims of correlation.

Limitations aside, the findings from this research and that of other researchers provides justification for the presence of quality-assured industrial work placements in academia, as such programmes not only augment the employability of the student, but they also enhance their maturity and academic prowess.

References

Atlay, M. & Harris, R. (2000) *An Institutional Approach to Developing Students'*, Innovations in Education and Training International, 37: p76-81

Bowes, L. & Harvey, L. (1999) *The Impact of Sandwich Education on the Activities of Graduates Six Months Post-Graduation*, Birmingham: Centre for Research into Quality.

Confederation of British Industry (2009) *Future Fit: Preparing Graduates for the World of Work*, London: Confederation of British Industry Higher Education Task Force.

Davies, L. (2003) *Experience-based Learning within the Curriculum – a synthesis study*, Sheffield: Association for Sandwich Education and Training.

Gomez, S., Lush, D. & Clements, M. (2004) Work Placements Enhance the Academic Performance of Bioscience Undergraduates, *Journal of Vocational Education and Training*, vol. 56, no 3, pp. 373-386.

Higher Education Group (2008) *Higher Education at Work: high skills, high value*, Sheffield: Department for Innovation, Universities and Skills.

Kemp, I. & Seagraves, L. (1995) *Transferable Skills – Can Higher Education Deliver?* Studies in Higher Education, 20: 3, pp315-328.

Knight, P. & Yorke, M. (2004) *Learning, Curriculum and Employability in Higher Education*, London: RoutledgeFalmer.

Knight, P. & Yorke, M. (2004) *Embedding Employability into the Curriculum*, York: Higher Education Authority.

Little, B. & Harvey, L. (2006) *Learning Through Work Placements and Beyond*, Sheffield: Centre for Research and Evaluation.

Mandilaras, A. (2004) Industrial Placement and Degree Performance: Evidence from a British Higher Institution, *International Review of Economics Education*, vol. 3, no. 1, pp. 39-51.

Mayo, R. & Jones, and L. (1985) *Proceedings of the Fourth World Conference on Co-operative Education*, pp 428-31, Edinburgh: Napier College.

Moreland, N. (2005) *Work-related Learning in Higher Education*, York: Higher Education Authority.

Nixon, I., Smith, K., Stafford, R. & Camm, S. (2006) *Work-based Learning: Illuminating the higher education landscape*, York: The Higher Education Academy

Raelin, J. (2000) *Work-based Learning: The New Frontier of Management Development*, New Jersey: Prentice Hall.

Tariq, V. & Cochrane, C. (2003) *Reflections on Key Skills: implementing change in a traditional university*, Journal of Education Policy, 18:5, pp481-498.

Tomlinson, M. (2007) *Graduate Employability and Student Attitudes and Orientations to the Labour Market*, Journal of Education and Work, 20:4, pp.285-304.

Tomlinson, M. (2008) *The Degree is Not Enough: students' perceptions of the role of higher education credentials for graduate work and employability',* British Journal of Sociology of Education, 29:1, pp49-61.

Wallace, R. (2002) *A Sandwich Year Can Seriously Damage Your Chances of Obtaining a Poor Degree,* ASET European Conference – Integrating Work and Learning in Europe, Cambridge: ASET