Irish Journal of Education, 2017, xlii, pp 28-66.

AN EXPLORATION OF VARIATION IN SUBJECT GRADING, STUDENT SUBJECT SELECTION AND OUTCOMES IN THE LEAVING CERTIFICATE EXAMINATION

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Results of a subject pairs analysis (SPA) showed that higher severity of grading indices are associated with 'more difficult' Leaving Certificate examination subjects such as Chemistry, Physics and Mathematics whilst lower indices are associated with 'easier' subjects such as Construction Studies, Art and History. However, there was no clear evidence of any systematic selection of subjects by students in order to maximise CAO points. Severity of grading indices were closely related to the academic ability of the group of students sitting a subject. Students who did well in the Leaving Certificate examination overall tended to more often select subjects that the SPA suggests are 'more difficult', whilst students who did less well tended to more often select subjects that the SPA suggests are 'easier'.

INTRODUCTION

The Leaving Certificate examination (LCE) is the terminal examination for post-primary senior cycle in Ireland. It is used both to certify student achievement and, predominantly, for selection to third level. Students can sit subjects at one of two levels, Higher or Ordinary, and additionally, in the case of Mathematics and Irish, at Foundation level. Students generally sit seven or eight subjects. For selection to third-level, the best six grades are awarded points by the Central Applications Office (CAO), a limited company set up by the Irish universities but now also processing entry to Institutes of Technology and Colleges of Education. CAO points are awarded to grades on a sliding scale for Higher and Ordinary level, with a greater weighting assigned to Higher level. In addition to the established LCE, students may take the Leaving Certificate Vocational Programme (LCVP). LCVP students are required to take at least five LCE subjects plus the Link Modules, effectively a sixth subject, that is awarded CAO points at the lower end of the Higher-level scale and the upper end

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of the Ordinary-level scale. Students have a choice of subject (and level). However, mainstream school students are generally required to study English, Irish and Mathematics plus a modern language. Choice is also restricted by the availability of the subject at the school they attend. Since 2012, 25 bonus CAO points have been awarded to Higher-level Mathematics grades D3 and above.

In 2017, a new grading system was introduced, reducing the number of grades at each level from 14 to eight. As a result, CAO points are now available for a Higher-level grade 7 (for students gaining between 30 and 39 percent of the available marks). This grade is broadly equivalent to the old E grade which did not attract points. Only Mathematics Higher-level grade 6 (the old D2 and D3 grades) or above are awarded the 25-point bonus.

Variation in grading between LCE subjects has been a concern because the grades awarded in different subjects are treated as equivalent in selection to third-level education. There has also been a concern that subjects in the state examinations differ in their difficulty and in the grades awarded and that these differences influence student subject choice. The Task Force on the Physical Sciences (2002) reported a decline in the take-up of science subjects among upper-secondary students since the early 1990s. It raised questions about the mathematical competency of second-level students and the problems this posed for participation in science, technology, engineering and mathematics (STEM) courses at third level, with such courses often operating below capacity. The issue of student choice is also relevant here. While personal interest and ability, or the need for specific STEM subjects for college courses or later careers, were motivating factors in participation, the report found that "Many Leaving Certificate students say they did not choose physics or chemistry because of the difficulty of the subjects. They also agreed that they would be more likely to choose these subjects if it was easier to get good Leaving Certificate grades and if the subjects involved less mathematics" (p. iv). Regarding mathematics, the report noted that "Students' perception of the difficulty of mathematics and their poor performance in the subject both act as barriers to participation and success in the sciences at second and at third level" (p. vii).

Two studies of LCE data conducted by the Educational Research Centre (Millar & Murphy, 2002; Kellaghan & Millar, 2003) provide evidence that students who sat Mathematics, the sciences and modern European languages did less well in these subjects compared to other subjects that they sat. Both studies used Subject Pairs Analysis (SPA). This approach takes a pair of subjects and calculates the grade in each subject for all students who took the

two subjects. Then, it compares a subject with every other subject it was taken with. The average of these differences gives an estimate of the relative difficulty. A number of issues have been raised with regard to SPA (Coe, 2007) which will be dealt with later. Coe, Searle, Barmby, Jones and Higgins (2008) used SPA along with other statistical approaches, including latent trait and other regression models, and found "agreement across models was generally high" (p. 2). They also concluded "from the evidence we have presented that the sciences are both objectively harder and widely perceived to be so" (Coe et al., 2008, p. 135). Such subject differences appear to be consistent over time (Ofqual, 2015).

The Economic and Social Research Institute (ESRI) conducted a longitudinal study of post-primary students as they progressed from junior to senior cycle and from senior cycle to life after school (Smyth & Calvert, 2011; Smyth, Banks & Calvert, 2011). While liking or being interested in a subject were important factors in subject selection, "Considering it easy to do well in a subject or receiving good marks in these subjects were important factors for the majority, and considered very important by more than a quarter" (Smyth & Calvert, 2011, p. 105) of Fifth-year students. Subjects such as languages, Mathematics and Home Economics were considered difficult by more than half of Fifth-year students (Smyth & Calvert, 2011). Modern European languages, Biology, Mathematics and Irish were viewed as difficult by more than half of Sixth-year students (Smyth, Banks & Calvert, 2011). There were some differences in perceptions between male and female students, and between subjects, depending on level.

There continues to be a concern that perceptions of subject difficulty influence student choice of Leaving Certificate subjects. "There is a perception that some subjects are marked more leniently than others are and that, by taking these subjects, students are more likely to get higher grades" (Coolahan, Drudy, Hogan, Hyland, & McGuinness, 2017, p. 87). Coe et al. (2008) also felt that differences in subject difficulties, in a situation where subjects were treated as being equivalent, was unfair. "What is not clear, however, is whether such unfairness actually changes people's behaviour" (Coe, Searle, Barmby, Jones & Higgins, 2008, p. 135). In response to these concerns, the State Examinations Commission (SEC) requested the Educational Research Centre to investigate the relative difficulties of a range of LCE subjects and to examine whether there was evidence of students strategically selecting subjects to maximise CAO points. The results of this investigation are presented in this paper.

ANALYSES AND DATA

The analyses reported here fall into three main parts. The first is a subject pairs analysis, following on from work conducted by Kellaghan and Millar (2003) on data from LCE 2000 and LCE 2001. This analysis also looks at the resulting estimates of subject difficulty (Severity of Grading indices) and compares them to an input measure of student ability i.e., student performance on the JCE (using the Junior Certificate Overall Performance Scale score). The second part is an analysis of how subject selection is associated with an outcome measure (CAO points), together with an analysis of the degree to which LCE subjects contribute to CAO points and of which subjects are taken alongside other subjects at Higher and Ordinary level. The third is an analysis of whether subject selection is associated with stronger or weaker performance in the LCE.

All of the analyses are based on data that were made available by the SEC for LCE 2013 and for the 2010 and 2011 Junior Certificate examinations (JCE). Data were matched between the examinations using students' Personal Public Service (PPS) numbers and were anonymised prior to analysis.

In 2013, a total of 52,767 students sat the LCE. Of these, 29,440 (55.8%) matched to JCE 2010 and 17,901[1] (33.9%) matched to JCE 2011. PPS numbers were missing for 1,237 (2.3%) while a further 4,198 (8.0%) of the 2013 LCE cohort did not match up to any JCE data.

The numbers sitting each subject were compared against the published SEC LCE 2013 and JCE 2010 and 2011 data (www.examinations.ie). CAO points calculated from the LCE data were compared against the published CAO LCE points for 2013 (www.cao.ie). Some small differences were observed that appear to be a result of the published CAO points having been calculated before the incorporation of any changes due to appeals. The published CAO points do not take into account the bonus points for taking Mathematics at Higher level. In this paper, CAO points calculated using the data provided by the SEC also follow this approach.

[1]Nine students were matched to both JCE 2010 and JCE 2011.

RESULTS

1. Severity of Grading Indices and Performance on the JCE

Subject pairs analysis (SPA) involves a comparison of the mean grade students were awarded in one subject with the mean grades they were awarded in one or more other subjects. For example, the LCE grades of all students who took both Higher-level English and Higher-level Mathematics might be looked at. If the grades awarded to this common group of students in the two examinations differ, one explanation is that one subject has been graded more or less harshly than the other. The analysis can be extended so that all candidates who take any pair of subjects are identified and the mean grades that they were awarded in each of the two subjects are compared. For each individual subject, the difference between the mean grade awarded in this subject and the mean grade awarded to the same students in the comparison subject can be averaged across all the comparison subjects. This yields, for each subject, an average mean difference which we refer to as the subject's *Severity of Grading Index*. In the analysis for this study, 16 subjects that had been selected for an earlier study conducted by Kellaghan and Millar (2003) were included to allow for a comparison of subject difficulties over time.

Candidates' grades in each subject were converted into numerical points: A1=1; A2=2; B1=3; B2=4; B3=5; C1=6; C2=7; C3=8; D1=9; D2=10; D3=11; E=12; F=13; NG=14. For each pair of subjects the mean grade for both was then calculated and the difference between the pairs of mean grades recorded. The final severity of grading index for each subject is given by the mean of these mean differences between a particular subject and the 15 comparator subjects.

Figure 1 shows the severity of grading index for 16 Higher-level subjects in LCE 2013 and for the same (or predecessor) subjects in 2000 and 2001. A negative value for the severity of grading index shows that, on average, students were awarded higher grades in a subject than on the comparison subjects (i.e., 'easier' subjects). A positive value shows that students were awarded lower grades in a subject than on the comparison subjects (i.e., 'more difficult' subjects). At Higher level, students tended to be awarded a lower grade in Mathematics, Chemistry, Physics, Accounting and French than in the 15 comparator subjects. On the other hand, students tended to be awarded a higher grade in Construction Studies, Design & Communications Graphics, Home Economics, Art and Geography. While the magnitude of the differences between subjects has varied, the direction of the differences has generally remained the same – only Irish goes against this general pattern.

Figure 2 shows severity of grading index for 16 Ordinary-level subjects in LCE 2013. At Ordinary level, students were awarded lower grades in Chemistry, Mathematics, French, Irish, German, Physics, Biology and Accounting than in other subjects. Conversely, students tended to be awarded higher grades in History, Art, Geography, Design & Communication Graphics, Business, Home Economics, Construction Studies and English. As was the case at Higher level, the direction of the differences in LCE 2013 is similar to those found for LCE 2000 and LCE 2001.

It needs to be asked whether the SPA actually measures subject difficulty per se or some other quality of students taking particular subjects? As noted above, we were able to match 2013 LCE students to their 2010 or 2011 JCE grades. Similar to the calculation of CAO points, a measure of Junior Certificate performance (the JCE Overall Performance Scale (JOPS), see Table 1) involves allocating numerical values to the alphabetical grades awarded in the examination for a candidate's seven best subjects (Kellaghan & Millar, 2003). Values are weighted relative to the level at which an examination was taken with Higher-level subjects awarded higher scores than Ordinary-level subjects. The maximum JOPS score is 84.

Table 1
Junior Certificate Examination Overall Performance Scale (JOPS) Scores

Higher level	Ordinary level	Foundation level	OPS score
A			12
B			11
C			10
D	A		9
E	B		8
F	C		7
	D	A	6
	E	B	5
	F	C	4
		D	3
		E	2
		F	1

Figure 1
Differences between the Mean Grade for Students in a Target Subject and the Mean of the Means of the Same Students in Other Subjects They Took in the LCE Higher Level, 2000, 2001, 2013

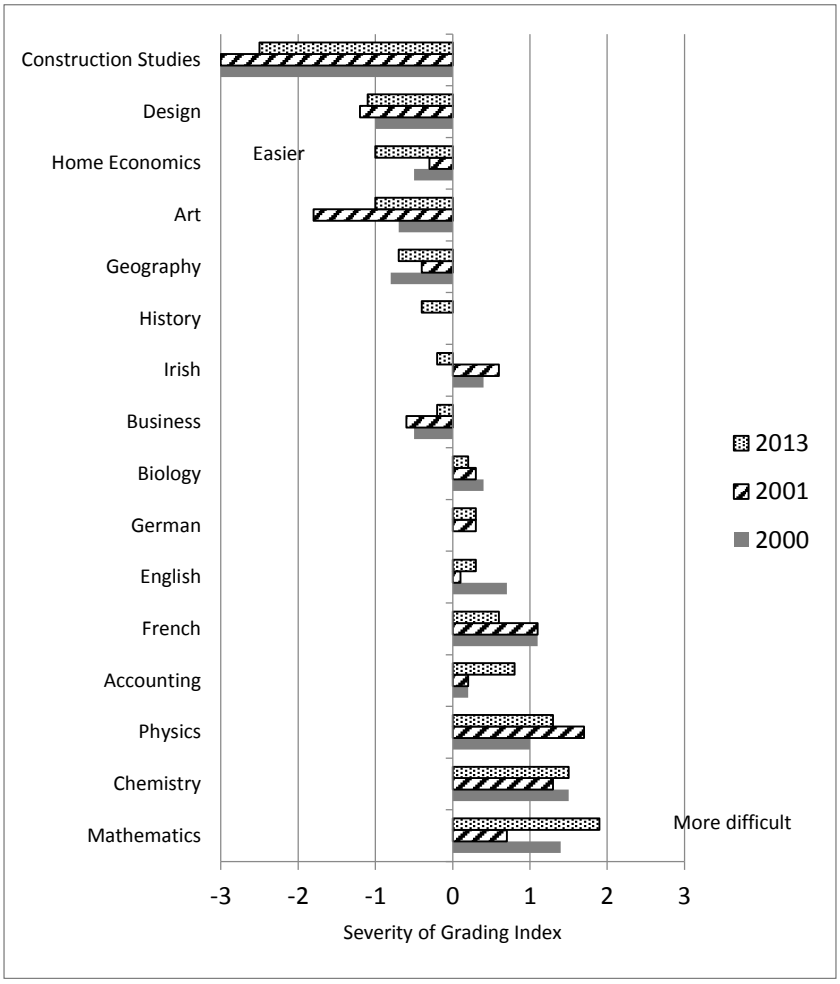


Figure 2

Differences between the Mean Grade for Students in a Target Subject and the Mean of the Means of the Same Students in Other Subjects They Took in the LCE Ordinary Level, 2000, 2001, 2013

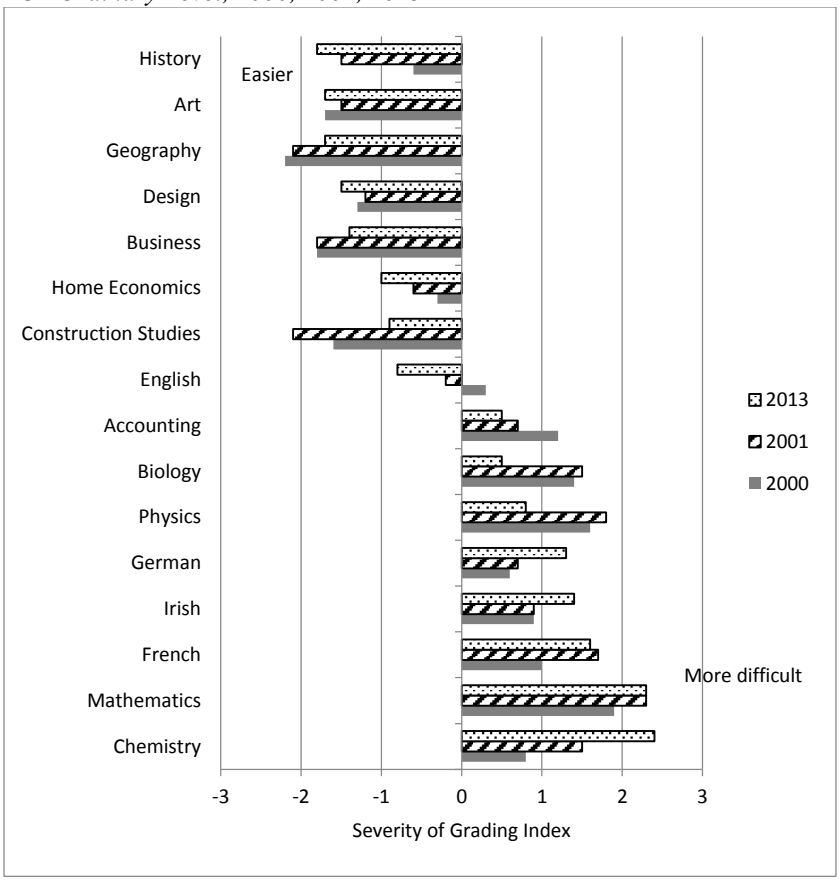


Figure 3 shows a plot of the relationship between the severity of grading index derived from the SPA of 16 Higher-level subjects against the mean JOPS score of the students who went on to sit those subjects at Higher level in LCE 2013. Figure 4 shows the same plot for the 16 Ordinary level LCE subjects. It can be seen that subjects that were taken by students with high overall achievement scores (JOPS) (presumably more-able students) tended to be the subjects associated with high severity of grading indices, while subjects taken by students with low overall achievement scores (weaker students) tended to be the subjects with low severity of grading indices. This suggests that the SPA is not simply measuring the relative difficulty of subjects but may be measuring, in some sense, differences in the general academic ability of the cohort of students selecting a particular subject at a particular level.

2. Subject Selection and Contribution to CAO Points

Is a student's choice of subject influenced by the 'difficulty' of subjects and does this change depending on achievement levels? The subject choices of students at different levels of achievement are now examined using another measure of general academic ability – in this case an outcome measure, CAO points achieved.

While the previous analyses used data from all students, the analyses that follow use only data for students who took at least six subjects that were eligible for CAO points. Students sitting fewer than six CAO points-eligible subjects (about 10% of all students sitting the LCE 2013) are presumably not primarily interested in gaining CAO points for entry to third level. A total of 47,465 students, 90.0% of all students who sat LCE 2013, are included in the following analyses.

Restricting consideration to students who sat at least six CAO points-eligible subjects, Table 3 shows the percentage of these who sat each of 19 Higher level subjects. The table also breaks this information down by each of 12 outcome categories, in terms of the achieved CAO points of candidates. The shaded cells show where a subject is over-represented in comparison to the percentage of students taking the subject overall. For example, 14.1% of students sat Higher-level Chemistry. However, Higher-level Chemistry was taken by 18.8% of students who achieved a CAO points score of 405-450 points and by 62.8% of students who scored 555-600 CAO points. Compare this to Higher-level Construction Studies which was taken by 13.4% of students overall. The latter was taken by 9.8% of students who achieved a

Figure 3

Relationship between 'Severity of Grading Index' and Mean JOPS Scores, LCE Higher Level, 2013

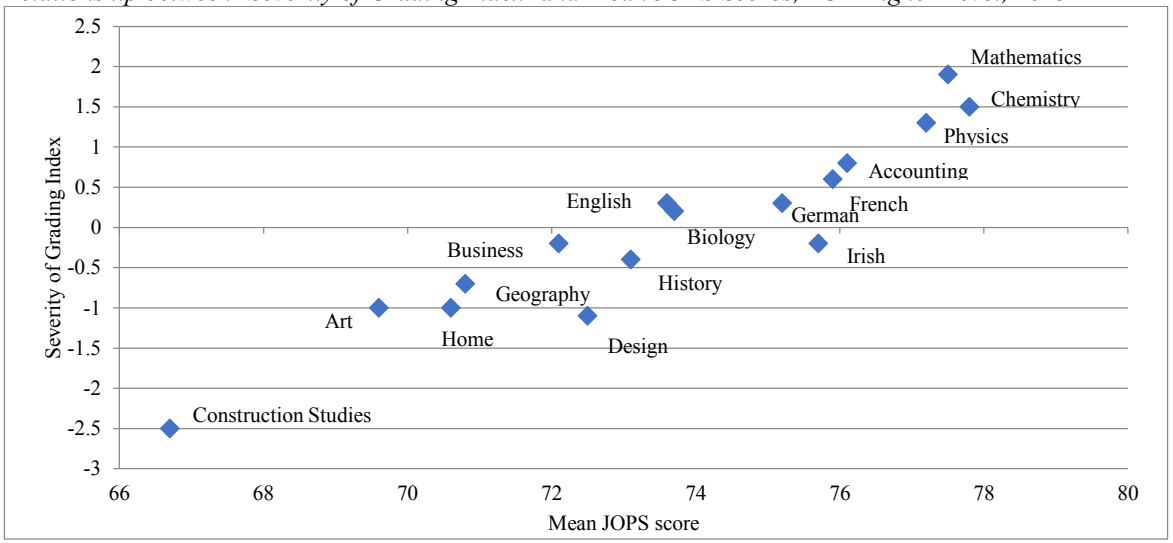
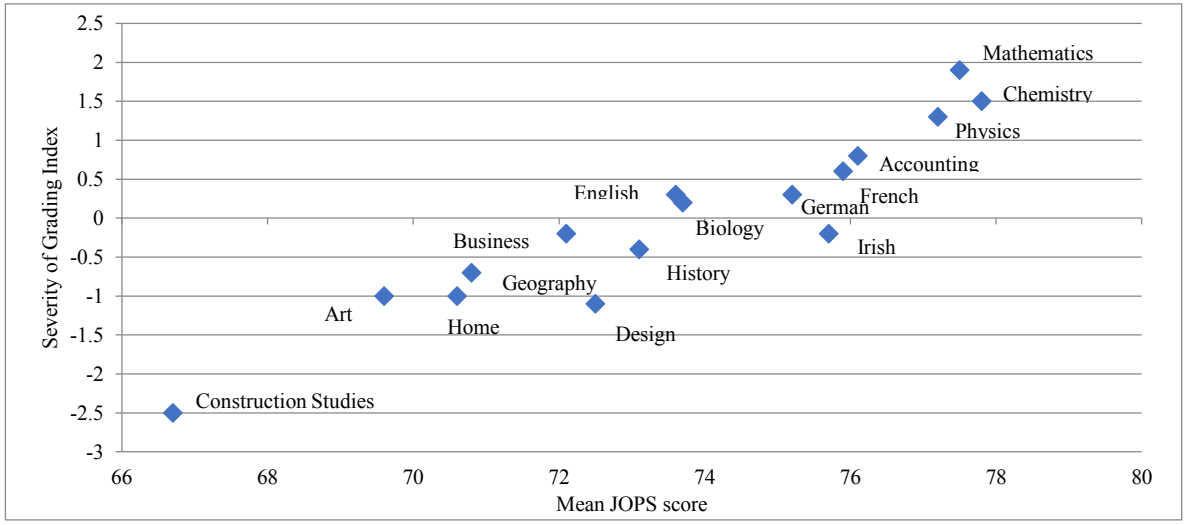


Figure 4
Relationship between 'Severity of Grading Index' and Mean JOPS Scores, LCE Ordinary Level, 2013



CAO points score of 405-450 points and by 1.7% of students who scored 555-600 CAO points. This means that Chemistry is over-represented in the subject-selection preferences of these categories of student, while Construction Studies is under-represented. The extent to which the shading for a subject is to the right hand side of Table 2 indicates the degree to which that subject is disproportionately favoured by students of higher overall achievement; subjects are sorted in terms of the ratio of the percentage who sat the subject overall to the percentage who sat the subject in the highest CAO points category (555-600).

Table 2 also shows the percentage of students who took a subject at Higher level as well as the percentage who took the subject at all levels (including Ordinary level, and in the case of Mathematics and Irish, Foundation level). So, looking at Chemistry, 14.1% of students sat the subject at Higher level and 16.9% in total including the 2.8% of the cohort who took the subject at Ordinary level. In this case we see that most students taking Chemistry did so at Higher level. This is true for all subjects apart from Mathematics and Irish where the majority of students who sat these subjects did so at Ordinary level.

Comparing Table 2 to Figure 1 (above) it is apparent that 'more difficult' subjects (in terms of the severity of grading index) tended to be taken more often by students who did better in terms of the outcome (CAO points). The first four subjects in Table 2 (Chemistry, Physics, Mathematics and Accounting) are the four 'most difficult' subjects in Figure 1. The last four subjects in Table 2 (Geography, Art, Home Economics, and Construction Studies) are four of the five 'easiest' subjects in Figure 1. These four subjects tended to be taken less often by students who achieved higher CAO points in LCE 2013.

Table 3 shows the percentage of students who sat at least six CAO points-eligible subjects who took the Link Modules[2] or sat each of 19 Ordinary level subjects. This table again breaks this information down by each of 12 outcome categories, in terms of the achieved CAO points of candidates. The shaded cells show where a subject is over-represented in comparison to the percentage of students taking the subject overall. In contrast to the Higher- level subjects shown in Table 2, Ordinary-level subjects tend to be comparatively over-

[2] The Link Modules are part of the Leaving Certificate Vocational Programme (LCVP). The LCVP was introduced in 1994 and is intended to promote the vocational dimension of the established LCE. Students are required to take at least five LCE subjects plus the Link Modules. Up to and including LCE 2017 the Link Modules were awarded CAO points on the basis of 70 points for a Distinction, 50 points for a Merit or 30 points for a Pass.

represented where students performed less well overall. Only for Irish, French, English, Mathematics and the Link Modules do we see comparatively higher percentages taking a subject at Ordinary level and achieving CAO points at the higher end of the range. As with Higher level, the subjects indicated by the SPA (Figure 2) as being more harshly graded (e.g. German, Irish, French, Mathematics and Chemistry) tended to be taken more often by groups of students that include those who performed better overall in the examinations. Subjects that the SPA flagged as being more leniently graded (e.g. History, Art, Geography, Design & Communication Graphics and Business) tended to be taken more often by groups of students who performed at the lower end of the range in the examinations overall.

These findings are not consistent with a suggestion that students who take 'easier' subjects perform better overall than students who sit 'more difficult' subjects but do support the earlier finding that certain subjects are taken more often by more academically-able students.

Table 2

Percentage of Students Taking Each of 19 Subjects at Higher Level by CAO Points Score, LCE 2013[1]

Subject	CAO points range												n	%	% all levels[2]
	0-50	55-100	105-150	155-200	205-250	255-300	305-350	355-400	405-450	455-500	505-550	555-600			
Chemistry	1.5	2.1	1.5	1.6	2.1	4.2	6.7	12.0	18.8	26.8	41.6	62.8	6709	14.1	16.9
Physics	0.9	1.3	1.5	1.0	1.8	3.5	5.9	9.6	13.8	18.7	26.4	40.7	4810	10.1	13.4
Maths	1.7	1.3	1.1	1.4	2.6	4.9	12.5	24.9	42.4	59.4	76.4	88.6	12956	27.3	98.4
Accounting	0.6	0.3	0.5	1.4	1.8	3.5	5.9	9.3	12.2	15.3	18.0	20.3	3919	8.3	11.5
Irish	0.2	1.1	2.9	3.8	6.6	11.1	23.0	39.0	54.4	67.3	73.6	76.1	16249	34.2	86.1
French	1.1	1.5	2.0	3.1	5.1	9.9	21.6	36.5	46.8	56.3	62.2	64.2	14151	29.8	52.4
Spanish	0.0	0.8	0.3	0.8	1.3	2.7	4.8	7.7	9.8	11.1	12.2	12.3	2951	6.2	10.0
German	0.4	0.6	1.0	1.2	2.4	4.3	7.7	11.4	14.4	14.9	16.4	17.9	4315	9.1	13.8
Music	0.2	1.6	3.3	4.9	7.0	9.3	10.6	12.5	15.3	18.7	20.2	19.8	5632	11.9	12.6
Biology	9.4	8.7	9.9	14.1	23.6	37.5	53.1	63.3	65.7	68.5	69.3	68.6	23272	49.0	63.2
English	7.7	8.4	14.4	23.5	38.6	57.2	75.2	87.5	93.2	94.8	94.4	92.7	33004	69.5	98.9
History	4.1	3.5	5.5	5.7	10.3	14.3	16.9	19.5	21.6	21.9	21.2	19.0	7702	16.2	22.0
Design	1.9	1.8	2.1	3.2	5.7	8.8	10.6	10.8	9.9	9.6	8.9	8.3	3968	8.4	10.7
Ag. Sci.	3.6	2.4	3.1	5.1	8.8	13.4	16.1	16.6	15.9	13.3	11.3	9.3	5916	12.5	15.0
Business	3.9	5.0	7.0	9.5	14.9	21.9	29.8	32.8	32.5	29.0	25.6	17.5	11520	24.3	32.9
Geography	11.3	12.2	17.1	27.8	39.9	46.4	51.8	49.8	47.4	40.9	33.7	23.3	19495	41.1	48.9
Art	5.1	6.8	11.2	15.1	20.0	21.4	19.4	16.6	15.9	13.7	9.7	7.2	7548	15.9	18.9
Home Ec.	3.6	4.1	6.9	11.2	18.2	23.8	24.4	23.7	20.8	18.6	11.8	7.0	8823	18.6	23.3
Con. Stud.	7.3	7.6	12.8	18.4	21.2	21.3	17.5	14.5	9.8	6.1	2.9	1.7	6346	13.4	15.4

[1]The shaded cells show where a subject is over-represented in comparison to the percentage of students taking the subject overall. For Chemistry 14.1% of all students taking six or more CAO points-eligible subjects took the subject. However, 62.8% of students who gained 555-600 CAO points took Chemistry.

[2]This column shows the percentage of all students who took the subject. So, 14.1% of all students taking six or more CAO points-eligible subjects took Chemistry at Higher level. A further 2.8% took the subject at Ordinary level (Table 3, below).

Table 3

Percentage of Students Taking Link Modules and 19 Subjects at Ordinary Level by CAO Points Score, LCE 2013[1]

Subject	CAO points range												n	%	% all levels
	0-50	55-100	105-150	155-200	205-250	255-300	305-350	355-400	405-450	455-500	505-550	555-600			
Link Modules	32.5	34.8	36.6	38.9	39.8	40.8	39.8	36.1	28.3	20.5	11.1	4.8	15210	32.0	32.0
Irish	42.6	55.4	58.7	63.2	66.2	68.2	60.7	48.0	34.8	24.4	19.0	15.3	22641	47.7	86.1
French	31.5	33.3	37.8	38.0	37.8	35.6	28.1	18.4	11.6	7.4	5.3	4.7	10738	22.6	52.4
English	91.9	91.2	85.3	76.1	60.8	41.9	23.5	11.5	5.3	3.4	4.0	5.1	13924	29.3	98.9
Mathematics	63.6	64.9	71.6	80.3	87.2	89.9	84.7	72.3	55.1	38.4	22.0	10.6	31240	65.8	98.4
Spanish	4.3	5.0	6.8	6.7	6.7	6.5	4.8	3.0	1.8	0.7	0.4	0.5	1797	3.8	10.0
German	8.1	7.7	7.6	8.3	8.6	8.4	5.9	3.3	1.6	1.2	0.9	0.4	2213	4.7	13.8
Physics	6.6	6.4	4.7	5.1	5.8	5.7	4.5	2.8	1.2	0.4	0.3	0.1	1532	3.2	13.4
Accounting	6.2	9.3	6.4	6.5	6.5	5.9	3.6	2.2	1.0	0.2	0.0	0.1	1558	3.3	11.5
History	26.1	24.1	22.8	18.2	12.5	7.2	2.9	1.0	0.3	0.1	0.0	0.1	2743	5.8	22.0
Ag. Sci.	10.3	11.9	11.1	8.4	6.5	2.8	0.8	0.2	0.0	0.0	0.0	0.0	1223	2.6	15.0
Art	21.0	22.3	16.5	10.3	4.6	1.4	0.5	0.2	0.0	0.0	0.0	0.0	1411	3.0	18.9
Biology	45.0	45.4	44.2	42.2	34.1	22.1	10.2	2.9	0.9	0.3	0.0	0.0	6744	14.2	63.2
Business	35.8	31.7	30.6	26.5	20.9	12.5	4.5	1.4	0.3	0.2	0.0	0.0	4105	8.6	32.9
Chemistry	6.9	5.0	4.5	4.7	5.1	4.6	4.0	2.1	1.1	0.5	0.1	0.0	1328	2.8	16.9
Con. Stud.	21.2	17.0	11.7	6.4	2.9	0.6	0.2	0.0	0.0	0.0	0.0	0.0	962	2.0	15.4
Design	8.4	9.3	8.3	7.5	5.1	3.2	1.2	0.5	0.1	0.0	0.0	0.0	1099	2.3	10.7
Geography	42.6	43.3	38.7	27.9	16.1	6.3	1.7	0.2	0.1	0.0	0.0	0.0	3705	7.8	48.9
Home Ec.	23.1	24.2	23.0	18.2	9.5	3.3	1.0	0.3	0.0	0.0	0.0	0.0	2213	4.7	23.3
Music	4.9	4.1	2.9	2.6	1.5	0.6	0.1	0.0	0.0	0.0	0.0	0.0	333	0.7	12.6

[1]The shaded cells show where a subject is over-represented in comparison to the percentage of students taking the subject overall. 32.0% of students taking 6 or more CAO-points eligible subjects took the Link Modules. However, only 4.8% of students who gained 555-600 CAO points took the Link Modules.

The previous analysis looked at whether students who did well in the LCE were more likely to take 'easier' subjects. Here we investigate whether or not 'easier' subjects contribute to a student's CAO points more often and 'more difficult' subjects contribute less often.

In calculating CAO points, grades are converted to a numeric value and then the best six are summed together to give a total. In making this calculation, where, say, a student was awarded five C2 grades and two C3 grades at Higher level, it doesn't matter in which two subjects the C3 grades were awarded. Nor does it matter which of the two C3 grades are counted and which are omitted. In the current analysis, all subjects that could have contributed to the CAO points total are included. So, in the example just given, seven subjects would be flagged as having contributed to the CAO points score for the student described, rather than six. Tables 4 and 5 show how often Higher- and Ordinary-level subjects contributed to students' CAO points scores. The tables also break this information down by each of 12 outcome categories, in terms of the achieved CAO point scores of candidates.

In Table 4 we see the number of students who sat each of 19 subjects at Higher level, the number of students whose grade in each subject contributed to their CAO points total, and the percentage of students whose grade in each subject contributed to their CAO points. The shaded cells show where a subject contributed more frequently than the subject contributed overall. Thus, performance on Higher-level Music contributed to the CAO points total for 99.0% of all students who took the subject but for 91.6% of the students who scored in the range 555-600 CAO points. For eight of the 19 Higher-level subjects, a student's grade contributed to the CAO points total for 95% or more of students. For another seven subjects, more than 90% of students sitting the subject received a grade that contributed to that student's CAO points total. Four subjects, Physics (87.3%), Accounting (87.0%), Chemistry (84.8%) and Mathematics (78.7%) contributed less frequently to CAO points totals.

Table 5 shows the same information as Table 4, this time for Ordinary level, along with the LCVP Link Modules. In contrast to the same subjects at Higher level, grades at Ordinary level were somewhat less likely to contribute to students' CAO points. However, grades in four subjects (Music, Geography, Art and History) still contributed for more than 95% of the students taking them, while grades in another four (Business, Home Economics, Design & Communications Graphics and Construction Studies) contributed for 90% or more of the students taking them. Ordinary-level Mathematics is the only subject for which a student's grade contributed to CAO points for fewer than

half of students sitting the subject. However, French (58.7%), Chemistry (58.6%) and Irish (53.5%) also contributed comparatively rarely.

It should come as little surprise that subjects contribute to a student's CAO points total very often. CAO points are calculated on the best six grades and few students sit more than seven or eight CAO points-eligible subjects. Nor should it be surprising that Higher-level subjects contribute more often than Ordinary-level subjects, given the different weighting attached to grades from the two levels applied by the CAO. However, one might ask whether the comparatively low contribution of Mathematics or other subjects at Higher and Ordinary level suggests that these subjects are graded more severely than others? To answer this we need to know something about the context of subject selection within and across students.

As noted above, when calculating CAO points, a student's Higher-level, Ordinary-level or LCVP Link Modules grades are converted to a numeric value and then the best six are summed to give a total points score. Given the greater weighting of CAO points for Higher-level grades, when compared to CAO points awarded for Ordinary-level subjects or for the Link Modules, the degree to which subjects are taken side-by-side with other Higher- or Ordinary-level subjects is likely to have a bearing on how subjects contribute to a final CAO points score. As we have seen, LCE Higher- or Ordinary-level subjects differ in terms of the general academic achievement of the students taking them. The next analysis looks at how frequently a particular subject, taken at Higher or Ordinary level, is taken with other Higher-, Ordinary- or Foundation-level subjects or with the Link Modules, within and across students. In this instance, we are not looking at *what* other subjects are taken, merely at the *level* at which other subjects are taken. For example, for students who sat Higher-level Mathematics, we count how many of their *other* subjects were taken at each level. The percentage of subjects taken at each level is then calculated for each student and averaged across all students who took Mathematics at Higher level.

Table 4

Contribution to CAO Points by Each of 19 Higher-Level Subjects, LCE 2013[1]

Subject	CAO points range													
	0-50	55-100	105-150	155-200	205-250	255-300	305-350	355-400	405-450	455-500	505-550	555-600	n	n cont.[i]	% cont.
Music	0.0	95.0	94.7	99.4	99.7	100	100	99.9	99.9	99.5	97.5	91.6	5632	5578	99.0
Art	12.5	60.7	89.5	96.3	98.8	99.7	100	99.9	99.6	98.8	96.7	88.9	7548	7400	98.0
Con. Stud.	0.0	61.7	86.7	96.6	99.2	99.8	100	99.9	99.7	100	100	100	6346	6204	97.8
Home Ec	0.0	9.8	53.8	87.2	96.4	99.2	99.7	99.8	100	99.5	98.9	95.9	8823	8581	97.3
Geography	1.9	26.0	66.3	87.6	97.5	99.1	99.9	99.9	99.7	99.4	97.9	96.0	19495	18956	97.2
Design	11.1	18.2	47.9	78.9	93.4	98.1	99.6	99.7	99.9	97.9	97.5	95.6	3968	3840	96.8
Irish	0.0	78.6	89.4	96.1	99.6	99.1	99.7	99.4	98.4	95.9	93.2	88.4	16249	15714	96.7
Spanish		40.0	57.1	61.5	79.6	93.6	95.0	98.4	96.3	96.4	95.4	93.5	2951	2812	95.3
History	0.0	14.0	38.6	74.9	86.8	95.0	99.0	99.1	99.1	97.9	95.3	91.6	7702	7309	94.9
English	5.6	45.6	71.7	86.1	94.0	97.6	99.4	99.4	97.8	93.7	87.2	75.7	33004	31306	94.9
German	0.0	0.0	31.8	53.8	69.6	85.8	95.1	97.6	98.1	96.6	95.0	95.5	4315	4082	94.6
French	40.0	26.3	45.7	50.5	65.7	86.0	93.8	96.2	95.6	93.1	92.7	92.5	14151	13157	93.0
Ag. Sci.	0.0	10.0	22.2	47.4	76.9	91.4	96.7	99.1	98.7	97.7	97.2	94.5	5916	5486	92.7
Business	0.0	4.9	10.6	37.2	67.6	91.2	97.3	98.9	98.9	98.8	98.6	94.2	11520	10647	92.4
Biology	0.0	2.8	15.0	27.5	53.7	80.9	93.6	97.2	97.5	98.3	98.9	99.0	23272	21192	91.1
Physics	0.0	6.3	8.8	8.6	31.6	54.9	79.9	91.6	90.7	91.5	92.9	95.4	4810	4198	87.3
Accounting	0.0	0.0	18.2	10.4	25.6	52.2	80.9	88.7	92.6	92.3	96.3	97.1	3919	3409	87.0
Chemistry	0.0	0.0	11.4	7.4	22.0	50.0	71.5	83.4	88.5	88.8	91.7	96.2	6709	5688	84.8
Mathematics	0.0	6.3	7.7	27.7	44.0	70.3	87.8	89.9	84.5	76.1	71.6	73.7	12956	10202	78.7

[1]The shaded cells show where a subject contributed to CAO points more often than the subject contributed overall. A student's grade in Music contributed to CAO points for 99.0% of students who took the subject at Higher level. The Music grade contributed to CAO points for 100.0% of students who gained 305-350 CAO points and for 91.6% of students who gained 555-600 CAO points.

Table 5

Contribution to CAO Points by Link Modules, 19 Ordinary-Level Subjects, LCE 2013[1]

Subject	CAO points range														
	0-50	55-100	105-150	155-200	205-250	255-300	305-350	355-400	405-450	455-500	505-550	555-600	n	n cont.[ii]	% cont.
Link Mod.	11.2	44.1	71.0	86.3	92.9	94.9	89.4	82.5	60.6	44.0	16.5	1.5	15210	11689	76.9
Music	91.3	96.0	98.5	98.9	98.4	100.0	85.7	33.3					333	323	97.0
Geography	74.4	95.1	98.6	98.9	99.1	98.5	92.7	87.5	71.4	0.0	0.0		3705	3581	96.7
Art	83.7	96.7	99.2	98.0	95.9	98.7	96.6	75.0	66.7				1411	1362	96.5
History	74.6	91.2	97.9	98.0	98.1	96.8	94.6	81.7	80.0	40.0		0.0	2743	2610	95.2
Business	62.9	87.7	96.3	97.8	97.5	97.9	95.4	84.0	63.2	22.2			4105	3870	94.3
HOME EC.	48.1	91.3	95.5	98.2	96.8	96.0	95.1	69.6	33.3				2213	2064	93.3
Design	56.4	76.5	92.1	96.8	95.9	94.6	89.0	76.5	80.0	50.0	0.0		1099	995	90.5
Con. Stud.	65.7	88.1	95.5	94.9	93.6	87.1	84.6	100.0					962	866	90.0
English	76.2	93.1	98.3	98.2	96.2	92.4	84.2	66.3	43.3	17.6	2.4	0.0	13924	12327	88.5
Biology	28.1	59.0	82.8	90.9	90.3	88.1	81.7	58.7	40.0	6.7	0.0		6744	5525	81.9
Accounting	20.7	46.1	61.2	77.4	88.0	85.5	84.4	76.6	65.7	18.2		0.0	1558	1183	75.9
Physics	25.8	51.9	73.8	82.5	85.0	82.7	82.9	70.9	48.2	13.0	0.0	0.0	1532	1143	74.6
Ag. Sci.	27.1	57.1	74.5	82.6	80.7	73.5	55.1	43.8	0.0	0.0			1223	884	72.3
Spanish	10.0	62.3	85.8	92.9	85.4	82.8	76.2	47.7	27.8	12.2	0.0	0.0	1797	1285	71.5
German	31.6	47.4	67.6	83.6	87.2	79.9	74.6	52.7	24.8	2.9	0.0	0.0	2213	1512	68.3
French	24.5	55.4	75.5	83.9	80.0	71.0	58.6	40.2	14.2	2.4	0.6	0.0	10738	6307	58.7
Chemistry	9.4	32.3	51.5	59.5	75.2	71.6	60.2	55.6	36.7	17.2	50.0		1328	778	58.6
Irish	36.7	71.4	83.8	85.8	82.1	71.8	54.8	34.0	15.8	3.5	0.3	0.0	22641	12109	53.5
Mathematics	10.4	33.5	53.2	64.5	65.4	59.5	48.8	34.9	18.6	6.1	1.3	0.0	31240	13435	43.0

[1]The shaded cells show where a subject contributed to CAO points more often than the subject contributed overall. A student's grade in the Link Modules contributed to CAO points for 76.9% of students who took the Link Modules. The Link Modules grade contributed to CAO points for 94.9% of students who gained 255-300 CAO points and for 1.5% of students who gained 555-600 CAO points.

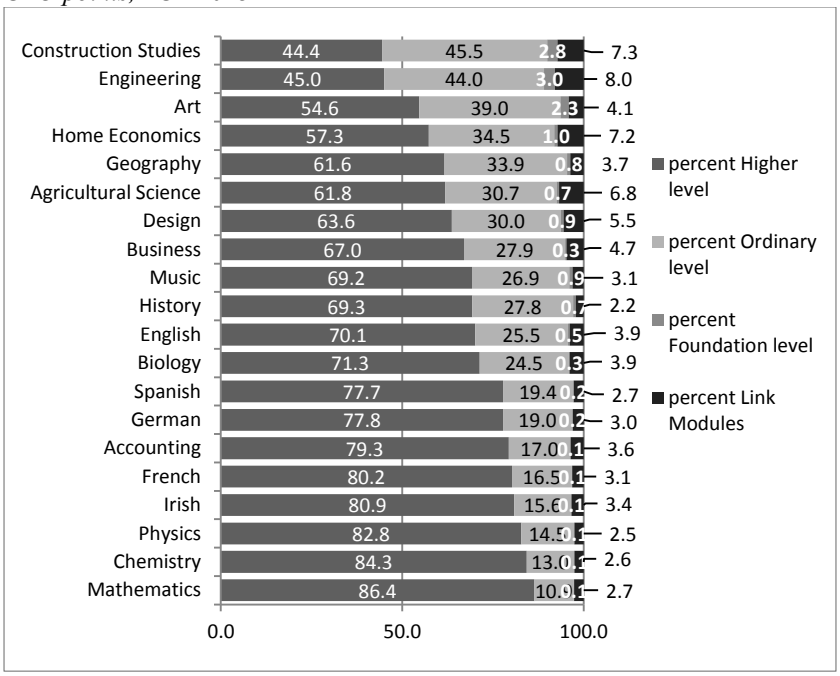
Figures 5 and 6 show the result of this calculation. That is, for each of the 20 subjects, they show the percentage of other subjects that were taken at Higher, Ordinary or Foundation level, or with the Link Modules. For example, in Figure 5, for students who sat Higher-level Mathematics, on average 86.4% of their other subjects were taken at Higher level, 10.9% of their other subjects were taken at Ordinary level, and 2.7% of the time the subject was taken alongside the Link Modules. In comparison, for students who sat Higher level Construction Studies, on average 44.4% of their other subjects were taken at Higher level, 45.5% were taken at Ordinary level, and 7.3% with the Link Modules. In Figure 6, for Ordinary-level Mathematics, 62.2% of the other subjects taken by students sitting Ordinary-level Mathematics were taken at Higher level and 31.7% were taken at Ordinary level. For students who sat Ordinary-level Construction Studies, 8.5% of their chosen subjects were taken at Higher level and 69.6% were taken at Ordinary level on average.

If we compare Figure 5 with Table 4 (above) we find that, at Higher level, the subjects that contributed to CAO points most often tended to be taken along with other Higher-level subjects less often – Music (99.0%, 69.2%[3]), Art (98.0%, 54.6%), Construction Studies (97.8%, 44.4%), Home Economics (97.3%, 57.3%) and Geography (97.2%, 61.6%). On the other hand, those Higher-level subjects that contributed to CAO points least often tended to be taken along with other Higher-level subjects more often – Physics (87.3%, 82.8%), Accounting (87.0%, 79.3%), Chemistry (84.8%, 84.3%) and Mathematics (78.7%, 86.4%).

The same pattern holds for Ordinary-level subjects in Figure 6 and Table 5 (above). The subjects that contributed to CAO points most often tended to be taken along with Higher-level subjects less often – Music (97.0%, 13.1%), Geography (96.7%, 13.6%), Art (96.5%, 9.8%) and History (95.2%, 20.4%). Ordinary-level subjects that contributed to CAO points least often were more often taken along with Higher-level subjects – French (58.7%, 49.9%), Chemistry (58.6%, 49.3%), Irish (53.5%, 58.2%) and Mathematics (43.0%, 62.2%).

[3] For each pair of percentages, the first indicates how often on average a subject contributed to a student's CAO points and the second the average percentage of other subjects taken by a student at Higher level.

Figure 5
The Degree to Which 20 Higher-level Subjects are Taken with Other Subjects at Higher, Ordinary, Foundation level or Link Modules in the Calculation of CAO points, LCE 2013



3. Subject Selection and Performance in the LCE

A question remains as to whether or not there is evidence in the data of any systematic selection of subjects by students in order to 'game the system' by selecting subjects to achieve a competitive edge and gain more CAO points. To try to answer this question we now look at differences in subject selection by students in particular circumstances.

Figure 6

The Degree to Which 20 Ordinary level Subjects are Taken with Other Subjects at Higher, Ordinary, Foundation level or Link Modules in the Calculation of CAO Points, LCE 2013

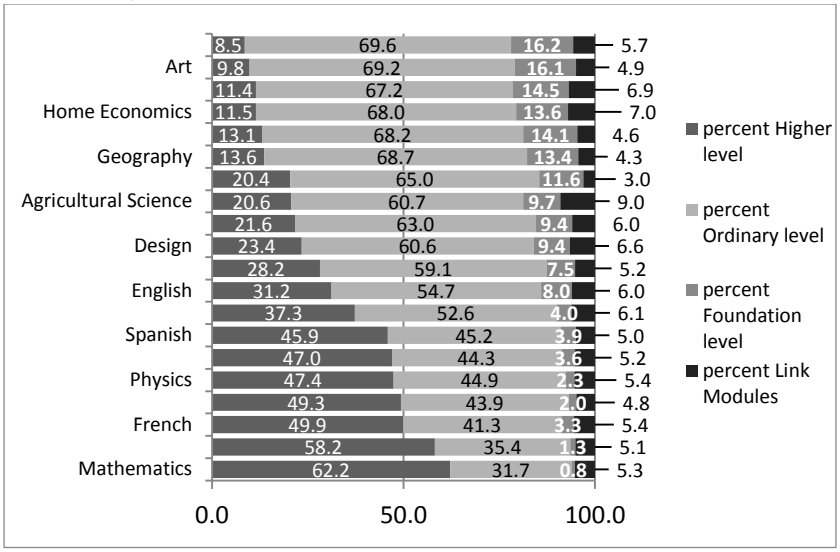


Table 6 shows the mean CAO points score and mean JOPS score of candidates broken down by the total number of CAO points-eligible subjects taken and the number taken at Higher level. These could be roughly interpreted as an estimate of the academic ability of students as estimated by an input measure (JOPS) and an outcome measure (CAO points). The highlighted cells show two groups of students that we will focus on in the next two analyses. First, we look at those students who sat six subjects at Higher level and either seven or eight CAO points-eligible subjects overall. It is apparent that mean student outcomes (CAO points (432.4 and 428.3)) and inputs (JOPS scores (71.7 and 72.0) were similar.

Note relating to Table 6 is on page 63.

Table 6

Mean CAO Points Score and Mean JOPS Score of LCE 2013 Candidates Broken Down by the Total Number of CAO Points-Eligible Subjects Taken, Number Taken at Higher Level and Numbers of Candidates

			Number of subjects taken at Higher level										
			0	1	2	3	4	5	6	7	8	9	10
Total number of CAO points eligible subjects taken	6	Mean CAO	115.5	149.7	189.3	233.7	285.3	341.4	431.1				
	7	Mean CAO	133.8	170.2	208.4	250.8	301.8	356.8	432.4	487.9			
	8	Mean CAO	154.0	191.6	228.8	274.5	323.3	371.7	428.3	479.2	521.6		
	9	Mean CAO		187.8	229.2	271.3	320.8	371.4	434.9	467.6	502.1	546.9	
	10	Mean CAO			265.0		390.0	345.0	441.7	497.5	391.0	538.3	592.0
	6	Mean JOPS	50.6	50.6	51.4	54.3	49.1	44.1	40.6				
	7	Mean JOPS	55.0	55.7	58.8	60.6	63.9	67.2	71.7	75.4			
	8	Mean JOPS	56.4	56.9	60.3	63.0	66.6	69.4	72.0	75.1	76.9		
	9	Mean JOPS		55.1	52.6	56.2	59.4	65.0	69.0	71.3	75.4	75.0	
	10	Mean JOPS			0		60	69.0	49.5	55.4	62.2	82.7	67.0
	6	n	1415	1009	1029	864	806	664	657				
	7	n	964	1236	1867	2527	3474	4342	7053	4084			
	8	n	287	442	864	1424	2142	2794	3468	2275	884		
	9	n		9	19	34	48	167	261	201	85	35	
	10	n			1		1	3	6	10	5	3	5

These students were then divided according to whether they had scored well above the mean (440 CAO points or more) or well below the mean (420 CAO points or fewer). This 20 CAO point gap was selected because it represents a substantial difference in outcomes while retaining large enough numbers of students for comparisons. Of the 7,053 students taking seven subjects overall and six at Higher level, 3,028 (45.5%) achieved 440 CAO points or more and 2,786 (39.5%) achieved 420 CAO points or fewer. Of the 3,468 students taking eight subjects overall and six at Higher level, 1,443 (41.6%) achieved 440 CAO points or more and 1,501 (43.3%) achieved 420 CAO points or fewer.

Tables 7a and 7b show the percentage of students taking each subject at Higher or Ordinary level for students scoring above 440 CAO points or below 420 CAO points. For both Higher and Ordinary level, the five subjects with the lowest severity of grading indices ('easier subjects') have been highlighted in light grey and the five subjects with the highest severity of grading indices ('more difficult subjects') have been highlighted in dark grey.

Apart from Mathematics and Irish, comparatively few students sat any of the subjects at Ordinary level. There seems to be very little systematic difference in the uptake of these subjects at Ordinary level in terms of whether students scored towards the higher end of the range in terms of CAO points. Looking at the 'easier' and 'more difficult' subjects at Higher level, no clear pattern emerges. Certainly, it is not the case that students scoring at the higher end of the range of CAO points were systematically more likely to have achieved this by taking 'easy' subjects and correspondingly less likely to have taken 'difficult' subjects than those students scoring fewer CAO points. Nor is there any clear indication that overall the 'easy' subjects were a more popular choice. Of course, the choice of subject is constrained by the availability of the subject in the school students attend, and this is not taken account of in this analysis.

Table 7a

Percentage of Students Taking Each Subject at Higher Level for Students Who Sat Seven or Eight LCE Subjects, with Six Subjects Taken at Higher Level, LCE 2013[iii]

	Higher			
	7 subjects		8 subjects	
Subject	Above 440 points	Below 420 points	Above 440 points	Below 420 points
Link Modules	2.4	2.3	58.9	64.5
English	95.7	96.7	91.8	95.4
Biology	69.9	70.6	68.5	68.9
Irish	66.0	63.1	52.3	54.0
French	58.0	53.8	44.6	49.7
Geography	45.2	52.9	42.1	44.8
Maths	38.8	40.0	39.6	33.4
Business	29.0	32.4	37.5	37.1
History	27.1	23.1	15.6	13.8
Chemistry	20.5	17.1	21.6	17.1
Music	19.6	12.9	14.0	14.2
German	17.1	16.5	13.5	11.3
Home Economics	16.2	17.2	28.9	28.7
Art	14.6	14.7	12.1	14.4
Physics	13.0	14.0	15.0	12.6
Spanish	12.5	10.7	8.5	8.9
Economics	11.6	12.6	13.9	11.6
Accounting	11.5	12.0	14.5	12.8
Ag. Sci.	8.1	8.6	21.0	23.0
Design	7.2	8.2	10.2	10.8
Construction Std.	4.1	7.0	9.4	12.2
Religion	2.8	2.5	3.9	5.2

The five subjects with the lowest severity of grading indices ('easy subjects') and the five subjects with the highest severity of grading indices ('difficult subject') have been highlighted in light grey and dark grey respectively.

Table 7b

Percentage of Students Taking Each Subject at Ordinary Level for Students Who Sat Seven or Eight LCE Subjects, with Six Subjects Taken at Higher Level, LCE 2013[iv]

	Ordinary			
	7 subjects		8 subjects	
Subject	Above 440 points	Below 420 points	Above 440 points	Below 420 points
Link Modules				
English	3.2	2.4	8.1	4.6
Biology	0.3	0.5	0.4	0.4
Irish	26.6	26.2	44.1	40.8
French	4.4	5.1	20.2	13.9
Geography	0.0	0.0	0.0	0.1
Maths	60.2	58.6	60.3	66.5
Business	0.1	0.1	0.1	0.4
History	0.1	0.2	0.1	0.5
Chemistry	0.4	0.7	1.1	1.3
Music	0.0	0.0	0.0	0.0
German	0.9	0.8	2.6	1.5
Home Ec.	0.0	0.1	0.0	0.0
Art	0.0	0.0	0.0	0.0
Physics	0.6	0.9	0.9	1.3
Spanish	0.5	0.9	2.5	2.0
Economics	0.0	0.1	0.1	0.1
Accounting	0.3	0.5	0.2	0.6
Ag. Sci.	0.0	0.0	0.1	0.1
Design	0.0	0.1	0.1	0.1
Construction St	0.0	0.0	0.0	0.0
Religion	0.0	0.0	0.0	0.0

The five subjects with the lowest severity of grading indices ('easy subjects') and the five subjects with the highest severity of grading indices ('difficult subject') have been highlighted in light grey and dark grey respectively.

We now look at the subject selection of students who sat seven subjects in LCE 2013, with either six subjects at Higher level and one other (7,053) or all seven at Higher level (4,084) (Table 6 above). In contrast to the analysis immediately above, where students in the two cells we looked at were similar in terms of input (JOPS score) and output (CAO points) measures of achievement, students who took all seven subjects at Higher level achieved a mean of 487.9 (SD 58.6) CAO points compared to a mean of 432.4 (SD 61.2) CAO points for those students who took six subjects at Higher level. Also, those students who took seven Higher-level subjects were stronger academically going into the programme, achieving a mean JOPS score of 75.4 (SD 18.0) compared to a mean of 71.7 (SD 17.5) for students who took six subjects at Higher level plus one other.

Considering only the 7,053 students who sat exactly six subjects at Higher level and one other subject, Table 8 shows the subject choice for the seventh subject. Of the 25 subjects, Mathematics (4,200 students, 59.5%) and Irish (1,854, 26.3%) between them account for 85.8% of the candidates. None of the candidates selected a Foundation-level subject. The selection of these subjects at Ordinary level may imply both that the subjects are perceived as demanding or difficult, and/or that their selection was made to satisfy third-level matriculation requirements. The fact that the students who made the decision to take the subjects at Ordinary level are by both input (JOPS score) and output measures (CAO points) towards the higher end of the achievement spectrum is relevant to any discussion of subject difficulty.

This set of students (those taking six subjects at Higher level and one other) is now compared with those taking seven subjects at Higher level. Do we see any differences in their selection of subjects to take at Higher level? Table 9 shows the percentage of students in each group taking each subject at Higher level and the difference in that uptake between the two groups. It is this difference rather than the percentages themselves that is perhaps most telling. Loosely speaking, we might consider this difference to measure the extent to which a person who is following a subject as one of seven subjects is likely to 'drop' to Ordinary level for the subject while remaining at Higher level in all of their other subjects. Reflecting what was found above, we see that the students who sat all seven subjects at Higher level were more likely to sit Higher-level Mathematics (98.9% v 39.2%) and Irish (90.7% v 64.9%). Those taking all seven subjects at Higher level were also more likely to take Chemistry, Physics, French and Accounting. Conversely, such candidates were somewhat less likely to sit Geography, Business or Home Economics.

Looking at those students who took six subjects at Higher level, they were less likely to take Mathematics, Irish, Chemistry, Physics, French and Accounting at Higher level (subjects with higher severity of grading indices) and more likely to take Construction Studies, Art, History, Home Economics, Business and Geography at Higher level (subjects with lower severity of grading indices). Thus, it is apparent that students who did better in the LCE were less likely to select subjects that the SPA suggests are 'easier' but more likely to select subjects that the SPA suggests are 'harder'.

Table 8

Choice of Ordinary Level Subject or Link Modules for Students Who Sat Seven CAO Points-Eligible Subjects but Six at Higher Level, LCE 2013, Numbers and Percentages of Students

Subject	n	%	Subject	n	%
Mathematics	4200	59.5	Business	6	0.1
Irish	1854	26.3	Italian	4	0.1
French	333	4.7	Design	3	0.0
English	191	2.7	Economics	3	0.0
Link Modules	168	2.4	Home Ec.	2	0.0
German	61	0.9	Ag. Sci.	1	0.0
Physics	54	0.8	Arabic	1	0.0
Spanish	48	0.7	Art	1	0.0
Chemistry	42	0.6	Engineering	1	0.0
Biology	28	0.4	Geography	1	0.0
Accounting	27	0.4	Japanese	1	0.0
Applied Maths	12	0.2	Latin	1	0.0
History	10	0.1			

Table 9
Percentage of Students Taking Seven CAO Points-Eligible Subjects, with either Six or All Seven Taken at Higher Level, LCE 2013[1]

Subject	6 Higher	7 Higher	Diff.
Geography	49.1	33.6	-15.4
Business	30.8	23.1	-7.7
Home Ec.	16.9	10.7	-6.3
History	25.4	20.8	-4.6
Art	14.9	11	-3.9
Con. Stud.	5.5	3	-2.6
Ag. Sci.	8.5	6.1	-2.3
Engineering	2.9	1.6	-1.3
Religion	2.7	1.6	-1
Class. Stud.	1.8	1.1	-0.8
Design	7.6	7.4	-0.3
Technology	1.2	0.9	-0.3
Phy. & Chem.	0.7	0.4	-0.2
Arabic	0.2	0	-0.2
Spanish	11.6	11.4	-0.1
Italian	0.9	0.9	0
Japanese	0.4	0.4	0
Lithuanian	0.2	0.3	0
Russian	0.2	0.2	0
Romanian	0.1	0.1	0
Anc. Greek	0.1	0	0
Ag. Econ.	0.1	0.1	0
Slovenian	0	0	0
Dutch	0	0.1	0
Bulgarian	0	0	0

[i]Subjects taken by fewer than 5 candidates not listed.

Table 9 (contd.)
Percentage of Students Taking Seven CAO Points-Eligible Subjects, with either Six or All Seven Taken at Higher Level, LCE 2013[1]

Subject	6 Higher	7 Higher	Diff.
Czech	0	0	0
Finnish	0	0	0
Mod. Greek	0	0	0
Estonian	0	0	0
German L&L	0	0	0
Hebrew	0	0	0
Swedish	0	0	0
Portuguese	0	0	0
Latvian	0	0	0
Polish	0.7	0.8	0.1
Hungarian	0	0.1	0.1
Biology	70.2	70.4	0.3
Latin	0.2	0.6	0.4
German	16.8	17.3	0.6
Music	16.3	17.1	0.8
Economics	11.9	13	1.2
English	96.3	98.5	2.2
App. Maths	2.1	4.3	2.2
Accounting	11.6	19.5	7.9
French	56.1	66.1	10.1
Physics	13.2	24.6	11.5
Chemistry	18.5	42.9	24.3
Irish	64.9	90.7	25.9
Maths	39.2	98.9	59.7

[i]Subjects taken by fewer than 5 candidates not listed.

DISCUSSION

The purpose of this study was to examine if there was any evidence of differences in the severity of grading between LCE subjects and whether there was any evidence of students strategically avoiding or selecting subjects based on such differences. The severity of grading index from the SPA provides objective evidence that some subjects are graded more 'harshly' and others are graded more 'leniently'. However, this finding merely replicates something that has been known for more than a decade (Kellaghan & Millar, 2003) and reflects findings in other countries (Coe et al., 2008; Ofqual, 2015). It is apparent that students who are more academically-able (measured in terms of overall performance on either the JCE or LCE) tend more often to select subjects that the SPA suggests are 'more difficult', while students who are less academically able select more often subjects that the SPA suggests are 'easier'. The findings of the SPA might be interpreted as providing evidence that subjects such as Mathematics, Chemistry, Physics, Accounting and French were graded more harshly, and that Construction Studies, Design & Communications Graphics, Home Economics and Art were graded more leniently. However, according to Kellaghan and Miller (2003):

> an alternative explanation is more complex, and proposes that examiners reach a kind of compromise in grading, in which they attempt to balance examinees' overall achievement, the nature and demands of the syllabus they have followed, and the need to provide an acceptable distribution of grades for every subject, at both Higher and Ordinary level (p. 81).

SPA has a number of advantages. It is comparatively simple to conduct and the interpretation is intuitive. For example, if the Chief Examiner in Higher-level Mathematics wanted to reduce the severity of grading index for Mathematics it might simply involve moving all candidates (except those already receiving an A1) up one grade. This would have the effect of reducing the severity of grading index for Mathematics from +1.9 to +0.9. In other words, instead of students taking Higher-level Mathematics achieving on average almost two grades higher in the 15 comparator subjects they would achieve on average only one grade higher. This might seem to present a way of moderating the effect of differences in grading between subjects. However, Coe (2007) describes four criticisms of common examinee methods of comparing subject difficulties (of which SPA is one):

- That SPA measures factors other than difficulty;
- That examinations in different subjects are measuring different things (multidimensionality);
- That differences between subjects will depend on subgroups within student cohorts e.g., that female or male students may show different patterns in achievement in different subjects (sub-group differences);
- That the types of students taking any pair of subjects in the SPA are not representative of the students taking each subject overall (unrepresentativeness).

These are real rather than theoretical concerns. For example, taking the last objection, a pairwise comparison using LCE 2013 data suggests that Higher-level Mathematics is 1.2 grades more difficult than Higher-level English and that Higher-level Applied Mathematics is 2.1 grades more difficult than Higher-level Mathematics. However, Higher-level Applied Mathematics is only 0.4 grades more difficult than Higher-level English – not the 3.3 grades (1.2 plus 2.1) we might expect.

Although we have not dealt with the issue in the current analyses it should be noted that there are substantial subgroup differences (Coe's third criticism). For example, although Higher-level Mathematics is 1.2 grades more difficult than Higher-level English overall, the picture is different when we look at the data by student gender. For female students Higher-level Mathematics is 2.0 grades harder than Higher-level English, while for male students Higher-level Mathematics is 0.6 grades more difficult. Such differences present practical and equity problems where an authority might be considering making adjustments to grades (Goldstein, 2007).

Another issue with the SPA in the Irish context is that it is not well-suited to assess differences between levels in the same subject. For example, it is complicated trying to assess the relative difficulties of, say, Higher- and Ordinary-level Mathematics since no students take any subject at two levels. The analyses here only compare subjects *within* Higher level and subjects *within* Ordinary level – not across levels. This is a limitation in the analysis.

The question of whether or not students select subjects strategically is difficult to answer. It is apparent that, even in the case of more-able students, certain subjects (Mathematics and Irish) are taken less often at Higher level. The fact that Mathematics and Irish are avoided at Higher level by students who performed comparatively well in the 2013 examination suggests that these

subjects are perceived as being more difficult in some sense. However, it is not clear from the current analyses that students systematically select 'easier' subjects to gain an advantage in terms of their CAO points, or, if they do, that the selection of these subjects confers an advantage to them.

Students who did well in the LCE (as measured by the CAO points achieved) tended to select subjects more often that the SPA suggests are 'more difficult', whilst students who did less well tended to select subjects more often that the SPA suggest are 'easier'. This

is not consistent with a suggestion that students who take 'easier' subjects perform better than students who sit 'more difficult' subjects. However, it is consistent with the finding that certain subjects are taken more (or less) often by more academically-able students.

Subjects that the SPA suggests are 'more difficult' tend to contribute to CAO points less often while those the SPA suggest are 'easier' tend to contribute to CAO points more often. However, the degree to which subjects contribute to CAO points is closely related to how many Higher- and Ordinary-level subjects these tend to be taken with. More able students take more Higher-level subjects.

There is no evidence of any systematic selection of subjects by students in order to maximise CAO points. When we select out a group of students who have similar academic ability in terms of an input measure (JCE performance) we find no tendency for those who performed better in terms of CAO points to have selected 'easier' subjects or to have avoided 'more difficult' ones. Similarly, those who performed less well did not select 'more difficult' subjects more often.

A comparison between students who take all subjects at Higher level and those who take all but one at Higher level shows that those who take all subjects at Higher level are more likely to take subjects that the SPA suggests are 'more difficult' and less likely to take subjects the SPA suggests are 'easier'. However, students who take all subjects at Higher level tend to have higher academic ability, as indicated by both JCE and LCE performance.

The SPA is an imperfect tool for measuring the relative difficulty of subjects. However, it is probably no more imperfect than other statistical techniques and produces similar estimates. There is a risk that taking the results of the SPA at face value may reinforce existing perceptions about subjects, or perhaps shape perceptions. It may be that subjects come to be seen as 'easier' or 'more difficult' partly as a result of the subject pairs or other analyses and not because of anything inherent to the subjects themselves. Instead, the

relative apparent difficulties of subjects may be due to the general academic ability of the cohorts of students sitting the subjects and the other subjects (and levels) with which these are taken. Perhaps it is this complex interaction between student ability and choice of subject that needs to be explored and better understood.

Although bonus CAO points for Higher-level Mathematics were available to students achieving a grade D3 or better in LCE 2013, bonus points were ignored in the current analyses. The purpose of introducing bonus points was to encourage participation in Higher-level Mathematics. This goal appears to have been achieved. In 2011, the year before bonus points were introduced, 8,237 students (15.2% of the cohort) sat Mathematics at Higher level. In 2012 this figure had risen to 11,131 (21.2%) and to 13,014 (24.7%) in 2013. However, in spite of the increases in the numbers taking the subject at Higher level, and a concomitant change in the numbers taking Mathematics at Ordinary level, there was no improvement in the relative position of mathematics vis-a-vis other subjects, as indicated by the SPA. Indeed, for mathematics at Higher level, the severity of grading index was greater for LCE 2013 than for LCE 2000 or LCE 2001 (and about the same at Ordinary level for LCE 2013 and LCE 2001).

The failure to find evidence of systematic subject selection in order to gain CAO points should not be taken to mean that such subject selection is not attempted or successful. The rather crude analyses, at the level of groups of students, undertaken here may simply not be appropriate for the task. Any future research on the matter may require more complex statistical tools, along with a clearer understanding of the context.

The current analyses have not dealt with the relative standards between levels in the same subject, or differences between the relative standards of the levels between subjects. This particular issue could be dealt with using an Item Response Theory (IRT) model. The use of IRT would not only allow for a comparison of different methods for estimating differences in standards between subjects but would also allow for modelling the relative standards of different grades between subjects and across levels. The IRT approach also has an advantage in that it does not assume equal intervals between grades. This means that questions regarding the appropriateness of the relative weighting of Higher and Ordinary level in regards to the award of CAO points could be explored. Since we know that the distribution of grades varies between subjects, this approach also represents an advance on the SPA which considers

only mean grades. Therefore, IRT is a potentially fruitful approach to further research on this topic.

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NOTE ON TABLE 6

Shaded cells show students who sat six subjects at Higher level and either seven or eight CAO points-eligible subjects overall and seven subjects at Higher level, all of which are CAO-eligible.