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Student interests and undergraduate performance: the importance of student–course alignment

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There has been a growing interest in the influences on undergraduate performance in recent years as a result of the increasing diversity of students entering third-level education and an ever increasing emphasis on the development of a robust knowledge economy. This paper investigates the influence of students' dominant interest types and prior academic achievement on undergraduate performance in an Irish university. Holland's Self-Directed Search (SDS) interest inventory was completed by 308 students drawn from three, second year undergraduate programmes in engineering, nursing and teaching. The impact of dominant interest types and prior academic achievement on the performance of these students in their second year was then investigated using correlation and linear regression analyses. When combined, student interests and prior academic achievements were found to account for between 38% and 50% of the variance in undergraduate performance for students in these three undergraduate programmes.

Keywords: dominant interest types; prior academic results; undergraduate performance; alignment

Introduction

There are many enduring factors which influence undergraduate student performance at university. These variables include, for example, students' learning styles, prior academic results, levels of motivation, spatial ability, self-efficacy and student personality factors (O'Connor and Paunonen 2007). Many of these variables have previously been utilised in the development of diagnostic tools for predicting undergraduate performance, with varying degrees of success (Abedi 1991; Harackiewicz et al. 2002; McManus et al. 1998; Moruzi and Norman 2002). However, existing research suggests that diagnostic tools for undergraduate performance prove more effective when directed towards specific core disciplines within undergraduate courses, indicating that certain variables have a notable influence on the performance of students in distinct elements of the programme but not in others. For example, research by Potter and Merve (2001) demonstrated a strong correlation between undergraduate engineering students' results in spatial ability tests and their performance in communication graphics modules, while no statistically significant correlation was reported with their overall undergraduate results. As a result of enhanced understanding pertaining to the influences on student learning outcomes in discrete elements of undergraduate programmes, improvements in student

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performance for related disciplines have been identified (McKenzie and Schweitzer 2001; McKinley, Fraser, and Baker 2001; Potter and Merve 2001). However, in an Irish context, there exists a dearth of research into the influence of presage variables (that is, characteristics relating to the pre-university entry period) on undergraduate performance. The selection process for undergraduate courses in Ireland remains predominantly focused on prior academic results in the form of Leaving Certificate points (upper secondary grades). As a result, the majority of research into predicting undergraduate performance in Irish universities has focused on the predictive power of prior academic results and stressed that this factor, despite its many limitations across disciplines, remains the best predictor of undergraduate attainment (Byrne and Flood 2008; Lynch, McConnell, and Hannigan 2006; Lyons 2001; Moran and Crowley 1979). One of the largest studies into predicting undergraduate performance in Ireland, conducted by Moran and Crowley and published in 1979, concluded:

> Despite the limited predictive value of the Leaving Certificate, alternatives such as the Scholastic Aptitude Test seem substantially worse and the prospects for other prediction systems which can equal or improve on the Leaving Certificate seem poor. (Moran and Crowley 1979, 258)

Since the publication of this study, the selection process for undergraduate courses in Ireland has remained predominantly unchanged and, as suggested, research into 'other prediction systems' that improve on the Leaving Certificate has been diminutive. A subsequent report completed by The Commission on the Points System also highlighted that Leaving Certificate results are an incomplete predictor of third level performance noting, 'it is clear ... that entry qualifications are a reasonable, but far from perfect predictor of degree/diploma performance in higher education' (Government Publication 1999, 40). The Points Commission's report outlines significant variances in the predictive power of the Leaving Certificate across disciplines, a limitation supported by the work of Lynch et al. (1999) which suggests that the relationship between Leaving Certificate results and undergraduate performance is 'strongly mediated by a range of factors including field of study' (Lynch et al. 1999, 9). In light of the limited predictive value of the Leaving Certificate as highlighted by the Points Commission's report (Government Publication 1999) and Moran and Crowley (1979), this study aims to assess the strength of an alternative presage variable, that of students' interests. Enhanced understanding of different variables, such as students' interests and their impact on undergraduate performance, has the potential to contribute positively to enhancing student learning outcomes. This hypothesis is based on the subtle yet significant relationship that exists between student interests and their influence on student course choice, the assimilation of information, and undergraduate performance. Through enhanced understanding of the influences on undergraduate performance, it is proposed that more informed teaching and learning strategies can be developed which better align with the student cohort undertaking the programme.

Ability to predict undergraduate performance

International studies also highlight the limitations of prior academic results as a predictor of undergraduate success, with results varying greatly depending on the type

of course, student and undergraduate institution in which the study was undertaken. However, many international studies which compared alternative variables with undergraduate performance suggest that few can equal or improve on the predictive value of prior academic results. An American study conducted by Harackiewicz et al. (2002) on 471 undergraduate psychology students found that previous academic results in the form of Scholastic Aptitude Test (SAT) results accounted for 34% of the variance in undergraduate performance. In a comparable English study conducted by Ferguson, James, and Madeley (2002) on 21,905 undergraduate medical students, previous academic success in the form of GCSE results was found to account for 23% of the variance in undergraduate performance. Both studies, although assessing cohorts from different disciplines, were conducted within the same time period and both employed the use of multiple linear regression analysis.

The results of international studies which assessed the predictive power of alternative presage variables proved to be substantially worse. For example, in a study conducted by O'Connor and Paunonen (2007), students' 'Big Five' personality dimensions were found to account for 4% of the variance in undergraduate performance. By comparison, in the same study students' previous academic results were found to account for 16% of the variance. Both McManus et al. (1998) and Duff et al. (2004) reported that students' learning styles in isolation demonstrated no significant correlation with undergraduate performance. However, Duff et al. did report a significant correlation between prior educational attainment and undergraduate results, accounting for 24% of the variance in undergraduate performance. (All of the aforementioned studies employed the same multiple linear regression analysis strategy.) Although these international studies were conducted within different universities with varying entry systems, their findings suggest that 'prior academic results' remains one of the best predictors of undergraduate performance. However, the highest *R*-square value reported by any of these studies was 0.34 (Harackiewicz et al. 2002), which was much higher than figures reported in similar Irish studies (Byrne and Flood 2008; Lynch, McConnell, and Hannigan 2006). In an Irish context, studies have shown that the correlation between Leaving Certificate points and undergraduate performance varies greatly across programmes (Moore 2004; Moran and Crowley 1979; Morgan, Flanagan, and Kellaghan 2001).

Acknowledging the variances reported across universities and disciplines, this study endeavoured to assess the predictive power of students' interests, a variable seen to span disciplines. As part of this research, students' interests and, in particular, their dominant interest types, were compared to their corresponding second year undergraduate results. This study also compared the impact of students' interests on undergraduate performance to that of prior academic results in the form of their Leaving Certificate points. The predictive power of both these variables is also outlined in this paper. It is hypothesised that as interests are intrinsically linked to undergraduate course choice, the inclusion of interests in this model would result in a generic diagnostic tool that remains reliable across undergraduate programmes (unlike prior academic results). In order for this hypothesis to hold true, a prerequisite assumption to this research is that certain aspects of students' interests are transmitted into their work at the third level, thus affecting their performance. In general terms, this study is predicated on the assumption that when an individual enjoys the tasks they undertake and are interested in the subject matter they study, then it follows that this should be reflected in their academic performance.

In order to measure a student's interests and their alignment with that student's course of study, an interest inventory known as Holland's Self-Directed Search (SDS) was utilised. Although one's interests affect many aspects of an individual's life, interest inventories have predominantly been used only as a career guidance tool in the past (Anastasi and Urbina 1997). Holland's SDS inventory (Holland and Rayman 1986) was utilised as part of this study as it is one of the few interest inventories that can be self administered and to a large extent self assessed. As a result, the inventory can be simultaneously completed by a relatively large sample cohort and is very amenable to online publication. It is also extensive in its remit, comprising 228 items, and is widely recognised as one of the most reliable predictors of career choice and performance (Gottfredson and Jones 1993; Hogan and Blake 1999; Tokar and Swanson 1995). Tests conducted on the reliability of the SDS inventory have shown a median reliability coefficient of 0.82 for high school students and 0.92 for college students (Goldstein and Hersen 2000).

Holland's interest types

As previously outlined, Holland's SDS inventory was utilised as part of this research in place of alternative interest inventories due to its well established reliability, as well as its ability to be self administered. To further facilitate participation, an online version of Holland's SDS inventory was developed and made available to potential contributors to the study. The Self-Directed Search was developed by Holland to identify his six general interest types: Realistic, Investigative, Artistic, Social, Enterprising and Conventional (RIASEC). Many of the alternative interest inventories, such as the Strong Vocational Interest Blank, are based on the foundational work of Holland and also aim to identify these six interest types. Upon completion of the online SDS inventory, participants receive a score in all six interest types. The area in which a participant receives the highest score reflects their dominant interest type, also suggested by Holland (1985) to echo the personality type of that participant. Holland describes the six different interest types as follows:

Realistic (R) – practical, physical, hands-on, tool-orientated;
Investigative (I) – analytical, intellectual, scientific, explorative;
Artistic (A) – creative, original, independent, chaotic;
Social (S) – cooperative, supporting, helping, healing/nurturing;
Enterprising (E) – competitive environments, leadership, persuading;
Conventional (C) – detail-oriented, organising, clerical. (Gottfredson and Holland 1996)

In illustrating the relationship between the six interest types in this theory, a two-dimensional model known as Holland's Hexagon has prevailed as the best representation of vocational interests (see Figure 1). Holland's theory postulates that the six interest types are related to each other in this hexagonal structure (Holland 1985; Plutchik and Conte 1997). Holland's Hexagon represents the spatial organisation of the theoretical connection between the six interest types, reflecting the closeness or distance of the conceptual relationships. Holland suggests that the distances between the six types on the hexagon are 'inversely proportional to the theoretical relationships between them' (Holland 1985, 5); in other words, the further they are apart on the hexagon the less they have in common, as represented in Figure 1.

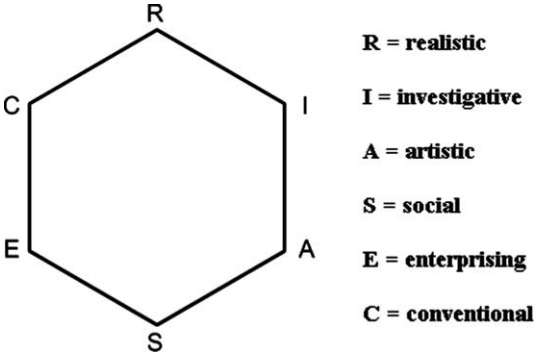

Figure 1. Holland's Hexagon.

As a result, Holland proposes that the correlations for the six adjacent types (RI, IA, AS, SE, EC and CR) should be greater than the correlations for any six alternate types. This theoretical relationship between interest types is important as it significantly contributed to the selection of sample cohorts for this study, as discussed later in this paper.

The link between interests and vocational outcome variables, such as career choice, vocational satisfaction and performance, has been well documented as part of a wider theoretical perspective known as the Person–Environment Fit (Edwards and Cooper 1990), as well as independently through the research of Holland and others (Gottfredson and Holland 1990; Tokar and Subich 1997). However, this paper outlines a novel study which examines for the first time in an Irish context the link between interests and academic outcome variables, such as course choice and undergraduate performance.

Methods

This study benefited from a 'pragmatic research approach' (Onwuegbuzie and Leech 2005) employing the use of both qualitative and quantitative paradigms. While much of this study concentrates on the positivist approach and the analysis of quantitative data, it was also supported by interpretative research methods both pre- and post-completion of the SDS interest inventory. Prior to the completion of the inventory, a preliminary study was conducted on 20 volunteer undergraduate students from the second year of the teacher education programme at the University of Limerick. These students provided a sample cohort on which to pilot the online version of the interest inventory and through focus groups afforded requisite feedback. These focus groups were also employed to qualitatively assess the potential strength of the hypothesis that students' interests have an impact on their undergraduate performance. Upon completion of the SDS inventory by students and the analysis of the data, interviews were also conducted with 10 undergraduate students who had previously transferred out of an engineering course into the teacher education programme at the University of Limerick. Each of the 10 undergraduate students was successfully in their third year of the teacher education programme having started over from first year upon transferring into the course. All 10 students were performing well in their new course and interviews were aimed at assessing their

motivations for the transfer and their perceptions of the impact of dominant interest types on their undergraduate performance in each course.

The recruitment of students as part of the positivist approach to this research study was addressed with acute appreciation for the sensitive data that participants were required to disclose. Therefore full ethical approval was first sought and granted by the University of Limerick Research Ethics Committee prior to the study. Participants were recruited through two forums. Students were first informed about the study and its aims and objectives at the end of one of their second year lectures in early October 2008. Later that week, all students were sent an email requesting their participation in the study. In the lecture and also as an attachment to the email, students were provided with an information sheet which again outlined the study and more importantly the requirements of participants. Students were informed that participation was completely voluntary and that at any stage they could choose to withdraw from the study. Also attached to the email was a consent sheet with a voting button at the bottom, requiring students' consent to access their online student records upon completion of the SDS inventory. Included in the consent form was the guarantee of confidentiality and anonymity for all participants. Students were also informed that upon completion of the interest inventory their individual results would be made available to them via email.

Participants

Based on the outcome of previous research on the link between dominant interest types and performance in specific disciplines, it was decided to focus on second year students drawn from three faculties: engineering, nursing and teaching. Second year students were chosen for this study as previous research has highlighted the significant impact of alternative environmental factors on first year performance and retention, as a direct result of new surroundings and teaching and learning structures (Moore 2004). By the second year, these environmental factors have been shown to be less prominent and therefore this cohort can arguably provide more stable and reliable results. The three faculties from which participants were recruited were selected for comparative purposes based on their dominant interest types. As a result of Holland's research on over 612,000 students across a range of disciplines, including engineering, nursing and teaching, dominant interest types for different vocations were previously established (Holland and Richards 1966). Holland's research suggests that the dominant interest type for engineers is Realistic (i.e. they like working on technical projects and solving 'real-life' problems) and for nurses it is Social (i.e. they like working with people and helping others). Therefore these two subsamples were chosen in order to establish the impact of interests on undergraduate performance for students with opposing interest types, as graphically represented on Holland's Hexagon, discussed previously (see Figure 1). The third subsample from the undergraduate teacher education programme was chosen to further validate findings from the study. Given the nature of their course and resulting occupation, this subsample requires proficient Social skills as well as a strong aptitude for Realistic challenges. It was therefore envisaged that undergraduate teachers would provide an advantageous comparative group with both other subsamples.

Table 1. Homogeneity of participating cohorts.

Cohort	No. of participants	Participation rate	No. of male	No. of female	Average age	Dominant interest type	Average LC points	Average QCA
Engineers	135	45.0%	111	24	19.86	Realistic	474.49	2.97
Nurses	72	44.7%	5	67	21.63	Social	436.56	2.98
Teachers	101	41.9%	56	45	21.19	Social	446.52	2.82

Notes: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

This resulted in a total of 308 undergraduate students from across three different faculties correctly completing the SDS interest inventory. Although more students completed the inventory, only 308 students provided valid results with incomplete and spoiled responses being rejected from the study. The homogeneity of the three subsamples is delineated in Table 1.

The inclusion of undergraduate teachers was also required in order to address the issue of gender imbalance presented by the other two cohorts. For the engineers 82% of participants were male, for the nurses 7% of participants were male and for the teachers 56% were male. Therefore overall 56% of the 308 participants in this study were male. The gender distribution of participants in this study is consistent with national participation rates in undergraduate degree courses. For example, in 2007, 79% of CAO[1] students who accepted engineering courses were male (Patterson et al. 2007). The mean score for the undergraduate performance (QCA) of each cohort involved in this study was consistent with the mean score for their respective programme of study at the time of data collection. For example, the average QCA for the engineering student participants in this study was 2.97 and the average for the entire second year cohort at the time of data collection was 2.93.

Procedure

Students' interests were measured using Holland's SDS interest inventory, with participants receiving scores for all six interest types. The higher the student's score in a particular *type* the higher their interest in that area, thus reflecting a personality type of Realistic, Investigative, Artistic, Social, Enterprising or Conventional (RIASEC). A student's highest score in the six different domains denotes their dominant interest type. All 308 participants completed the online SDS interest inventory.

Students' prior academic performance was assessed based on their Leaving Certificate results in specific subjects, as well as their overall Leaving Certificate points. Students' Leaving Certificate results were accessed through university student records which hold a complete register of prior academic results for every student that entered through the CAO system. Due to the participation of mature students in the study, as well as students who did not enrol through the CAO system, for example, not all 308 participants had Leaving Certificate results on record. Of the 135 engineers, 117 students had Leaving Certificate results on record, in addition to 64 nurses and 92 teachers. Of the 273 participants with Leaving Certificate results on record, all students had completed the Mathematics, English and Irish examinations. French was the only other subject to have a greater than 50% uptake for the Leaving

Certificate across all three groups, with 86 student engineers, 52 student nurses and 65 student teachers completing the French examination. While all subjects studied by participants were compared to undergraduate performance as part of this research, only these four subjects demonstrated statistically significant numbers to warrant highlighting in this study. Students' overall Leaving Certificate points were also compared to their undergraduate performance using correlation analysis. All data were analysed using SPSS. Multiple linear regression analysis was utilised to determine how much of the variance in undergraduate performance was explained by their Leaving Certificate results, as well as by students' interests (data were analysed on a pairwise basis).

Students' undergraduate performance was calculated based on their academic results, which at the University of Limerick is measured using the Quality Credit Average (QCA) system. The QCA system is similar to the Grade Point Average (GPA) system utilised in most American institutions of higher education. The QCA system results in a continuous variable between 0 and 4. If a student receives a QCA of less than 2, then they are deemed to be failing their respective course of study.

Results

The preliminary study conducted on 20 volunteer second year students provided formative feedback on the structure, content and reliability of the SDS inventory, as well as highlighting many potential additional benefits to the study not previously recognised. For example, during interviews subsequent to completing the SDS inventory for the first time, students suggested a strong link between their dominant interest types and the modules they enjoyed and performed strongly in. Many noted that the process of completing the extensive inventory itself served to heighten their awareness of where their interests lie and also what areas and topics truly engage them. This was highlighted by one student who stated:

> The questions on what I liked to do and on what activities I am interested in were a bit of an eye opener. Although they were about everyday things, they were often things I didn't stop to think about ... I found that the things I liked to do were also the things I was good at. I could see this when I was asked to rate my ability in each of the areas in the last part of the survey.

It is this link highlighted by the above student, between student interests, efficacy and performance, that this study aimed to develop and assess.

This preliminary study also resulted in a retest reliability coefficient of 0.89 for the SDS inventory, with a delay between testing of six months. Considering that there are 228 items in the SDS inventory, it is noteworthy that results remained consistent over the six month time-frame, further validating the reliability of the SDS inventory as stressed by previous studies (Goldstein and Hersen 2000; Holland and Lutz 1967; Holland and Richards 1966).

Students' dominant interest types

Students' results from the interest inventory were consistent with Holland's previous findings on the dominant interest types of engineers, nurses and teachers.

Engineering students scored highest in the Realistic and Investigative domains (see Figure 2), reflecting their interest in solving complex problems, completing technical tasks and investigating the world around them. Nursing students scored highest in the Social and Investigative domains reflecting their social and caring nature, as well as the desire to investigate and solve problems impinging on patients. As hypothesised, student teachers scored highest in the Social and Realistic domains, highlighting their similarities to the other subsamples and their potential as a model cohort for comparison, while remaining germane to the overall aims of this study.

Interests compared to undergraduate performance

As predicted, based on the results of previous research focusing on the link between interest types and vocational performance, the relationship between interest types and undergraduate performance, as measured in terms of correlations, varied between the groups of students. However, in general the strongest correlations were observed between students' dominant interest types and undergraduate results. As shown in Table 2, for engineering students there was a significant correlation between both their Realistic and Investigative interest scores and undergraduate performance, with their Investigative results having the highest Pearson correlation value of 0.415 ($p < 0.005$). However, significantly higher correlation values were witnessed between the common dominant interest type of student nurses and teachers with their undergraduate results. For both student nurses and teachers, a significant correlation was witnessed between their Artistic and Social interest scores and undergraduate performance. The highest Pearson correlation for nurses proved to be between their Social interest score and undergraduate performance at 0.629 ($p < 0.005$). Similarly to nurses, the highest correlation for the student teacher cohort was between their

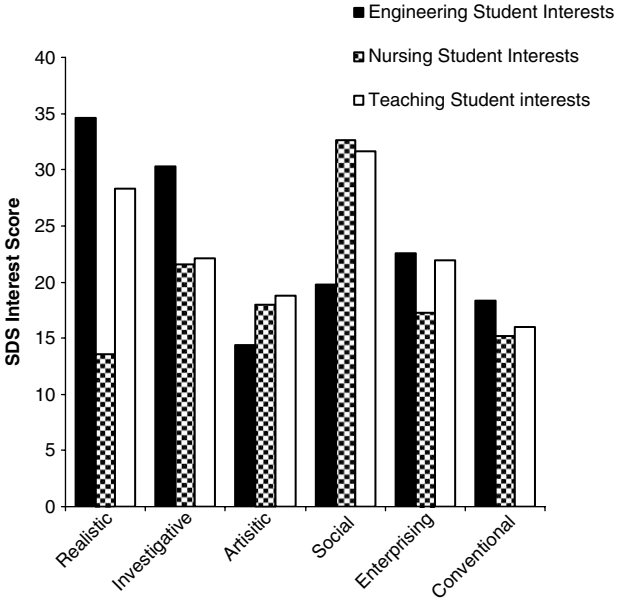

Figure 2. Average student interest scores per cohort.

Table 2. Correlation between interests and undergraduate performance.

	Descriptive Statistics								
	Engineers			Nurses			Teachers		
Interest type	*N*	Mean	σ	*N*	Mean	σ	*N*	Mean	σ
Realistic	135	34.58	5.49	72	14.03	4.17	101	29.22	7.11
Investigative	135	30.33	4.55	72	22.21	6.35	101	21.77	5.92
Artistic	135	14.39	5.85	72	17.97	5.61	101	19.12	6.41
Social	135	19.84	5.34	72	32.63	5.8	101	31.29	5.53
Enterprising	135	22.68	6.96	72	17.71	5.97	101	21.95	6.87
Conventional	135	18.32	5.9	72	13.61	5.7	101	15.61	5.62

	Correlation with Undergraduate Performance		
Interest type	Engineers	Nurses	Teachers
Realistic	0.233**	−0.005	−0.070
Investigative	0.415**	0.278*	0.196*
Artistic	0.026	0.476**	0.414**
Social	0.056	0.626**	0.549**
Enterprising	−0.002	0.181	0.164
Conventional	−0.063	0.223	0.233*

Note: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Social interest scores and undergraduate performance at 0.549 ($p < 0.005$). It is important to note that, while on average engineers scored highest in the Realistic domain, it was their Investigative results that had the highest correlation with undergraduate performance.

In order to test this model a multiple linear regression analysis was performed which resulted in an *R*-Squared value of 0.241 ($p < 0.001$) for engineers, 0.396 ($p < 0.001$) for student nurses, and 0.362 ($p < 0.001$) for student teachers. For undergraduate engineers, it was found that the Investigative domain made the strongest unique contribution to the variance in undergraduate performance with a β-coefficient of 0.226 ($p < 0.018$). Results in the Social domain made the strongest unique contribution for both student nurses and student teachers with a β-coefficient of 0.350 ($p < 0.002$) and 0.332 ($p < 0.01$) respectively.

Second-level results compared to undergraduate performance

Upon analysis, it was found that for undergraduate engineers significant correlations were witnessed between their results in all four second-level subjects and their undergraduate performance, as shown in Table 3. However, no significant correlation was witnessed between the individual second-level subject results of the student nurses and teachers and undergraduate performance. It is important to note that significant correlations of 0.474 ($p < 0.001$) and 0.385 ($p < 0.001$) were also observed for undergraduate engineers between their results in Physics and Technical Graphics and their undergraduate performance, respectively. The number of student engineers

Table 3. Correlation between second level results and undergraduate performance.

	Descriptive Statistics								
	Engineers			Nurses			Teachers		
Second level result	*N*	Mean	σ	*N*	Mean	σ	*N*	Mean	σ
Mathematics	117	78.5	12.19	64	48.49	13.84	92	66.3	17.97
English	117	72.24	15.58	64	71.48	11.77	92	69.89	17.14
Irish	117	65.83	21.09	64	60.94	15.29	92	69.95	15.87
French	86	68.14	15.55	52	65.1	14.26	65	67.85	14.39
Leaving Certificate points	117	474.5	40.59	64	436.6	41.47	92	446.5	42.47

	Correlation with Undergraduate Performance		
Second level result	Engineers	Nurses	Teachers
Mathematics	0.520**	0.014	−0.004
English	0.249**	0.162	0.059
Irish	0.212*	0.053	0.008
French	0.441**	−0.039	0.004
Leaving Certificate points	0.618**	0.180	0.236*

Note: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

who sat the Physics and Technical Graphics examination for the Leaving Certificate was 73 and 47, respectively. No other significant correlations were observed between individual second-level subject results and undergraduate performance for any of the discrete cohorts involved in this study. As shown in Table 3, engineering students' Leaving Certificate points had the highest correlation with undergraduate performance at 0.618 ($p < 0.001$). A small correlation of 0.236 ($p < 0.005$) was also witnessed between the overall Leaving Certificate Points of student teachers and their undergraduate performance.

When tested, the above model was shown to result in an *R*-Squared value of 0.437 ($p < 0.005$) for undergraduate engineers, suggesting that 44% of the variance in engineering students' undergraduate performance was explained by their second-level results. However, the extremely high *p*-values of 0.979 and 0.607 observed for the undergraduate nursing and teaching cohorts would denote that second-level results had no significant impact on the undergraduate performance of these two cohorts. For undergraduate engineers, Leaving Certificate points were shown to have made the strongest unique contribution to the variance in QCA with a β-coefficient of 0.443 ($p < 0.001$).

Combined ability to predict undergraduate performance

In order to assess the combined ability of these two presage variables – students' interests and second level results – to predict undergraduate performance, a third linear regression analysis was performed. For this analysis, students' Leaving Certificate points were included with their six interest scores in a new model. Students' Leaving Certificate points were included in this model as they had the

strongest correlation with undergraduate performance for the second model (shown in Table 3). For the purpose of this model, students' Leaving Certificate points were deemed representative of their prior academic performance. The resulting *R*-Squared values are shown in Table 4. These results suggest that, when combined, students' interest and Leaving Certificate points accounted for 50% of the variance in the engineering students' undergraduate performance, 42% of the variance in the student nurses' performance, and 38% of the variance for the student teachers.

Discussion

For the student nursing and teaching cohorts involved in this study, a significant correlation between their dominant interests and undergraduate performance was witnessed. However, no significant correlation was evident between their second-level subject results and undergraduate attainment. The opposite was true for undergraduate engineers with a stronger correlation witnessed between their Leaving Certificate points and undergraduate performance when compared to their dominant interest types. The lack of a significant correlation between prior individual subject results and undergraduate performance for two of the groups involved in this study is surprising, given the emphasis placed on these results under the Irish higher education entry system. This finding was also replicated in previous studies which equally highlighted limitations in the predictive power of Leaving Certificate results, particularly across courses and disciplines (Moore 2004; Moore and Kuol 2007). While acknowledging that numerous variables will continue to influence undergraduate performance, findings from this study suggest that the alignment between students' interests and course of study, in many cases, is as imperative as meeting the current university entry requirements.

The results of the SDS inventory reflect the interest type for each cohort. Thus, these findings emphasise that engineers are intrinsically interested in both Realistic and Investigative endeavours, and, as such, naturally enjoy completing technical tasks and using critical thinking to solve 'real-world' problems. These characteristics reflect the archetype of a successful engineer, as well as being sought-after traits by industry (Lang et al. 1999). Therefore it is natural to assume that these characteristics will be of benefit to an undergraduate engineer and that the strength of these characteristics would be echoed in that student's performance, as supported by findings from this study. Similarly, the dominant interest type for student nurses and student teachers was Social, reflecting their cooperative, supportive and often creative qualities (Boyle et al. 1991). Again, such characteristics are actively required of practising nurses and teachers. The strength of these characteristics was also echoed in the undergraduate performance of both these cohorts. On average, all three cohorts' interests reflected the requirements of their potential careers, as previously

Table 4. Summary of regression on combined model.

Cohort	*R*-square value	
Undergraduate engineers	0.500	$(p < 0.0005)$
Undergraduate nurses	0.418	$(p < 0.0005)$
Undergraduate teachers	0.378	$(p < 0.0005)$

suggested by Holland (1985). However, they also accounted for a significant proportion of the variance in their undergraduate performance. It is therefore suggested that students' interests and their alignment with their respective course of study operate as either an expansive or constraining element in their willingness to assimilate information relating to that course. Although students' dominant interest types and their interest in their respective course of study are distinctly different factors, this research would suggest that they are both strongly related. Just as previous research has highlighted significant links between interest types and vocational performance and satisfaction (Holland 1985), these findings suggest that similar links exist between student interest types and undergraduate performance and, moreover, course satisfaction, as highlighted during the interpretative stage of the research.

Subsequent to the collection of student interest data, interviews were held with 10 undergraduate students who had previously transferred out of an engineering course into an alternative course at the University of Limerick. During these interviews, students frequently highlighted a lack of interest in the material and/or a misalignment between their interests and course of study as influential factors in their decision to transfer out of that engineering course:

> I just didn't feel that the course suited me. There was far too much theory and not enough practical, hands-on modules. When studying engineering at school (second-level) it was the practical projects that I enjoyed completing not the theory. I expected the course to have more lab-based modules. (Student C)

> I failed a few exams and wasn't enjoying the course. It was my own fault. I missed a lot of lectures and labs, but I just wasn't interested in the course. But I really like the course I'm studying now. (Student F)

While the interviews also highlighted other personal and psychosocial reasons for students transferring out of an engineering course, it was clear that for many students a misalignment between their interests, undergraduate pedagogy and course content had an impact on their decision to transfer. It is noteworthy that of the 10 students interviewed, eight had failed one or more modules during their previous course of study and all 10 students were now successful honours students in their third year of study in the teacher education programme. All 10 students also completed the SDS inventory and their results showed that their interests were more closely aligned with the teacher education course than with the engineering programme. The 10 students scored highest in the Social and Artistic domains, replicating the average results for the 101 student teachers previously accessed. When asked why he believed he was doing better in his new course of study, one student stated:

> To start with I found college hard, I was a bit homesick and I didn't like the course. So I said I'd transfer and if I didn't like the new course I'd drop out. But thankfully I really enjoy the teacher course. I much prefer the material covered and I especially enjoy the course work. Over the last few years the course has got harder but I find the material very interesting, especially this semester. (Student A)

It is clear from this student's statement that although from his perspective other variables had a significant impact on his performance in the undergraduate

engineering course, by transferring into the teacher education course he gradually escaped his desire to 'drop out' of third-level education. By his own expression, this was largely influenced by his levels of interest in the course and material covered, as well as the enjoyment derived from studying and completing course work on the teacher education programme. The SDS results for Student A also predict that his interests are more aligned to a teacher education programme than an engineering degree. Therefore this research places greater emphasis on student–course alignment and the importance of student interest types not only in undergraduate performance but perhaps also in student course satisfaction, as suggested during interviews with transferee students. While the link between interest types, vocational performance and satisfaction is expounded by the theoretical framework of the Person–Environment Fit, this research would suggest that similar links exist between interest types, undergraduate performance and satisfaction.

Implications for undergraduate pedagogy

The results from this study suggest that a significant percentage of undergraduate performance for each cohort was explained by presage influences, a finding which has further implications for undergraduate pedagogy. Given that presage variables continue to influence student performance at university, it follows that they cannot be ignored when designing teaching and learning strategies. Student interests and, in particular, their dominant interest types, expose the possibility for improvements in undergraduate pedagogy for all three groups in this study.

These findings suggest that undergraduate courses that fail to engage with students and to stimulate their interests could have a negative impact on student learning outcomes and possibly even result in increased attrition rates. Recent studies have sought to achieve a balance between some of the historic aims of higher education in passing on received knowledge, while also providing a space for students to actively engage with the material they are studying (Tormey and Henchy 2008). Research by Tormey and Henchy (2008) concluded that undergraduate students responded positively to teaching and learning strategies that encouraged student engagement, shared decision making, critical thinking and dialogue.

The use of teaching and learning strategies that engage students and cater for the complex, multifaceted nature of learning within primary and secondary level education has been well documented (Dunphy 2008; Moody 2009; Wideen, Mayer-Smith, and Moon 1998); however, at higher education level, teaching is usually described in terms of having an in-depth knowledge of the subject matter and the ability to skilfully present it – in other words, the emphasis is usually placed on content knowledge and presentation (Saroyan and Amundsen 2004). While these are important attributes of effective teaching, they do not successfully describe the art of teaching since generic skills cannot be considered as unrelated to, or independent of, subject matter. As a result, traditional teaching and learning strategies often fail to engage students (Saroyan and Amundsen 2004). Such focus on content transmission fails to acknowledge the personal influences on learning outcomes, such as students' interests. This can often be to the detriment of student motivation and, as suggested by the results of this study, can have a negative impact on students' overall performance. It is therefore suggested that the acknowledgement of students' dominant interest types in the design of teaching and learning strategies could

result in enhanced student learning. Such a shift in focus also requires the acknowledgement of alternative pedagogies. For example, engineering students scored highest in the Realistic and Investigative domains suggesting that they enjoy completing technical tasks and solving complex 'real-life' problems. This supports a recent shift in engineering pedagogy towards the integration of more Problem and Project-Based Learning (PBL) (Akinoglu and Tandogan 2007). Such learning strategies encourage the development of teamwork skills, as well as creative and critical thinking, attributes that were also reflected in the interest scores of the undergraduate nursing and teacher cohorts.

Link between student interests, course choice and performance

While the correct alignment between students' interests and undergraduate pedagogy is influential in students' undergraduate performance, the correct alignment between students and their course of study is perhaps more important and more difficult to address once students have entered their respective course of study. The University of Limerick has recently begun to recognise the importance of student–course alignment and, as a result, student movement between engineering courses during the first year of study is often supported in an attempt to ameliorate student–course alignment for the benefit of the student. Since this study took place in 2008, and supported by other research conducted in the university, UL has responded by introducing additional common-entry courses for the engineering, science and nursing degree programmes, allowing students to specialise at a later stage (typically second year). Two of these common entry courses will run for the first time in the 2010/2011 academic year. The movement (internal transfer) of students between alternative disciplines, such as the transfer of students from an engineering course to a nursing course, however, remains for many impracticable. This is due to the prerequisite knowledge required by many courses as outlined in the selection process, for example, the requirement for a minimum of a C3 in higher level mathematics for most engineering courses. Therefore it is imperative that the correct support and direction is provided for students in determining where their dominant interests lie, especially during the decision-making process prior to completing their final course choice. Since the formal establishment of a Guidance and Counselling Service in Irish second-level schools in 1966, this has largely been the responsibility of the school Guidance Counsellor. However, in a study conducted by McCoy et al. (2006), which included 15 case-study schools, many Leaving Certificate students were reported as being 'less than satisfied' with the guidance they had received from the school Guidance Counsellor. While some students were broadly satisfied with the support they received during the decision process, others were critical of 'the information and advice they received on post-school options' (McCoy et al. 2006, 139). The study also found that 18% of students left second-level education without receiving any advice from their Guidance Counsellor. The work of McCoy et al. in conjunction with the findings from this study strongly suggest that enhanced student–course alignment, and in turn course satisfaction, necessitates greater support and guidance for students at the second level.

Limitations of this research study

The average response rate for the three cohorts involved in this study was 44%. However, no statistically significant difference was witnessed between the average undergraduate performance of the participating students, when compared to the results of the entire undergraduate cohort in each of the three courses. Average results from the SDS inventory also compare well with Holland's results (Holland and Richards 1966) on much larger sample sizes. This would support the validity of the sample cohorts in this study as an accurate reflection of the respective student cohorts. However, this study compared students' interests and prior academic results to a system of accessing undergraduate performance known as the Quality Credit Average (QCA). Other institutions of higher education in Ireland employ alternative systems of evaluating students. Other systems may produce alternate results. Therefore while these results are an accurate reflection of the interest types and the corresponding undergraduate performance of second year students at the University of Limerick, it is vital that further research, involving larger student cohorts and across different universities, is conducted.

By its nature this study was simply an analysis of variance and, unlike experimental designs, variables were not deliberately manipulated or controlled but described as they naturally exist. As a result, although the findings from this study suggest improvements in undergraduate performance can be achieved through better student–course alignment, further research is required to confirm this theory.

Conclusions

Findings from this study suggest that, for some students, correct alignment between individual interests and course of study was as important, and in some cases more important, than prior academic results. This invokes two forms of argument; in the first instance, it can be argued that the current undergraduate selection process in Ireland is an inaccurate generalisation of future performance. This is a limitation supported by the Points Commission's report, especially in relation to variances across fields of study (Government Publication 1999). A long-term recommendation would focus on an enhanced selection process that respects the complex nature of education and reflects supplementary student characteristics which are influential in undergraduate performance. What should constitute matriculation is too lengthy and complex an argument to address in this paper. However, this research has highlighted that other variables have a significant impact of student performance. The employment of prior academic results in the matriculation of students is consistent with the majority of international undergraduate selection processes. However, the current Irish matriculation system remains somewhat insensitive to the wide range of variables that influence student learning outcomes.

In the second instance, this research suggests that certain presage variables are responsible for the construction of a series of perceptual schemata, the importance of which in the subsequent structuring of education at the third level cannot, without oversimplification, be rejected. The development of such perceptual schemata mediates one's perceptions and motivations for a particular course. As a result, findings from this study have shown that the alignment between students' interests

and course of study can have a significant influence on undergraduate performance. Results from interviews with students who transferred out of an engineering course also suggest that poor alignment between their interests and course of study was an influential factor in their decision to leave the course. Therefore the provision of suitable support and guidance structures for students during the decision process on apposite third-level courses based on their dominant interest types must be further developed. It is also essential that the internal movement and transfer of students between courses be supported wherever possible, to ensure student–course alignment and course satisfaction.

Finally, while previously in an Irish context only utilised as a predictor of vocational performance and satisfaction, the use of the SDS interest inventory proved advantageous in this study in predicting undergraduate performance. However, as transpired from interviews with 20 volunteer students, for many the completion of the SDS interest inventory also served to promote introspective reflection, helping to highlight for the first time their dominant interest type.

Note

1. The Central Applications Office (CAO) acts as a national clearing-house for the vast majority of applications to undergraduate courses.

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