The Roehampton Annual Computing Education Report

2015 data from England

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1 Executive Summary

This report aims to analyse the uptake of computing / computer science qualifications at GCSE and A-level by looking at the schools that offered the qualifications and the students sitting them in 2015. Below are the key findings.

1.1 Key Findings

Despite computing's place on the national curriculum as a foundation subject, only a minority of schools (28.5%) entered pupils for GCSE computing in 2015. At A-level, only 24% of providers entered students for the qualification.

Provision of GCSE and A-level computing varied significantly across the country:

- There were 9 Local Authorities (LAs) where less than 2% of students took GCSE computing. At the other end of the scale, there were six (Reading, Blackpool, Newham, Sefton, Bournemouth and West Berkshire) where more than 10% of students are entered.
- 6.5% of students in the South East sat computing GCSE, compared to only 4.2% in the North East.
- Seven LAs had no A-level entries for computing. On the other hand, there were 5 LAs, (Poole, Bury, Hartlepool, Middlesbrough and Stockton-On-Tees) where more than 4% of students took A-level computing.
- 2.1% of students in the North West sat computing at A-level, compared to just 1.1% in Yorkshire and the Humber.
- Urban schools were more likely to offer computing at GCSE or A-level than those in rural locations (29.5% vs 22.7% and 25.1% vs 18.1% respectively).
- There was no significant difference between coastal and inland schools in provision of computing at GCSE or A-level. There was considerable variation between school types in entries for GCSE and A-level computing:
- 51.1% of academy converters offered GCSE computing, compared to 37.8% of community schools, 37.1% of foundation schools, 35.2% of sponsor led academies and 34.8% of voluntary aided schools. Only 14.1% of independent schools and 2% of special schools offered GCSE computing.
- At A-level, 41% of further education institutions (including sixth form colleges) offered computing. 31.6% of Academy converters also offered A-level computing. Just 15.9% of independent schools did so.
- Boys and mixed schools were more likely to offer computing than girls schools. At GCSE 19.6% of girls-only providers offered computing compared to 31.6% of boys-only and 29.1% of mixed providers. 9.3% of girls-only providers offered computing at A-level compared to 43.7% of boys-only and 24.5% of mixed providers.
- Grammar schools were much more likely to offer computing than non-selective state schools: 53.1% compared to 31.7% of schools at GCSE, and 46% compared to 24.7% at A Level.
- School size was linked closely with the likelihood that computing GCSE be offered, although the same is true for other subjects, such as physics and ICT.

At GCSE, it was very unusual for computing to be taken by the majority of students in a year group - there were only twenty-one schools where this was the case, seven of which were independent schools. Nevertheless, cohort sizes at GCSE might be considered robust, averaging 22.9. 47.6% of schools offering computing did so with groups smaller than 20 at GCSE. At A-level, cohort sizes were much smaller, with a mean of 7 and a median of just 4. 58.5% of A-level computing providers had fewer than 6 entries. The average cohort size for further education institutions (including sixth form colleges) that offer A-level computing was 18.5, but academy converters offering the subject had an average cohort size of just 5.7 . If the number of students taking computing A-level in many of these providers does not increase then questions are likely to be raised over the economic viability of the qualification due to recent sixth form provision funding changes.

- Where computing provision did exist in mixed schools, girls were often absent. At GCSE 26.9% of mixed providers had no female students, at A-level the figure was 65.3%.

The entitlement to computing which the national curriculum provides did not appear to be maintained at GCSE or A-level. Only a small fraction of pupils chose (and/or were allowed) to take qualifications in computing: 5.5% of GCSE students and only 1.7% of A-level candidates. As with schools' take up of the qualification, so with individual students': there is considerable variation between gender, socio-economic status and ethnicity.

- Pupil premium students were under-represented in GCSE computing (19%, compared to 26.6% across GCSE entries); entrants had a lower IDACI index than the average (0.194 vs 0.218). Pupil premium students, on average, scored worse than their peers.
- At A-level, pupil premium students' uptake of computing was close to the average for all subjects (8.9%, compared to 9.0% across A-level entries), although the IDACI score was still lower (0.161 vs 0.178). The attainment gap between pupil premium and non-pupil premium students for computing was broadly the same as across all subjects. Only 34 pupil premium girls took A-level computing in 2015.
- Asian and Chinese students were a higher proportion of GCSE computing students than across the national cohort; black students somewhat lower. At A-level, white and Chinese students made up a higher proportion of the computing cohort, other ethnic groups rather lower.
- Whilst pupil premium students were less likely to sit GCSE computing than their peers, the propensity of girls to sit computing was not as reduced by pupil premium as it was for their male counterparts. Amongst all pupil premium groupings, white British girls were proportionally underrepresented.

At GCSE computing, girls outperformed boys, achieving proportionally more A* to B grades, and proportionally fewer other grades. A-level shows a similar pattern to GCSE, with girls, achieving proportionally more A* to B grades, and proportionally fewer other grades.

Computing students might be characterised as relatively academic, although performance on exams is rather lower than might be expected given the entry profile. It is unclear whether this is due to the relative difficulty of the qualification, teaching in the subject or some combination of these and other factors.

Computing and ICT seem rather different qualifications:

- At GCSE and A-level, ICT has a much more equitable gender spread than computing.
- At GCSE, 1433 providers offered computing, which was taken by 32820 students, compared to 1886 providers offering ICT, taken by 93015 students.
- At A-level, 697 providers offered computing, which was taken by 4890 students, compared to 804 providers offering ICT, taken by 6650 students. Larger sixth form or FE colleges are more likely to offer A-level Computing rather than ICT, perhaps as the ICT qualification offered in such institutions is more likely to be one of the vocational alternatives.
- 3167 students (9.6% of the computing cohort) took GCSEs in both computing and ICT. 156 students (3.2% of the computing cohort) took both computing and ICT at A-level, a combination offered by only 240 (8.3%) of providers.
- Computing students were more likely to take triple science than ICT students at GCSE: Only 1126 students took computing as one of three EBacc sciences (3.4% of computing entries), although a further 10849 (33.1%) took computing as one of four science subjects.
- At A-level, computing was often combined with maths, further maths and physics - the latter two were subjects which did not feature highly in combination with ICT.
- Asian students had similar representation at both GCSE ICT and computing, but at A-level they had a much higher representation in ICT.
- Pupil premium students were substantially under-represented in GCSE computing (19%) compared to ICT (27.1%). The student average IDACI rating for students sitting computing (0.194) was substantially below that for ICT (0.233).
- At A-level, the percentage of pupil premium students for computing (8.9%) was below ICT (11%) and the student average IDACI rating for students sitting computing (0.161) was substantially below ICT (0.195).
- Students sitting GCSE computing had a stronger mathematics profile than students studying ICT.

1.2 Recommendations

- Increase the proportion of schools and colleges offering GCSE and A-level computing.
  - This can be achieved through applying models of provision in areas and school types where computing is well represented to those where it is presently under-represented.
  - Initiatives such as PiCademy, the CAS master teacher programme, CAS hubs and the CAS regional centres should prioritise extending support to areas and schools with low levels of provision.
  - National teacher training initiatives, such as Teach First, should look at focusing their computing provision in areas of low provision.
- Schools and colleges offering computing should aim to expand the numbers of pupils and students taking the qualification.
  - This can be achieved through addressing the relative under-representation of girls, some ethnic groups and, in the case of GCSE, pupil-premium students. Schools and colleges should consider carefully if selection policies for computing classes are unnecessarily restrictive or discriminatory.
- Schools should consider if changes are needed in the teaching of computing to bring outcomes in line with those which entry profiles would indicate.
- Awarding organisations should consider whether qualifications on offer are sufficiently appealing to pupils and to schools and colleges. They should consider whether grade expectations are in line with other qualifications they offer.
- Whilst the new computing curriculum is being established, there should be financial support for schools to offer the subject so they can build up sustainable cohort sizes.
- Discussions around diversity and computing should include socio-economic and ethnic factors in addition to gender.
- The impact resulting from the removal of ICT qualifications at KS4 and KS5 needs to be studied. Will students with profiles similar to those taking ICT in 2015 now sit Computer Science in similar numbers, find alternative provision through vocational qualifications, or will they show decreased access to qualifications in the IT / computer science space?

The research topics outlined in this report need further study, in particular there seems a pressing need to explore:

- the uptake of GCSE computing amongst pupil premium females.
- the regional distribution of computing provision across other factors such as gender and pupil premium.
- factors that might explain under-performance in computing.
- the uptake of other qualifications in the IT, digital media and computer science at at pre-university level.

2 About the study

This report analyses the uptake of computing / computer science qualifications at GCSE and A-level by looking at the schools that offer the qualification and the students sitting it. Not all schools offer computing qualification at GCSE or A-level and not all students sit qualifications in computing. Even where a qualification is taught by a school, subject requirements might limit the type of student who is able to take the course. Whilst at A-level computing is a well established subject, it is only offered by a minority of centres, with some areas having no provision. Until recently the number of students taking A-level computing has been in decline (McBride, 2008); JCQ(2014, 2015a, 2016b) figures show that since 2014 numbers have been increasing year on year. A new computing GCSE was introduced by the OCR exam board in 2011 (OCR, 2011) with the first cohort of students sitting exams in 2013. Understandably, not all schools adopted this qualification immediately, and whilst the number of centres and students have been increasing, the numbers have not yet matched those of ICT (JCQ, 2016c). A similar picture has been observed at A-level with numbers of computing students rising 50% in 5 years but still well below ICT (JCQ, 2011, 2015a). Additionally, with recent school funding changes at A-level, from a per subject to per student system (BBC, 2015; Education Funding Agency, 2016), the computing cohort size of A-level providers now becomes a greater concern for the ongoing financial viability of the subject. Smaller subject cohorts may make a course too expensive for smaller providers.

This report's first aim is to understand the A-level and GCSE computing cohorts beyond the widely publicised disparity in gender (JCQ, 2015b). It will look at provider type, provider location, subject mix, the ethnicity and socio-economic status of students. To conduct this research the report uses the DfE National Pupil Database (NPD) (DfE, 2015d) linked to Edubase (DfE, 2016a). The NPD provides individual student examination and characteristic data for GCSE and A-level; Edubase provides profile information on individual schools.

The GCSE and A-level in ICT are being discontinued in 2017 (DfE, 2015a). This leads to the report's second aim, which is to contrast the computing and ICT qualifications. The DfE justification for dropping the ICT qualification and keeping computer science is that the subjects occupy the "same [subject] space" (quoted in Vaughan, 2015). It is not within the scope of this report to address the overlap in content between these subjects, instead the aim here is to compare the profiles of schools offering each qualification and the examination cohorts. Can we expect students who would have previously chosen ICT qualifications to now choose computing, or that providers which previously ran ICT courses will now switch to computing?

This report is the first iteration of an annual statistical review of computing in England. As such, we welcome comments and suggestions for improvement, as well as suggestions for areas that we can explore further. An updated version, using data from 2016, will be available next year.

3 Research areas

3.1 Schools by Type of Establishment

There are many *types* of school specified by the DfE (2016e). Using data from Edubase (DfE, 2016a), students taking computing exams can be mapped to their school's profile and the school types and participation patterns analysed[1].

3.1.1 GCSE[2]

Academy Converter schools form the largest cohort of GCSE computing students with 51.1% of this school type offering it. In comparison, 35.2% of Academy Sponsor Led schools offer GCSE computing. On average, cohort sizes are roughly one class[3] per school, suggesting that computing commands class sized cohorts and is more likely to be financially sustainable. Free school cohort sizes are considerably smaller at 13.8. Just 14.1% of independent schools offered GCSE computing, with an average cohort size of 10.2. Anecdotal evidence suggests that some independent schools are choosing the IGCSE computing qualification instead of the GCSE; unfortunately data on the IGCSE is unavailable for this report.

Table 1: 2015 GCSE computing provision by type of provider

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Academy Converter	1271	242863	649	51.1	16670	6.9	25.7
Community School	601	107564	227	37.8	5380	5	23.7
Academy Sponsor Led	503	78884	177	35.2	3980	5	22.5
Foundation School	299	53481	111	37.1	2540	4.7	22.9
Voluntary Aided School	290	46365	101	34.8	2355	5.1	23.3
Other Independent School	827	44480	117	14.1	1190	2.7	10.2
Voluntary Controlled School	37	7524	13	35.1	340	4.5	26.2
Pupil Referral Unit	218	4117	6	2.8	X	X	X
Community Special School	300	2841	5	1.7	15	0.5	3
Further Education	237	1412	4	1.7	10	0.7	2.5
University Technical College	17	1264	6	35.3	140	11.1	23.3
Other Independent Special School	183	1179	4	2.2	20	1.7	5
Free Schools	21	1114	8	38.1	110	9.9	13.8
Studio Schools	21	822	1	4.8	30	3.6	30
Academy Special Converter	55	613	1	1.8	X	X	X
City Technology College	3	548	1	33.3	15	2.7	15
Foundation Special School	41	400	1	2.4	X	X	X
Non-Maintained Special School	35	231	1	2.9	X	X	X
Totals	5035	596727	1433	28.5	32820	5.5	22.9

[1] A less fine grained analysis was recently conducted by Cambridge Assessment (Gill & Williamson, 2016)
[2] see Notes section for meaning of X data
[3] a class is taken here to be 20-30 students

Note that the following school types had no GCSE computing examination cohorts in 2015 (n = total number of providers): Academy Alternative Provision Converter (n=19); Free Schools - Alternative Provision (n=24); Academy Special Sponsor Led (n=11); Academy Alternative Provision Sponsor Led (n=5); Secure Units (n=12); Free Schools Special (n=2); Academy 16-19 Converter (n=1); Special Post 16 Institution (n=1); Miscellaneous (n=1). Of note is the lack of GCSE computing provision in all special schools (n=614), where only 2% of schools provide the subject.

1886 providers offered ICT, with 93015 sitting the subject. For physics there were 2529 providers and 121585 students.

3.1.2 A-level[4]

The number of students sitting A-level Computing (n=4888) is much smaller than the number sitting the GCSE (n=32825). Numbers have increased substantially over the last few years (JCQ, 2014, 2015a, 2016b), but the total number of students for 2015 (n=4888, 1.7% of all A-level students) was below subjects such as physics (n=32328, 11.2% of all A-level students) and ICT (n=6641, 2.3% of all A-level students). Further Education is the largest category of institution offering A-level computing with 42% of computing students studying in this type of institution. Note that Sixth Form Colleges are included in this category.

Whilst Academy Converters provide 35% of total computing student places, and account for 34.9% of *all* A-level entries, average cohort size (5.7) is well below those of Further Education institutions (18.5). This raises concerns about the sustainability of computing courses at Academy Converters due to recent funding changes where school based A-level provision is now funded by student numbers, rather than by number of qualifications offered (BBC, 2015; Education Funding Agency, 2016)[5].

As seen in About the study, the number of students taking GCSE has been increasing; this might lead to an increase in demand from students to sit the A-level and an increase in teachers able and willing to deliver it. However, it is possible that the steady increase in A-level computing numbers over the last few years will taper off or even turn into a decline, where only the providers able to sustain large cohort sizes can offer the subject. The Sixth Form College Association (2016) notes that providers are already dropping courses due to funding cuts, however, it remains to be seen what impact this will have on computing provision. Additionally, with the implementation of linear A-level examinations, where AS qualifications no longer contribute to the final A-level qualification (Ofqual, 2015), the large number of AS students that traditionally led into the much smaller sized A-level groups is declining (JCQ, 2016a). Students are less likely to use the AS course as a 'taster' for the A-level and providers will be expected to cost the running of these courses with potentially smaller cohort sizes. It should be noted that the per-student funding model was already in place for Further Education institutions including Sixth Form Colleges. The overall average cohort size for all providers was 7.

Table 2: 2015 A-level computing provision by type of provider

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Academy Converter	945	100361	299	31.6	1700	1.7	5.7
Further Education	271	79479	111	41.0	2055	2.6	18.5
Other Independent School	586	38604	93	15.9	300	0.8	3.2
Community School	304	23613	63	20.7	245	1	3.9
Voluntary Aided School	174	14676	40	23.0	180	1.2	4.5
Academy Sponsor Led	337	14249	41	12.2	150	1.1	3.7
Foundation School	162	11853	31	19.1	145	1.2	4.7
Voluntary Controlled School	27	2447	7	25.9	45	1.8	6.4

[4] see notes section for meaning of X data

[5] this change was introduced in 2013/14 with transitional funding in place up to and including 2015/16

Free Schools - 16-19	9	444	4	44.4	20	4.5	5
University Technical College	16	336	3	18.8	10	3	3.3
Academy 16-19 Sponsor Led	1	270	1	100.0	10	3.7	10
Academy 16-19 Converter	2	197	1	50.0	X	X	X
Institution funded by other Government Department	1	156	1	100.0	15	9.6	15
Studio Schools	11	126	1	9.1	X	X	X
Non-Maintained Special School	5	31	1	20.0	X	X	X
Totals	2899	287652	697	24.0	4890	1.7	7

Note that the following school types had no A-level computing examination cohorts in 2015 (n = total number of providers): City Technology College (n=3); Free Schools (n=11); Other Independent Special School (n=12); Sixth Form Centres (n=5); Miscellaneous (n=2); Special Post 16 Institution (n=3); Community Special School (n=5); Pupil Referral Unit (n=4); Free Schools - Alternative Provision (n=1); Academy Special Converter (n=1); Foundation Special School (n=1)

804 providers offered ICT, with 6650 sitting the subject. For physics there were 2427 providers and 32335 students.

3.1.3 Key points

- The average cohort size for A-level computing is just 7. This raises concerns about the financial sustainability of A-level computing especially in non further education / sixth form college providers where the cohort sizes are much smaller;
- Academy converters are most likely to provide GCSE computing (51.1%), compared to just 14.1% of private schools and 2% of special schools;
- 42% of A-level providers categorised as Further education (including sixth form colleges) provide A-level computing, compared to just 15.9% of private schools;

3.2 Private and state school by gender

There is an established body of literature around female participation in computing (Varma, 2010; Vekiri, 2013). There is also speculation that private and grammar schools engage more with Computing A-level qualifications than other school types in England (Shepherd, 2012). Recent DfE(2015b) figures show the early adoption of GCSE computing among grammar school students in comparison to comprehensive and secondary modern students. Here we also analyse the relationship between gender characteristics of selective, non-selective and independent schools and their offering of computing qualifications at GCSE and A-level. Using provider characteristic data from Edubase (DfE, 2016a), students taking exams can be mapped to the gender characteristic of their school as well as whether the school is independent or state selective.

3.2.1 GCSE

The 2015 GCSE computing examination shows a higher proportion of boys schools offer computing (31.6%) than mixed (29.1%) and girls (19.6%) schools. In addition, boys schools have larger average cohort sizes (30.7). Grammar schools deliver computing (53.1%), more than any other grouping. In particular boys grammars show the highest representation with 62.7% of this type of school offering the GCSE. Note that the number of grammar schools and students taught in them remains small in comparison to non-selective state schools (3.7% of total students vs 88.6%). A smaller proportion of boys independent schools offer GCSE computing (7.4%) when compared to girls independents (11.5%). However, the cohort sizes in the boys independents (14.3) are substantially larger than girls (6.1). At A-level the picture is reversed with more boys independents offering computing than girls. The reasons for this disparity are unclear.

Table 3: 2015 GCSE computing provision by school gender characteristic

Gender	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Mixed	4331	525500	1260	29.1	28667	5.5	22.8
Girls	409	42849	80	19.6	1306	3	16.3
Boys	294	28370	93	31.6	2851	10	30.7
Totals	5034	596719	1433	28.5	32824	5.5	22.9

Table 4: 2015 GCSE computing provision by state selection and independent sector

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
State non-selective	3863	528693	1226	31.7	28923	5.5	23.6
Independent	1010	45659	121	12.0	1211	2.7	10
Grammar school	162	22375	86	53.1	2690	12	31.3
Totals	5035	596727	1433	28.5	32824	5.5	22.9

Table 5: 2015 GCSE computing provision by school type and school gender characteristic

Gender	Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Boys	Grammar school	59	8088	37	62.7	1309	16.2	35.4
Boys	Independent	94	5344	7	7.4	100	1.9	14.3
Boys	State non-selective	141	14938	49	34.8	1442	9.7	29.4
Girls	Grammar school	61	8355	23	37.7	581	7	25.3
Girls	Independent	191	9904	22	11.5	135	1.4	6.1
Girls	State non-selective	157	24590	35	22.3	590	2.4	16.9
Mixed	Grammar school	42	5932	26	61.9	800	13.5	30.8
Mixed	Independent	725	30411	92	12.7	976	3.2	10.6
Mixed	State non-selective	3564	489157	1142	32.0	26891	5.5	23.5
Totals		5034	596719	1433	28.5	32824	5.5	22.9

If we break down the mixed figures to look at numbers of male and female students in these providers, we can see that 26.9% of mixed schools had no female students in their GCSE computing cohorts, including 45.7% of mixed independents and 25.6% of mixed state non-selectives.

Table 6: 2015 GCSE computing mixed gender provision

Gender	Type	Total Computing Providers	Female computing students	Male computing students	Providers with no females	Percentage of providers
Mixed	Independent	92	130	846	42	45.7
Mixed	State Non Selective	1142	3695	23196	292	25.6
Mixed	State Selective	26	148	652	5	19.2
	Totals	1260	3973	24694	339	26.9

3.2.2 A-level

Provision of A-level computing varies greatly with the gender characteristic of a provider, there were 9.3% of girls-only providers offering computing compared to 43.7% of boys-only and 24.5% of mixed providers. In addition, girls-only providers average cohort size (3.4) is substantially below boys (6.4) and mixed (7.3). The speculated over-representation of grammar schools and independent schools (Shepherd, 2012) is confined to mixed and boys-only providers. Girls independent schools have the smallest representation with only 4.3% of institutions offering A-level computing and the actual numbers of students being so low as to require the anonymisation of the data to avoid cohorts of 5 or fewer students being recognised. All types of schools show small cohort sizes, raising concerns about the financial viability of A-level computing (see Schools by Type of Establishment).

Table 7: 2015 A-level computing provision by school gender characteristic

Gender	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Mixed	2403	242631	588	24.5	4279	1.8	7.3
Girls	313	25693	29	9.3	99	0.4	3.4
Boys	183	19328	80	43.7	510	2.6	6.4
Totals	2899	287652	697	24.0	4888	1.7	7

Table 8: 2015 A-level computing provision by state selection and independent sector

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
State non-selective	2138	224407	529	24.7	4087	1.8	7.7
Independent	598	38657	93	15.6	299	0.8	3.2
Grammar school	163	24588	75	46.0	502	2	6.7
Totals	2899	287652	697	24.0	4888	1.7	7

Table 9: 2015 A-level computing provision by school type and school gender characteristic

Gender	Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Boys	Grammar school	59	9049	40	67.8	325	3.6	8.1
Boys	Independent	53	4441	16	30.2	55	1.2	3.4
Boys	State non-selective	71	5838	24	33.8	130	2.2	5.4
Girls	Grammar school	60	8524	15	25.0	60	0.7	4
Girls	Independent	139	7128	6	4.3	X	X	X
Girls	State non-selective	114	10041	8	7.0	30	0.3	3.8
Mixed	Grammar school	44	7015	20	45.5	115	1.6	5.8
Mixed	Independent	406	27088	71	17.5	240	0.9	3.4
Mixed	State non-selective	1953	208528	497	25.4	3925	1.9	7.9
Totals		2899	287652	697	24.0	4885	1.7	7

If we break down the mixed figures to look at numbers of male and female students in these providers, we can see that 65.3% of mixed schools had no female students in their cohorts, including 73.2% of mixed independents and 64.6% of mixed state non-selectives. Grammar schools offer the best provision, but the numbers of female students are so small that it has been decided to redact the mixed school gender breakdown numbers from the table below.

Table 10: 2015 A-level computing mixed gender provision

Gender	Type	Total Computing Providers	Providers with no females	Percentage of providers
Mixed	Independent	71	52	73.2
Mixed	State Non Selective	497	321	64.6
Mixed	State Selective	20	11	55.0
	Totals	588	384	65.3

3.2.3 Key points

- A very low number of girls-only schools, apart from girls-only Grammar school (25%), provide A-level computing, with just 4.3% for independent girl schools and 7% for non-selective state schools for girls;
- Boys and mixed state selective schools are the most likely to offer GCSE computing (62.7% and 61.9%), compared to private schools for boys (7.4%), for girls (11.5%) and for mixed gender (12.7%);
- At A-level, 67.8% of boys state selective schools provide computing, as well as a substantial increase in provision among private schools for boys (30.2%), compared to GCSE. There is a substantial decrease in provision at private schools for girls (4.3%) and a similar percentage for private mixed gender schools (45.5%);
- At A-level state schools of all gender characteristics demonstrate small cohort sizes;

3.3 Schools by Rural and Urban locality

The DfE categorises educational institutions as either Urban or Rural, with several sub categories (DEFRA, 2016; DfE, 2016a). The effect of provider location on computing provision is not yet understood, however, teacher recruitment and retention outside cities is seen to be more difficult (Burns, 2015), and weaker performing schools are often isolated (The Future Leaders Trust, 2015) or situated in towns rather than cities (Ofsted, 2013). A lack of suitably qualified teachers might inhibit the adoption of a new qualification such as computing, and weaker performing schools might be less likely to expand into offering new qualifications. However, schools might receive additional funding due to their '*Sparsity*', where they serve rural communities (Roberts, 2016). Whilst this report cannot speak about problems in teacher recruitment it will focus on whether there are differences in computing provision between school localities.

3.3.1 GCSE

Schools serving urban communities were more likely to offer GCSE computing in 2015 than those in rural areas:

Table 11: 2015 GCSE computing provision by aggregated Urban/Rural categories

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Urban	4246	517054	1254	29.5	29116	5.6	23.2
Rural	789	79673	179	22.7	3708	4.7	20.7
Totals	5035	596727	1433	28.5	32824	5.5	22.9

While only 22.7% of rural and 29.5% of urban schools provide GCSE computing, this percentage drops to just 9.1% for providers in 'Rural hamlet and isolated dwellings in a sparse setting'. 42.9% of schools in 'Urban city and town in a sparse setting' provide GCSE computing. Schools situated in a 'Rural village with a sparse setting' fair well when looking at the proportion of schools offering GCSE computing (30%), but the overall number of providers is low (n=10) and the average cohort size is substantially below other institutions (4.7). Small cohort sizes at GCSE also have financial implications for the sustainability of qualifications within schools.

Table 12: 2015 GCSE computing provision by all Urban/Rural categories

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Urban city and town	2318	286085	721	31.1	16757	5.9	23.2
Urban major conurbation	1759	208516	467	26.5	10948	5.3	23.4
Rural town and fringe	381	51898	115	30.2	2583	5	22.5
Urban minor conurbation	162	21078	63	38.9	1363	6.5	21.6
Rural village	164	11533	28	17.1	488	4.2	17.4
Rural hamlet and isolated dwellings	188	11530	21	11.2	339	2.9	16.1

Rural town and fringe in a sparse setting	35	3805	11	31.4	268	7	24.4
Urban city and town in a sparse setting	7	1375	3	42.9	48	3.5	16
Rural village in a sparse setting	10	540	3	30.0	14	2.6	4.7
Rural hamlet and isolated dwellings in a sparse setting	11	367	1	9.1	16	4.4	16
Totals	5035	596727	1433	28.5	32824	5.5	22.9

3.3.2 A-level

Providers serving urban communities were more likely to offer A-level computing in 2015 than those in rural communities (25.1% vs 18.1%). Cohort sizes for urban providers are also larger than those for rural institutions (7.3 vs 5), suggesting that urban providers are more likely to be financially viable.

Table 13: 2015 A-level computing provision by aggregated Urban/Rural categories

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Urban	2485	257498	622	25.0	4510	1.8	7.3
Rural	414	30154	75	18.1	378	1.3	5
Totals	2899	287652	697	24.0	4888	1.7	7

Closer analysis reveals that no schools in ‘Rural hamlet and isolated dwellings in a sparse setting’ provide A-level computing (although this category of provider constitutes just 4 providers), another area offering limited provision ‘Rural town and fringe in a sparse setting’ at 9.5% of all providers. 16.7% of schools in ‘Urban city and town’ provided A-level computing.

Table 14: 2015 A-level computing provision by all Urban/Rural categories

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Urban city and town	1360	145809	392	28.8	2900	2	7.4
Urban major conurbation	1033	103041	210	20.3	1485	1.4	7.1
Rural town and fringe	205	16452	44	21.5	245	1.5	5.6
Urban minor conurbation	84	8170	19	22.6	125	1.5	6.6
Rural hamlet and isolated dwellings	96	6972	15	15.6	60	0.9	4
Rural village	84	5220	13	15.5	60	1.1	4.6

Rural town and fringe in a sparse setting	21	1279	2	9.5	10	0.8	5
Urban city and town in a sparse setting	6	454	1	16.7	X	X	X
Rural hamlet and isolated dwellings in a sparse setting	4	144	0	0.0	0	0	0
Rural village in a sparse setting	4	87	1	25.0	X	X	X
Totals	2897	287628	697	24.1	4895	1.7	7

3.3.3 Key points

- At GCSE, urban schools are more likely to provide computing when compared to rural schools (29.5% vs 22.7%);
- At A-level, urban schools are more likely to provide computing when compared to rural schools (25.1% vs 18.1%);

3.4 Coastal schools

Building on Thomson's (2015) definition of a coastal school being at most 5.5km from the coastline, we can look at the uptake of computing qualifications among students attending these institutions. Ofsted (2014) recognises that it is difficult for coastal schools to recruit and retain teachers in general. It might follow that this would lead to a reduced number of teachers able to deliver the new qualification and impact on the provision of computing qualifications for those students attending coastal schools.

3.4.1 GCSE

GCSE computing provision in 2015 shows that the percentage of coastal institutions offering the subject is in line with inland providers. This suggests that both types of institution are able to staff computing courses at roughly the same level.

Table 15: 2015 GCSE computing provision in coastal schools

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Inland	4191	497261	1188	28.3	27439	5.5	23.1
Coastal	844	99466	245	29.0	5385	5.4	22.0

3.4.2 A-level

A slightly higher proportion of inland schools offered A-level computing cohort in 2015, but cohort sizes in coastal schools were substantially larger than those inland.

Table 16: 2015 A-level computing provision in coastal schools

Type	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Inland	2477	246467	598	24.1	4037	1.6	6.8
Coastal	422	41185	99	23.5	851	2.1	8.6

3.4.3 Key points

- A similar proportion of inland and coastal schools provided GCSE computing (29% vs 28.3%) and A-level (23.5% vs 24.1%);
- Even though the percentages of schools offering A-level computing are similar, coastal schools have larger average cohort sizes (8.6) than inland schools (6.8);

3.5 Local authorities and regions

The majority of secondary schools are now academies (Bolton, 2015), this means that in general the 153 local authorities cannot be held accountable for the majority of schools within their geographic area. We use them here to present a finer grained geographic breakdown of provision. To give a broader geographic overview the nine Government Office Regions will be used: they were abolished in April 2011 but continue to be used for statistical purposes (Office for National Statistics, 2016).

3.5.1 GCSE

3.5.1.1 Local authorities

There were 2 local authorities with no provision of GCSE computing in 2015. Looking more closely, both of these LAs are very small in terms of total schools and total students. The 10 LAs with the lowest provision nationally by percentage of students taking computing are presented in the table below.

Table 17: 2015 GCSE computing by Local Authority - bottom provision by % of students taking computing

LEA Name	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
City of London	2	216	0	0.0	0	0.0	
Isles Of Scilly	1	19	0	0.0	0	0.0	
Barking and Dagenham	13	1879	1	7.7	7	0.4	7.0
North East Lincolnshire	13	1792	1	7.7	9	0.5	9.0
North Tyneside	18	2042	1	5.6	12	0.6	12.0
Darlington	11	1185	1	9.1	17	1.4	17.0
Peterborough	19	2334	2	10.5	41	1.8	20.5
St. Helens	14	1876	1	7.1	34	1.8	34.0
Blackburn with Darwen	17	1488	2	11.8	29	1.9	14.5
Stockport	30	3127	5	16.7	64	2.0	12.8

The 10 top local authorities are presented below:

Table 18: 2015 GCSE computing by Local Authority - top provision by % of students taking computing

LEA Name	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Reading	16	1514	5	31.2	182	12.0	36.4
Blackpool	11	1229	6	54.5	147	12.0	24.5
Newham	23	3680	10	43.5	430	11.7	43.0
Sefton	27	2955	12	44.4	339	11.5	28.2
Bournemouth	16	1755	5	31.2	184	10.5	36.8
West Berkshire	22	2319	9	40.9	238	10.3	26.4
Wirral	29	3404	12	41.4	329	9.7	27.4
Southend-on-Sea	19	1760	6	31.6	169	9.6	28.2
Wandsworth	24	2119	6	25.0	200	9.4	33.3
Hillingdon	23	3206	10	43.5	301	9.4	30.1

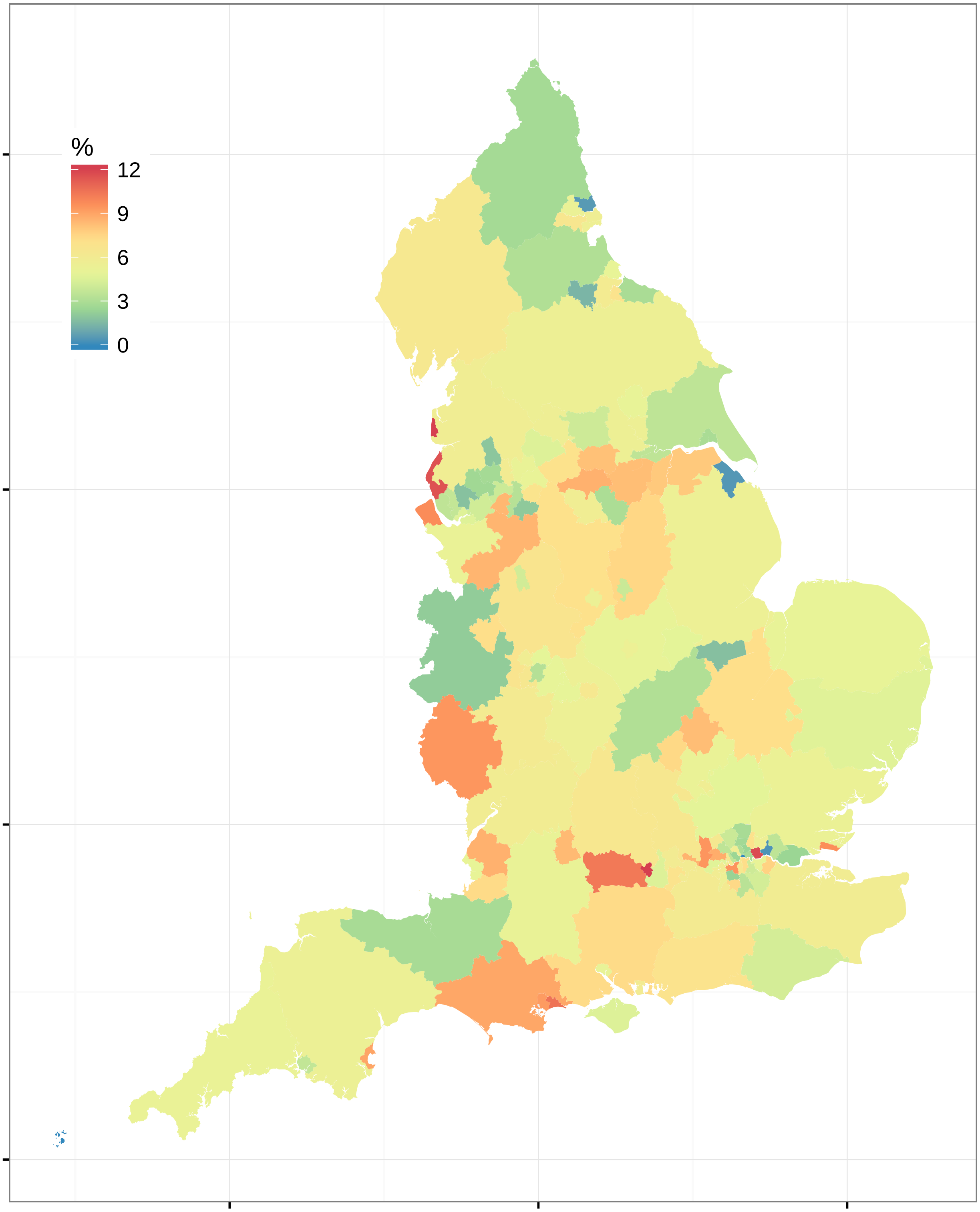


Figure 1: 2015 GCSE computing heat map by % of students per local authority

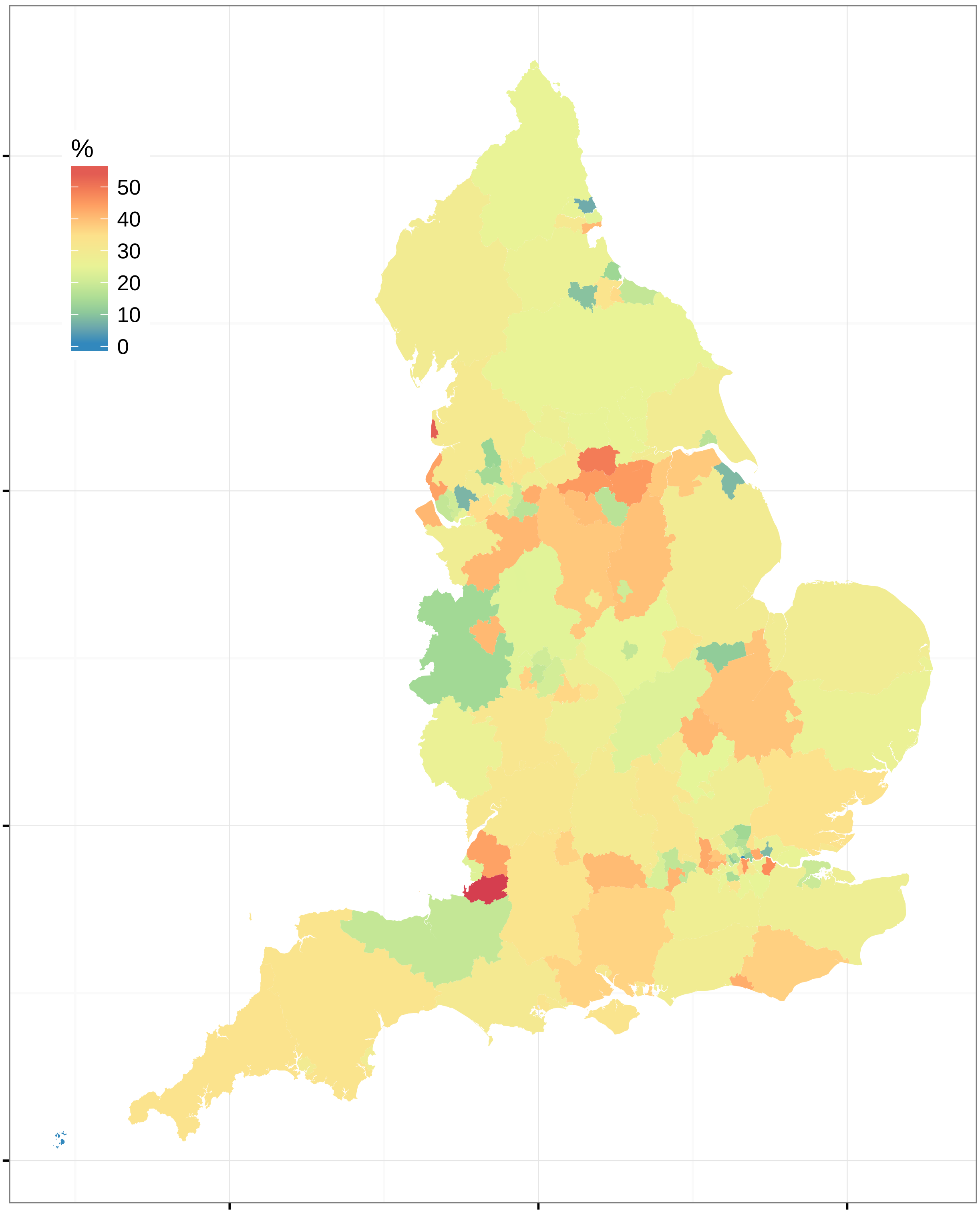


Figure 2: 2015 GCSE computing heat map by % of schools per local authority

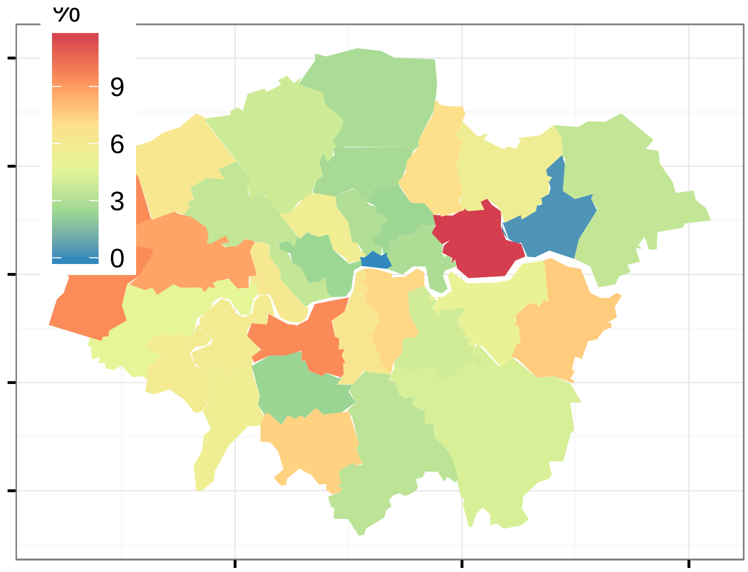


Figure 3: 2015 GCSE computing heat map by % of students per London LA

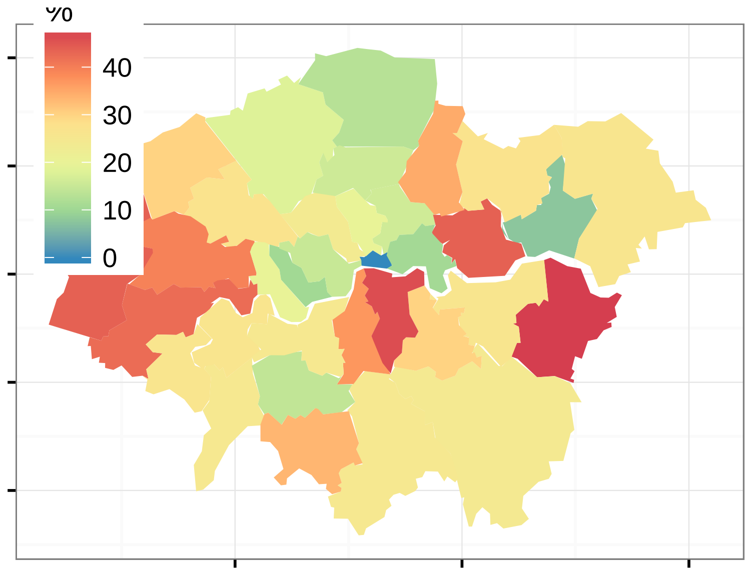
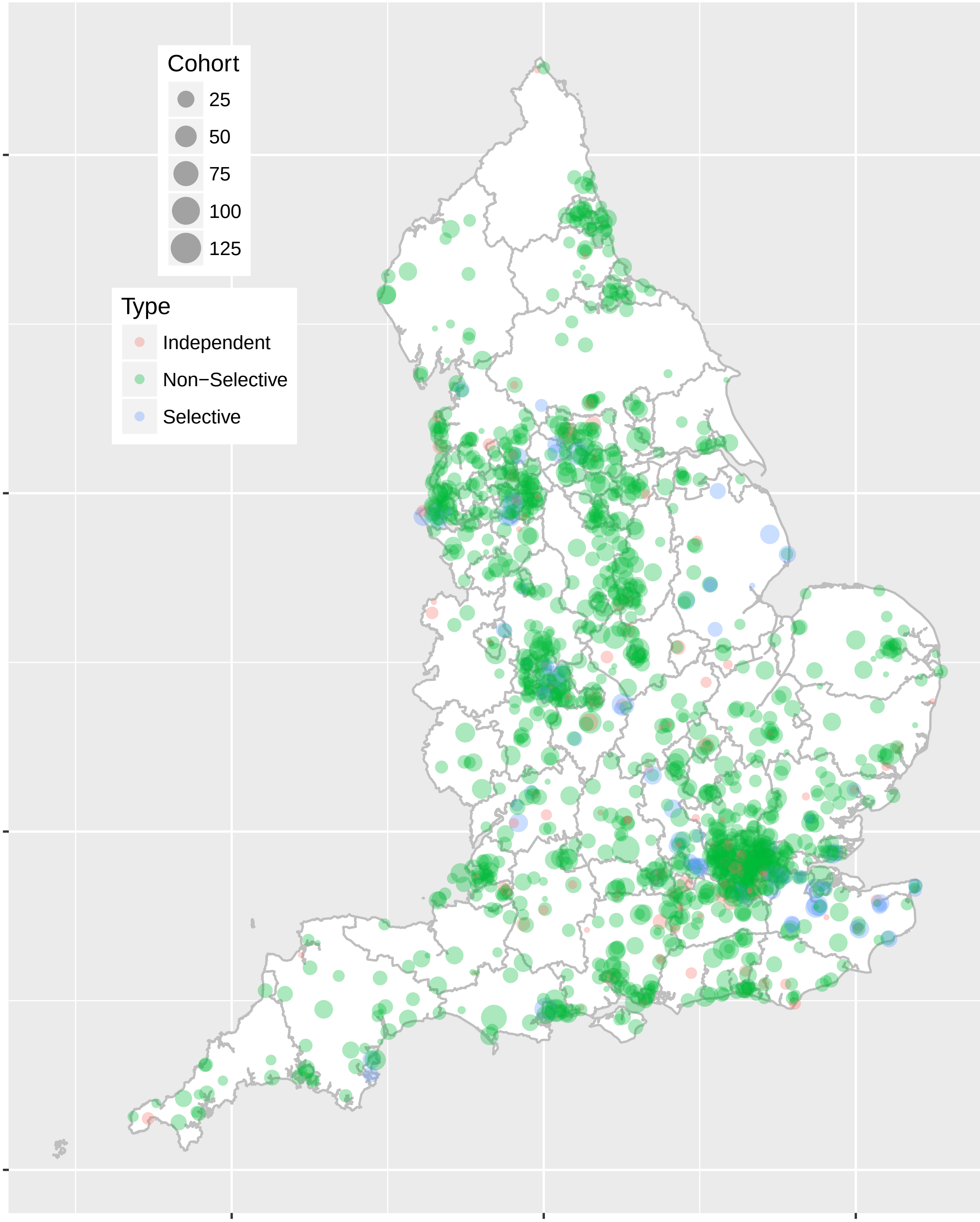


Figure 4: 2015 GCSE computing heat map by % of schools per London LA


Cohort
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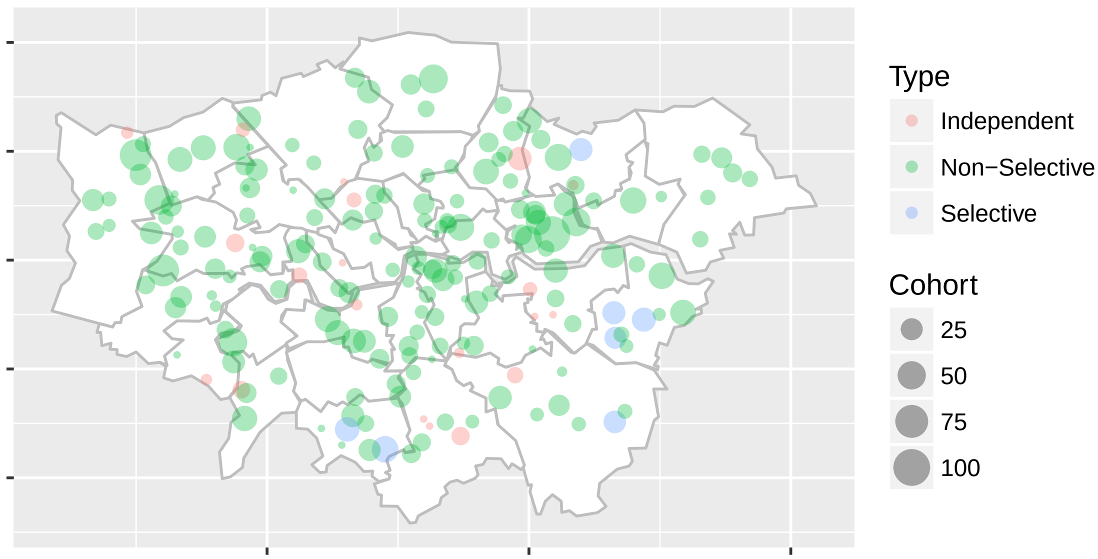


Figure 5: 2015 GCSE computing school scatter map by school type - London LAs

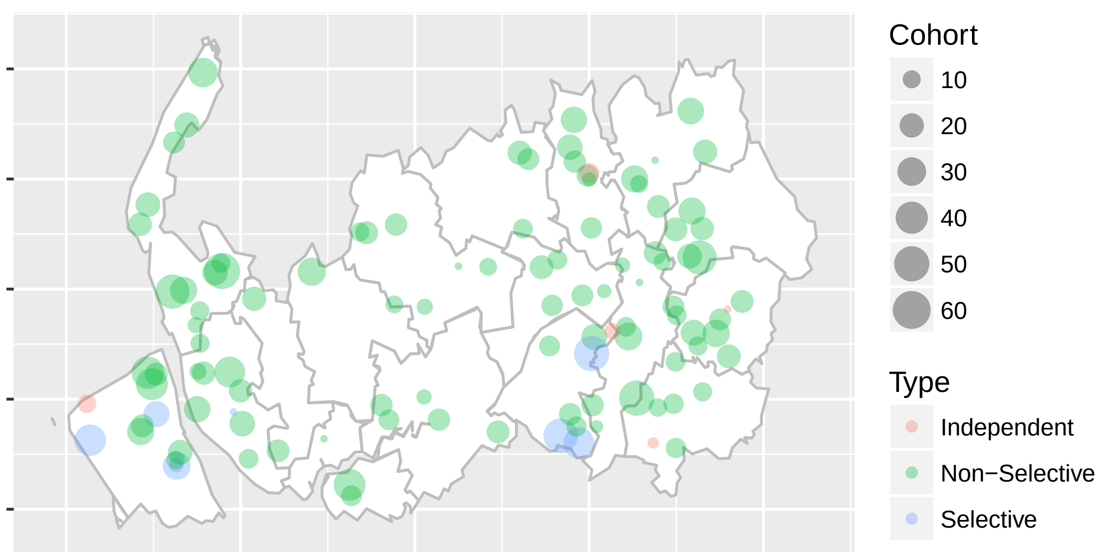


Figure 6: 2015 GCSE computing school scatter map by school type - Liverpool & Manchester LEAs

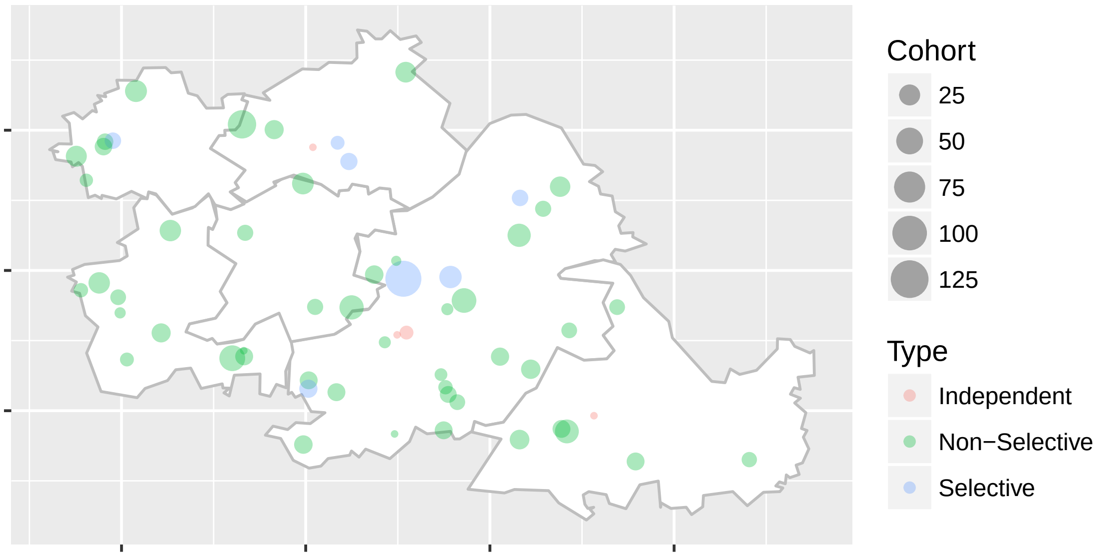


Figure 7: 2015 GCSE computing school scatter map by school type - Birmingham LAs

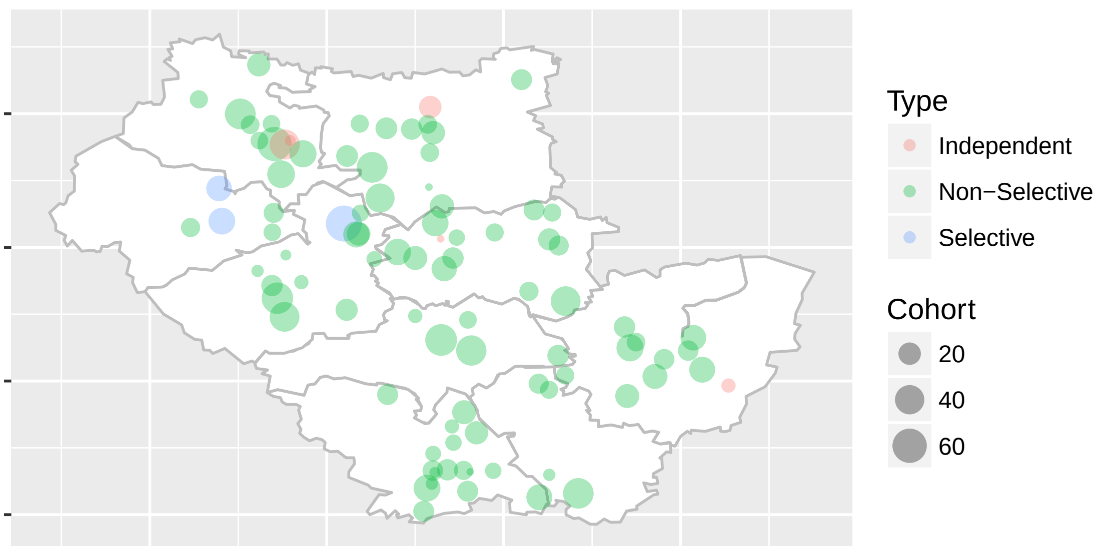


Figure 8: 2015 GCSE computing school scatter map by school type - Leeds & Sheffield LAs

3.5.1.2 Regions

Breaking down the GCSE provision by regions we can see that the top provision occurs in the south of the country. London's provision is below the average for the surrounding regions. The South East has the highest provision (6.5%) and the North East of England has the lowest provision with 4.2% of students sitting computing[6].

Table 19: 2015 GCSE computing provision by region, ordered by student population

Region	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
South East	874	99684	271	31.0	6526	6.5	24.1
London	744	84338	196	26.3	4517	5.4	23.0
North West	689	80084	196	28.4	4301	5.4	21.9
East of England	545	67917	161	29.5	3503	5.2	21.8
West Midlands	581	65024	145	25.0	3413	5.2	23.5
Yorkshire and The Humber	450	59532	131	29.1	3108	5.2	23.7
South West	508	59231	158	31.1	3460	5.8	21.9
East Midlands	397	51499	115	29.0	2831	5.5	24.6
North East	224	27629	55	24.6	1149	4.2	20.9
Totals	5012	594938	1428	28.5	32808	5.5	23.0

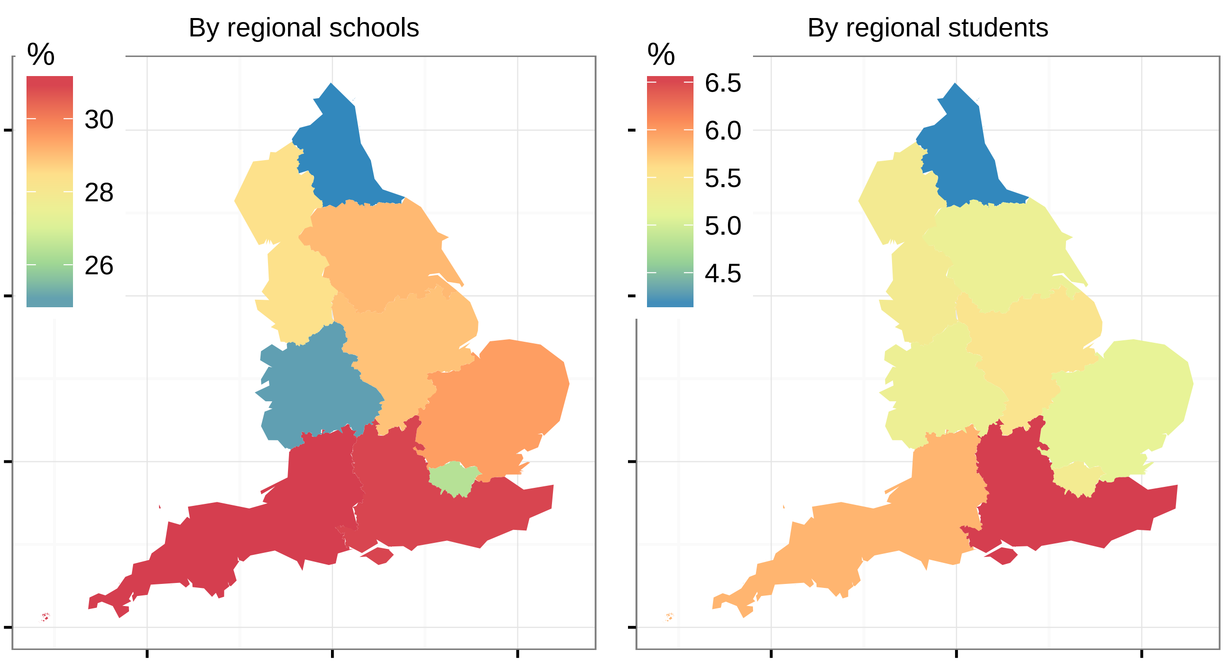


Figure 9: 2015 GCSE computing regional heat map by schools and by students.

[6] Note: If the North East were to match the provision in the South East, there would have to be 57.4% or 660 additional students sitting computing, and 26.7% or 15 additional providers.

3.5.2 A-level

3.5.2.1 Local authorities

Out of the 151 local authorities offering A-level qualifications in 2015[7], 7 had no provision of A-level computing. The LAs with no provision of A-level computing were (n = total number of providers): City of London (n=2); Enfield (n=19); Gateshead (n=10); Knowsley (n=3); Peterborough (n=13); Rutland (n=3); Salford (n=3)

Local authority provision of A-level computing is sparser than that of the GCSE. This is unsurprising as the numbers taking the A-level computing are much lower (A-level n = 4888; GCSE n = 32825) and local authorities have lower numbers of A-level computing providers than GCSE providers (A-level n = 697; GCSE n = 1433). In addition to the 7 authorities with no provision, school cohort sizes in 20 local authorities are low enough to require the anonymisation of student data before publication. As a result, other than the top 10 providers, we have chosen to redact student numbers from this section of the report.

The 10 top local authorities are presented below.

Table 20: 2015 A-level computing by Local Authority - top provision by % of students taking computing

LEA Name	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
Poole	7	896	5	71.4	62	6.9	12.4
Bury	7	1473	3	42.9	76	5.2	25.3
Hartlepool	4	505	2	50.0	25	5.0	12.5
Middlesbrough	4	354	2	50.0	16	4.5	8.0
Stockton-on-Tees	6	689	3	50.0	28	4.1	9.3
Reading	11	724	6	54.5	28	3.9	4.7
North East Lincolnshire	5	665	1	20.0	25	3.8	25.0
Dudley	7	1776	4	57.1	66	3.7	16.5
Blackburn with Darwen	8	740	4	50.0	27	3.6	6.8
Stoke-on-Trent	5	740	3	60.0	27	3.6	9.0

Due to low numbers of A-level computing students a heat map by % of schools per local authority is not shown as it might allow for the recognition of 5 or fewer students.

[7] Note: the Isles of Scilly offered no A-level provision in 2015

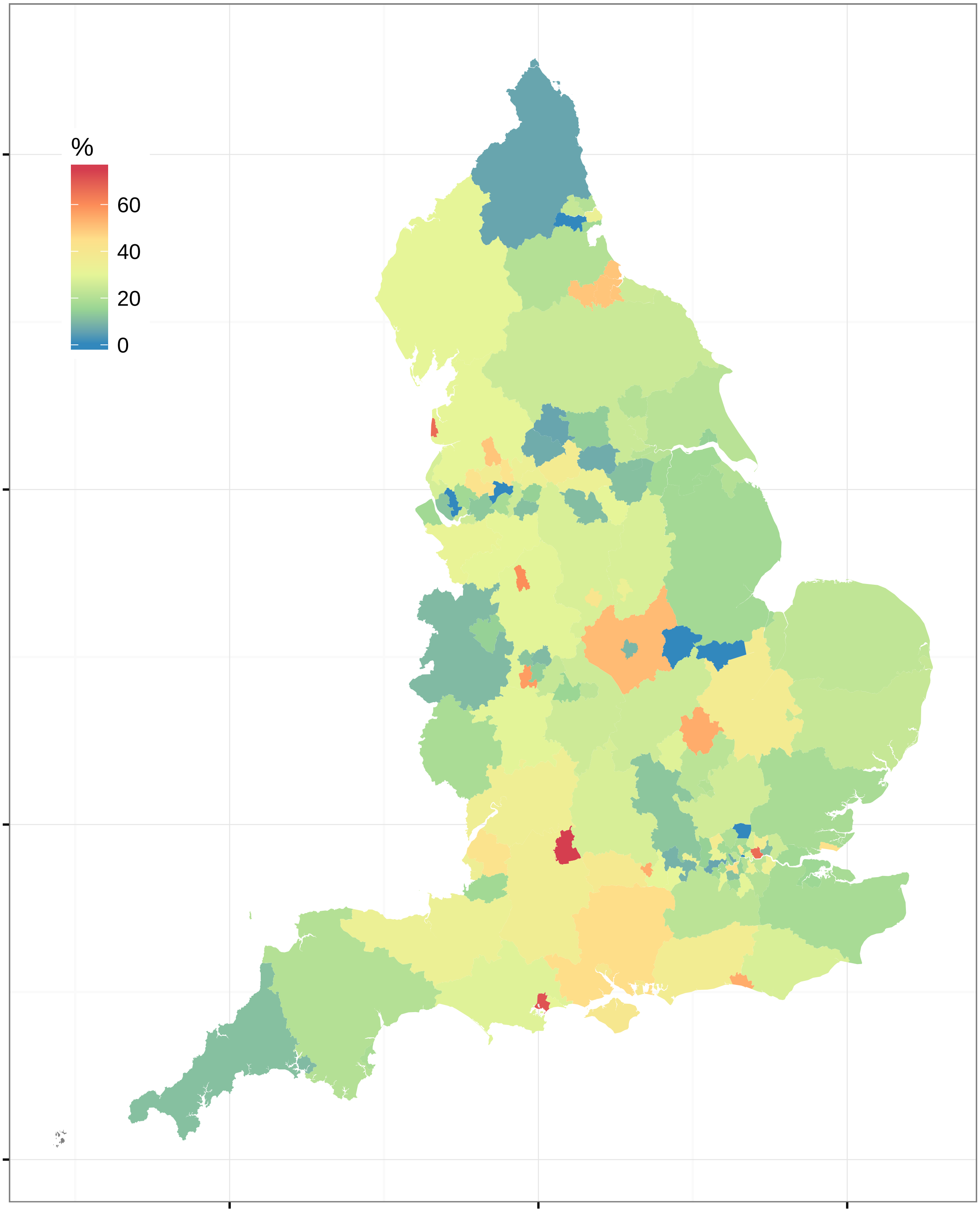


Figure 10: 2015 A-level computing heat map by % of schools in LA

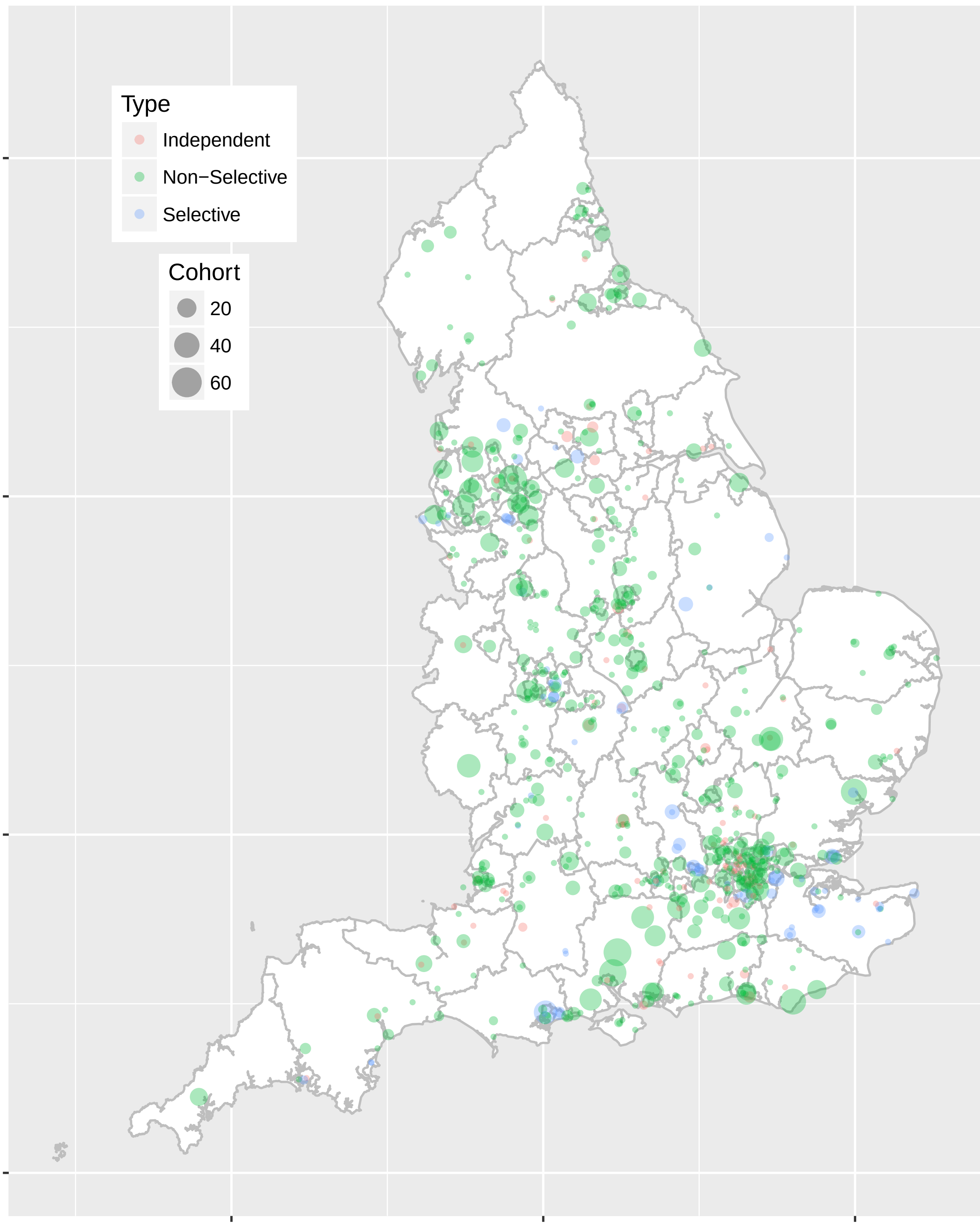


Figure 11: 2015 A-level computing school scatter map by school type (n=697)

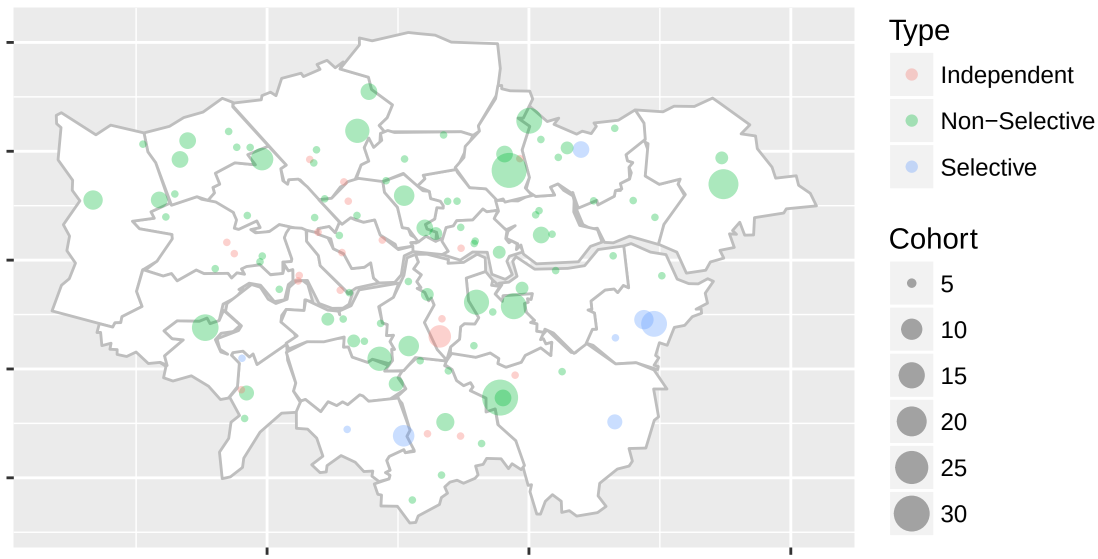


Figure 12: 2015 A-level computing school scatter map by school type - London LAs

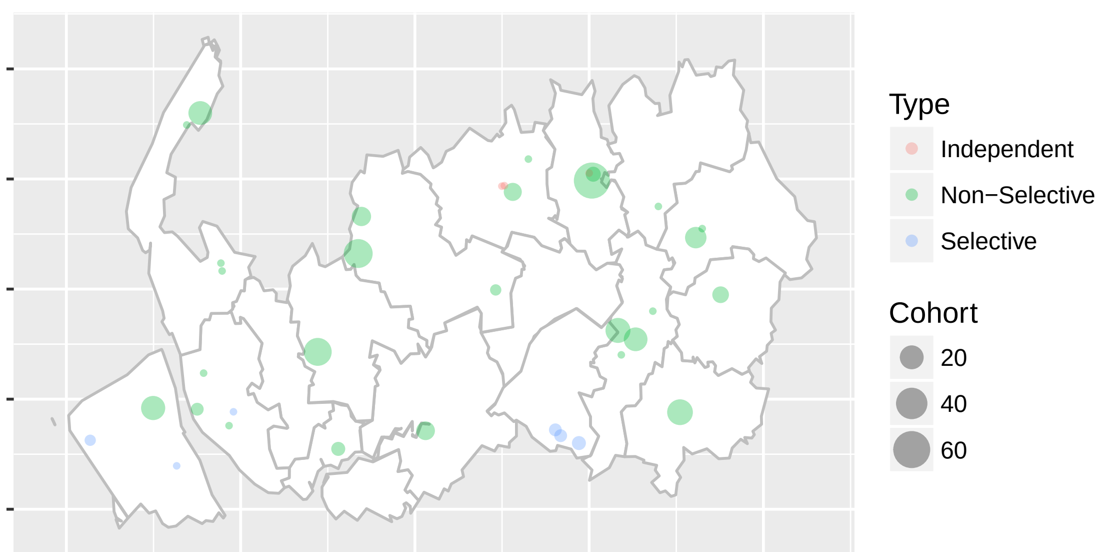


Figure 13: 2015 A-level computing school scatter map by school type - Liverpool & Manchester LEAs

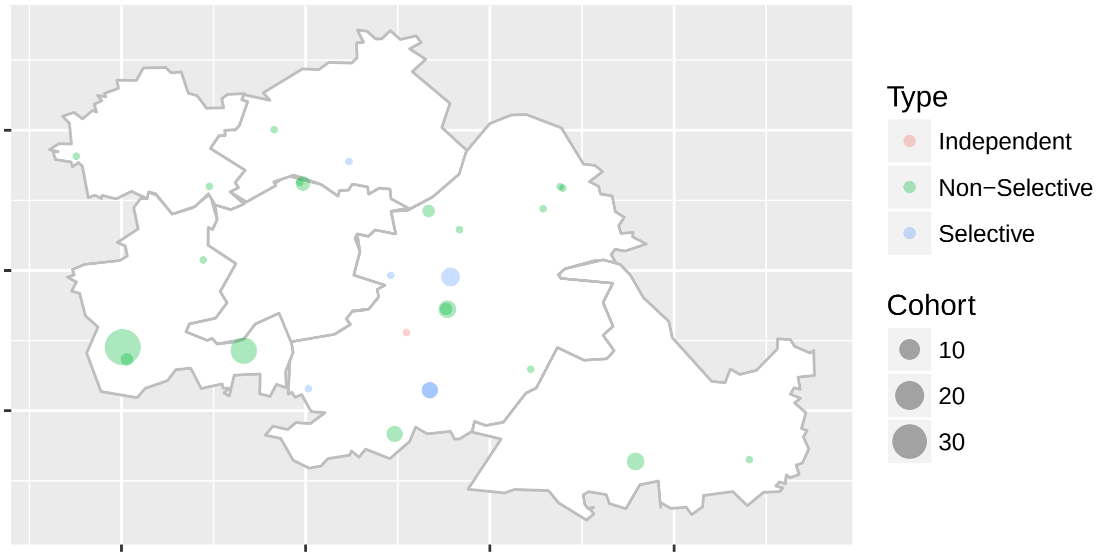


Figure 14: 2015 A-level computing school scatter map by school type - Birmingham LAs

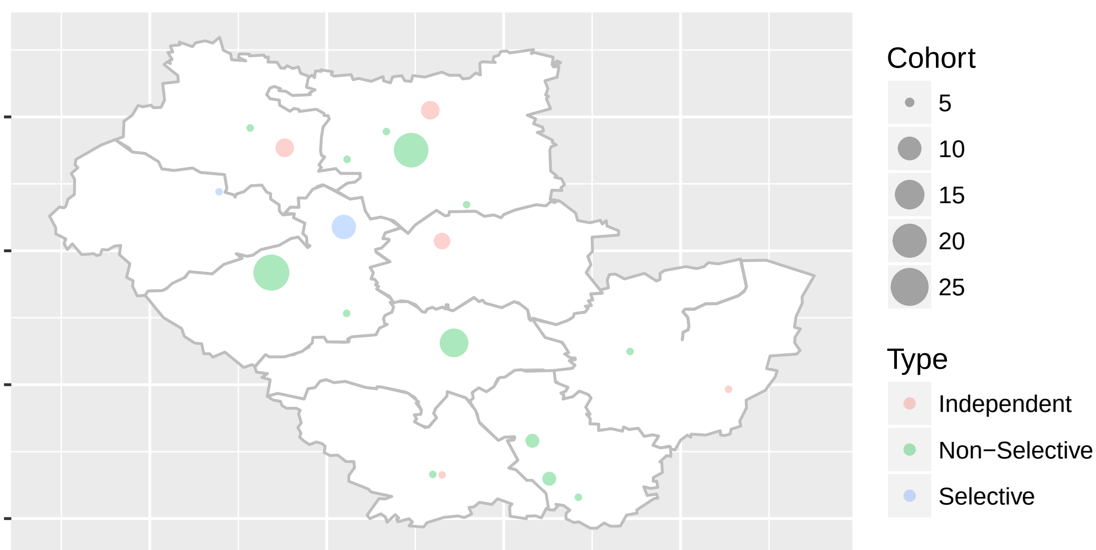


Figure 15: 2015 A-level computing school scatter map by school type - Leeds & Sheffield LAs

3.5.2.2 Regions

Breaking the A-level provision down by regions we can see that the largest proportion of schools offering computing A-level are in the South East and Northwest. Following the trend noticed at GCSE level, the South East of England offers the highest proportion of students in their region sitting a computing qualification (2.1%). London's provision is below the average for the surrounding regions and Yorkshire and Humberside has the lowest percentage of students sitting computing, at 1.1% of the overall population[8]. Some of this difference might be explained by the large number of grammar schools in South East England (Bolton, 2016) and the increased percentage of grammar schools offering A-level computing (see Private and state school by gender).

Table 21: 2015 A-level Computing provision by region

Region	Total Schools	Total Students	Subject Providers	Providers %	Subject Students	Students %	Average Cohort Size
South East	511	55636	139	27.2	1131	2.0	8.1
London	495	47866	110	22.2	612	1.3	5.6
North West	307	35340	78	25.4	742	2.1	9.5
East of England	336	33271	83	24.7	563	1.7	6.8
South West	295	29526	84	28.5	523	1.8	6.2
West Midlands	337	28407	74	22.0	460	1.6	6.2
Yorkshire and The Humber	247	24438	38	15.4	270	1.1	7.1
East Midlands	249	21986	68	27.3	418	1.9	6.1
North East	106	10639	23	21.7	169	1.6	7.3
Totals	2883	287109	697	24.2	4888	1.7	7.0

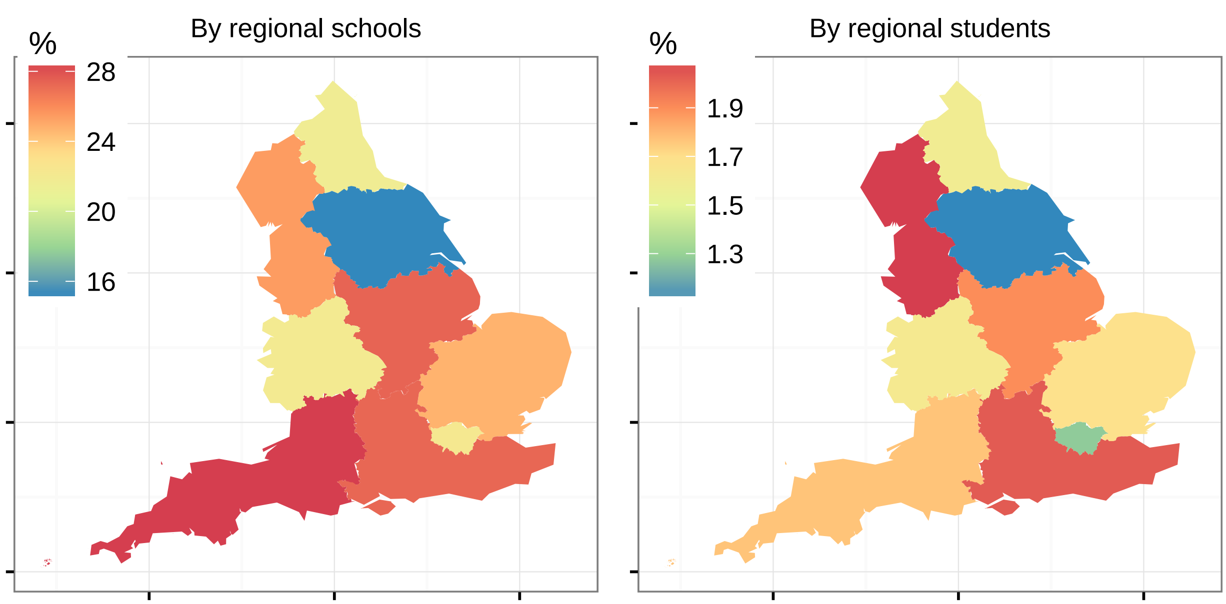


Figure 16: 2015 A-level computing regional heat map by schools and by students.

[8]Note: If Yorkshire and Humberside were to match the provision in the South East, there would be 90% or 243 additional students sitting computing, and 85.1% or 32 additional providers

3.5.3 Key points

- There are 2 local authorities with no GCSE computing provision and 7 local authorities with no A-level computing provision;
- Provision of GCSE and A-level computing varies significantly across the country;
- The North East of England has the lowest GCSE computing provision; the South East has the highest;
- Yorkshire and Humberside has the lowest A-level computing provision by percentage of schools, with the south having the highest;

3.6 Schools by overall examination cohort size

This section will explore the relationship between computing provision and cohort size as well as computing provision and subject offering of a provider. As noted in the Schools by Type of Establishment section above, the subject cohort size of a school is increasingly impacting the ability of a provider to offer A-level computing, while the relationship at GCSE remains less clear. Here we explore the relation between the cohort sizes of subjects, looking at the percentage of providers with a cohort size for GCSE (n>=20) and A-level (n>=6)[9], as well as how computing compares to the 30 largest subjects at GCSE and A-level. Additionally, we look at the size of provider in terms of total cohort for all subjects and number of qualifications offered, seeing how both of these factors impact on computing provision. As noted above, A-level and GCSE student numbers in computing are increasing, and these figures might change substantially in years to come.

3.6.1 GCSE

The cohort size of GCSE computing (M=22.9, SD=15) is, on average, larger than A-level (M=7, SD=8), and as a result there does not appear to be the same funding pressure on schools. However, if we look at the cohort sizes of individual schools we can see that 47.6% of schools have cohort sizes below 20 students (see above), which suggests that these providers might struggle to maintain GCSE computing courses at these current cohort sizes; computing has fewer schools meeting the cohort size criterion when compared to ICT and physics.

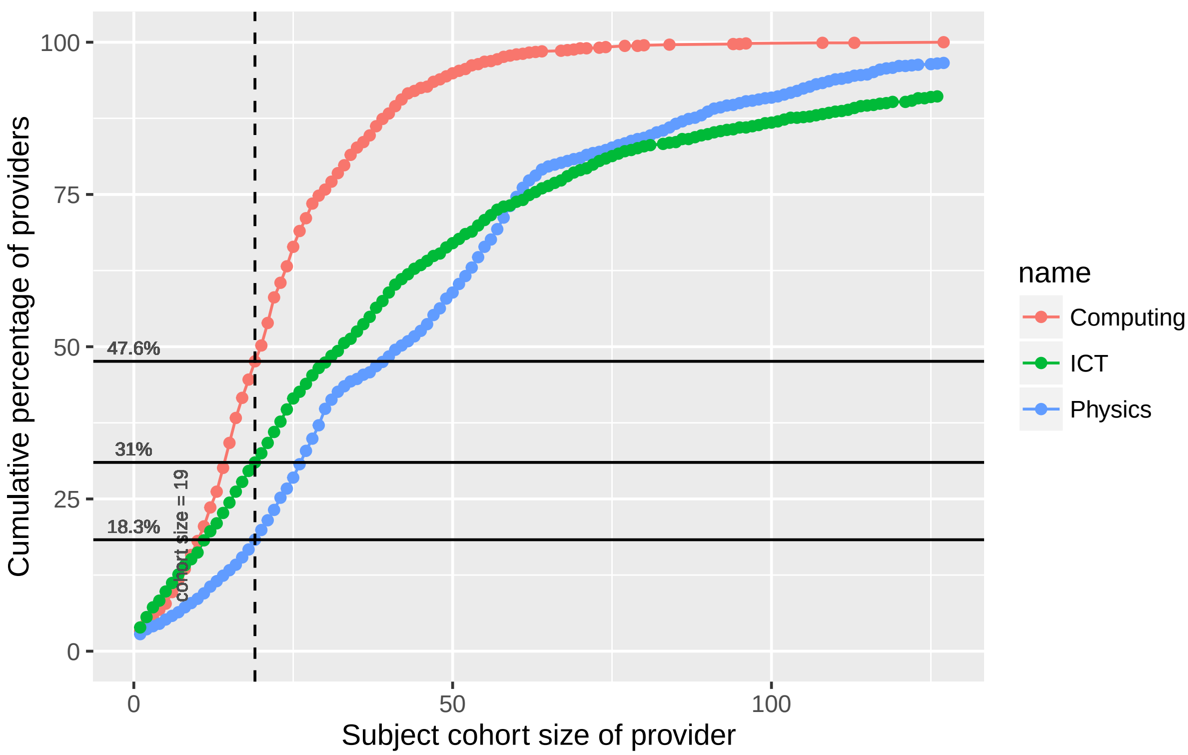


Figure 17: 2015 GCSE computing, ICT and physics cumulative cohort sizes (lines noting % of providers below cohort size of 20)

Additionally, when we compare computing to the 50 largest subjects at GCSE we can see that only half

[9]Note: funding models vary widely between providers and sustainable cohort sizes will differ, these figures are based on conversations with teachers, a more thorough methodology is needed

of the providers have cohort sizes of 20 or more students, while in most other subjects this is substantially higher, including ICT and physics.

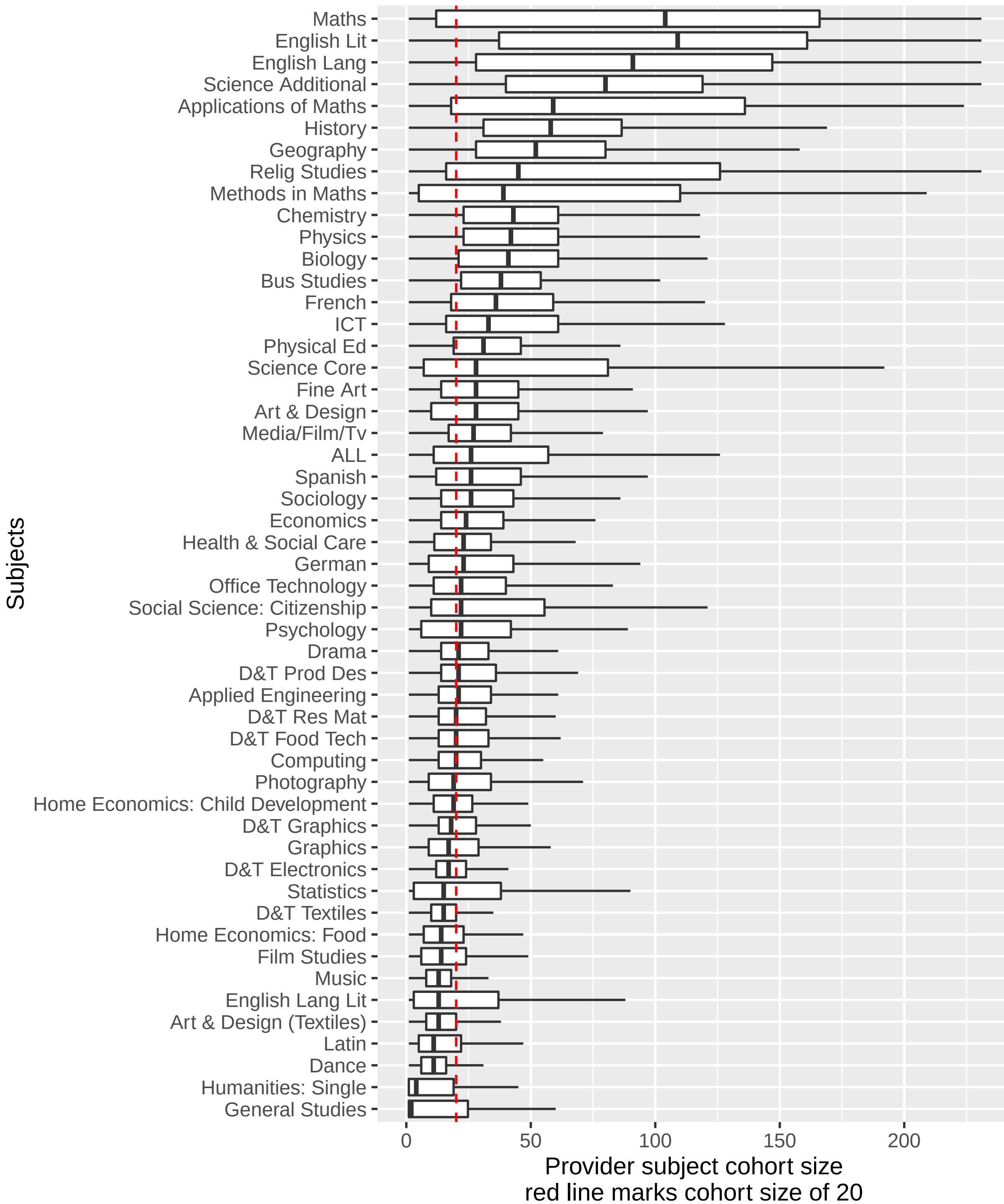


Figure 18: 2015 GCSE box plot subject cohort sizes (outliers truncated)

The provision of GCSE computing is strongly related to the size of the GCSE cohort in an institution. The larger the cohort, the more likely a school is to be offering the qualification. The graphs below split all GCSE providers (n=5035) into 5 groups containing an equal number of schools. The GCSE cohort sizes used to define the clusters are: 1-11, 12-89, 90-149, 150-200, 201-611. As can be seen, all sizes of school are currently offering ICT and physics more than computing. This might be expected as computing is a relatively new subject. Additionally, smaller providers might have teachers who deliver multiple courses and who have found that the new qualification of computing is further from their skillset than ICT, choosing to deliver ICT instead. Interestingly, ICT is more popular with very small schools (cohort size = 1-11) than physics; an explanation for this might be the limited resources of smaller providers being used to run a course where they feel more certain of getting favourable results.

Out of the 1433 GCSE computing providers, only 21 (1.5%) had the majority of their GCSE students sitting computing. 7 of these schools were independent schools with small overall GCSE cohorts.

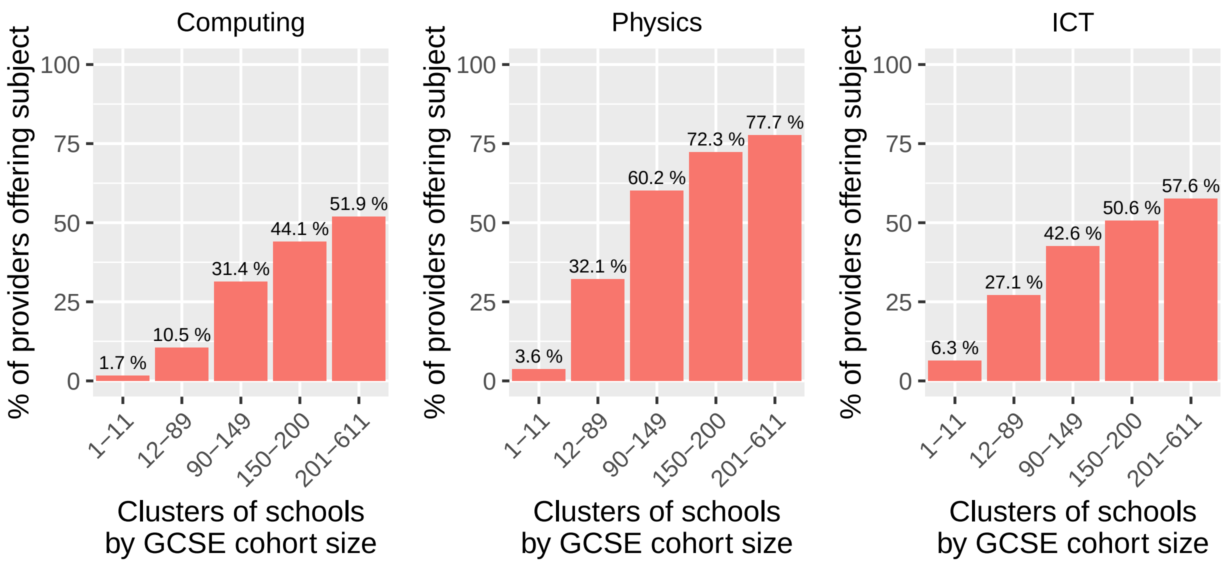


Figure 19: 2015 GCSE computing provision by school size

Another way at looking at the size of an institution is to look at the number of qualifications that a provider offers. As shown in the graphs below, providers offering smaller numbers of qualifications tend not to offer computing. Where schools have limited resources to provide qualifications, they tend not to number computing amongst their options.

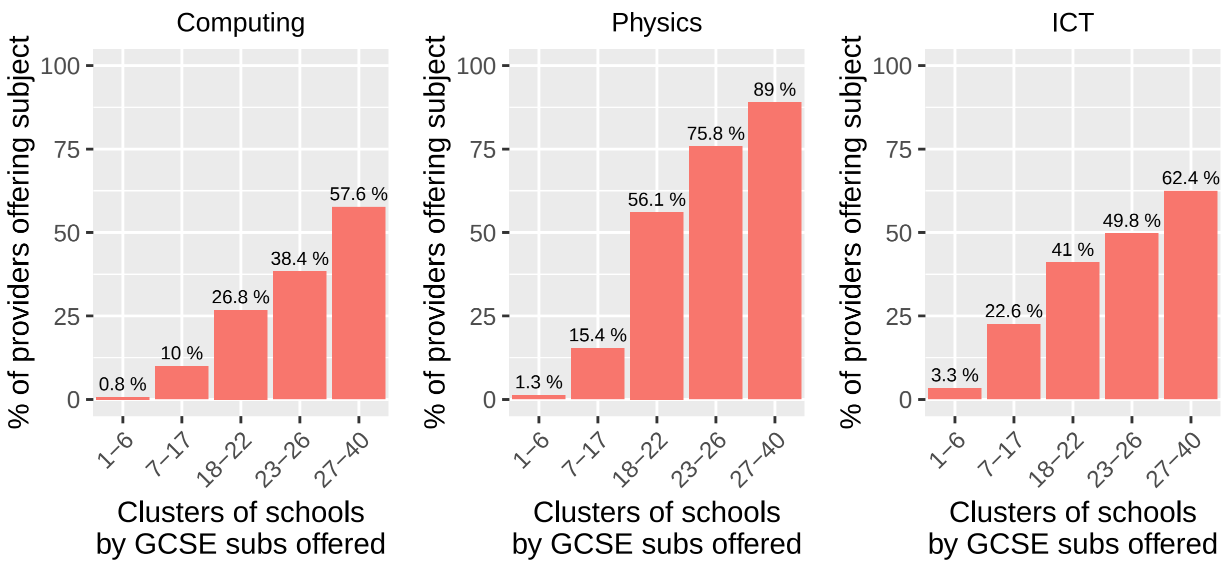


Figure 20: 2015 GCSE computing provision by qualifications offered

3.6.2 A-level

Cohort sizes for A-level (M=7, SD=8) are a concern due to recent funding changes (see Schools by Type of Establishment). If we look at the cohort sizes of individual providers we can see that 58.5% of providers have cohort sizes below 6 students, suggesting that many providers might struggle to maintain A-level computing courses at their current levels.

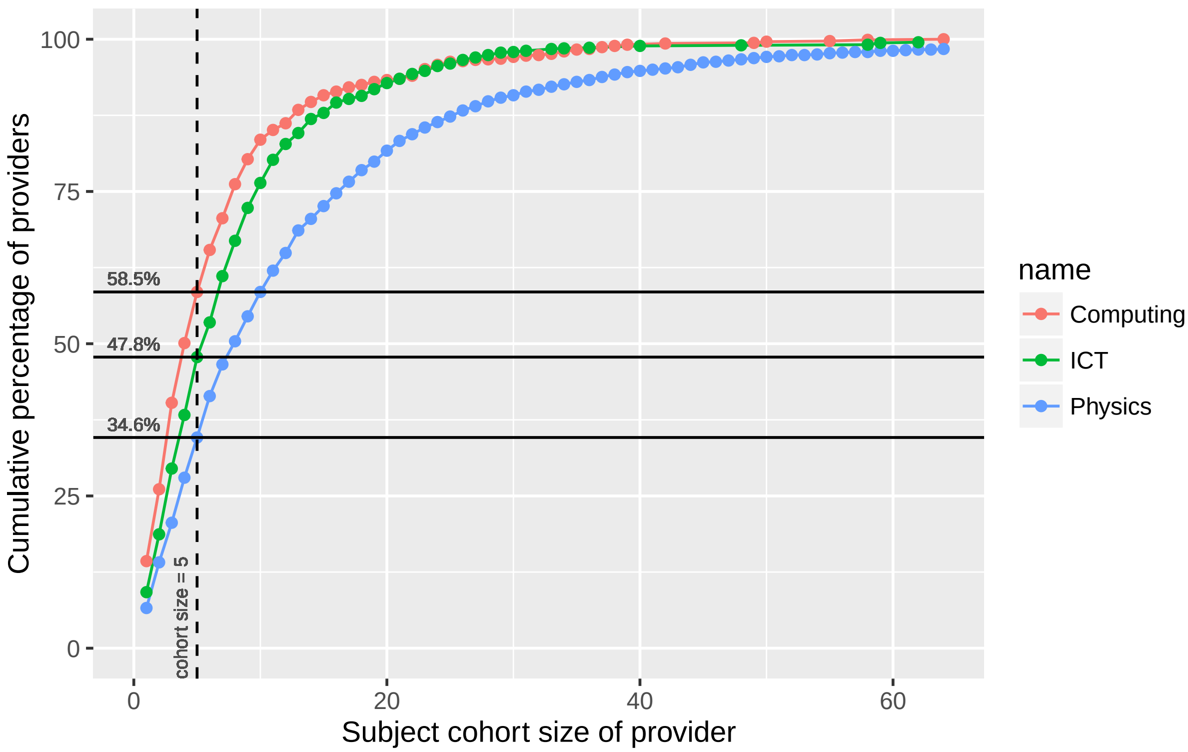


Figure 21: 2015 A-level computing, ICT and physics cumulative cohort sizes (lines noting % of providers below cohort size of 6)

Additionally, when we compare computing to the 50 largest subjects at A-level we can see that it is ranked amongst those subjects with smaller cohort sizes. Computing has a median cohort size of just 4 students. The distribution of both ICT and computing providers both look vulnerable to funding changes.

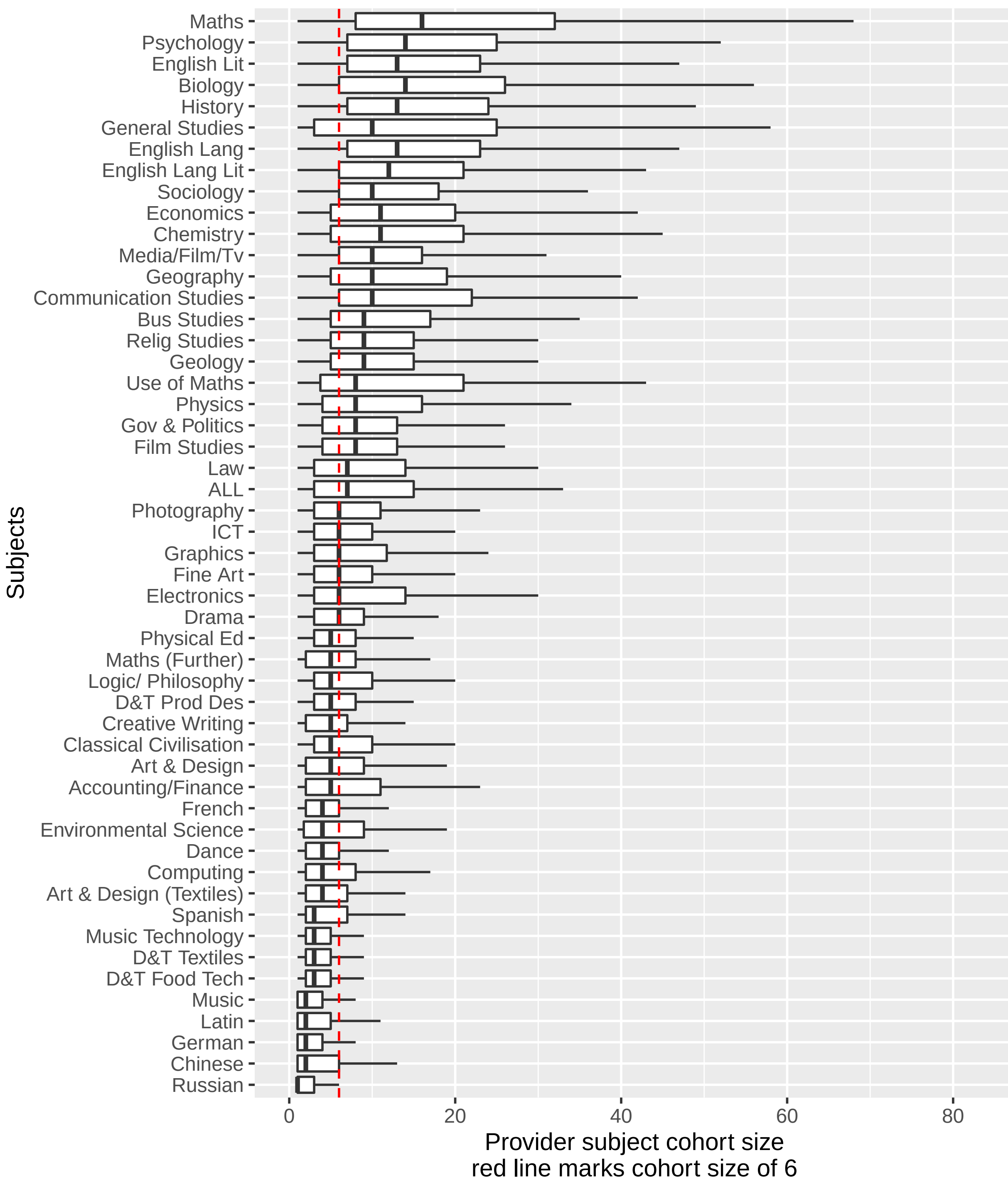


Figure 22: 2015 A-level box plot subject cohort sizes (outliers truncated)

The 2015 A-level entries show a marked difference between provision of computing by smaller institutions and provision by larger sized institutions. This maps onto the larger provision offered by Further Education providers (see Schools by Type of Establishment) including sixth form colleges, institutions that tend to have larger cohort sizes than school based sixth forms. Surprisingly, in providers with large A-level cohorts, computing is more commonly offered than ICT. The graphs below split all A-level providers (n=2899) into 5 equal clusters. The A-level cohort sizes used to define the clusters are: 1-27, 28-54, 55-87, 88-137, 138-1717

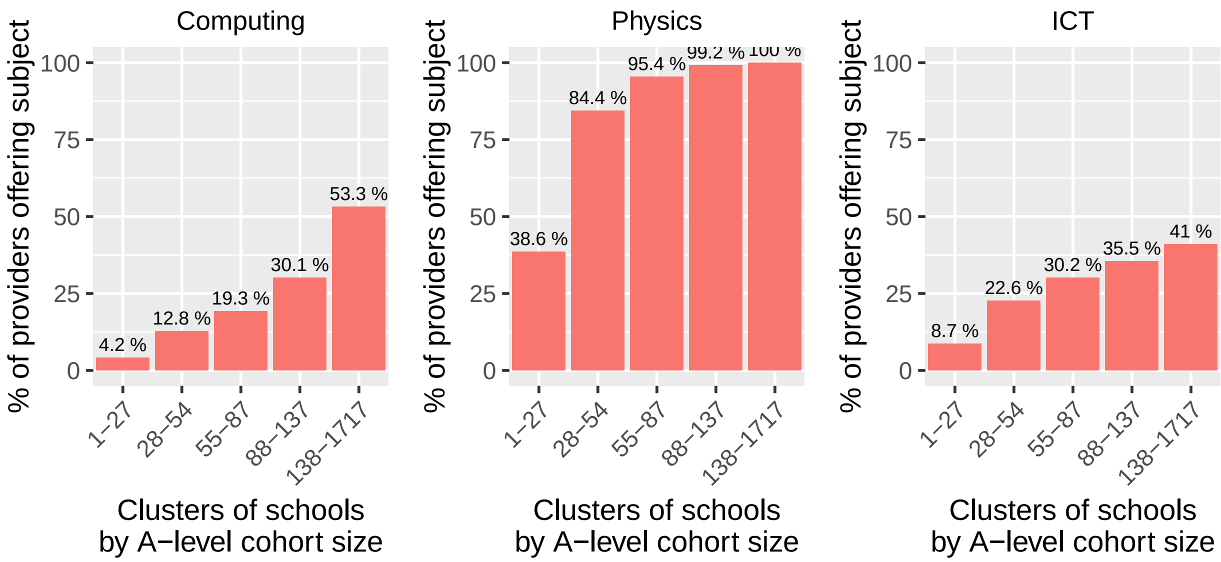


Figure 23: 2015 A-level computing provision by provider size

As might be expected, computing is not often offered in providers running only a small number of qualifications. This might also be a reflection of the lack of provision in sixth forms attached to schools, and the better provision offered by much larger sixth form colleges (see Schools by Type of Establishment).

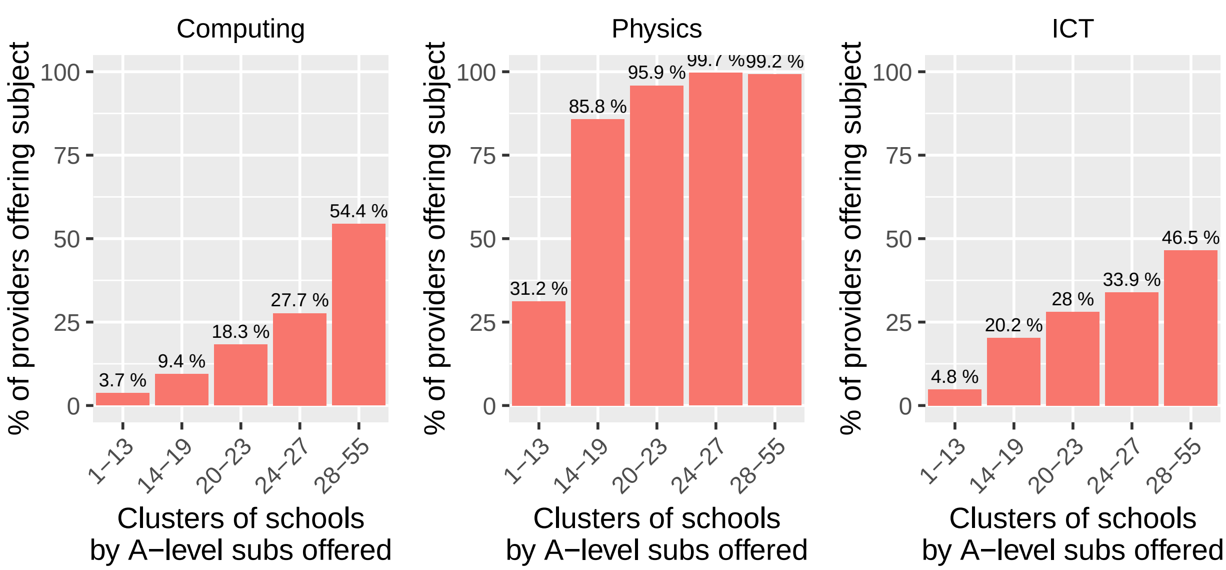


Figure 24: 2015 A-level computing provision by qualifications offered

3.6.3 Key points

- GCSE computing providers are in general showing viable cohort sizes;
- A-level computing cohort sizes are small with a median of 4 and a mean of 7. This raises concerns about the sustainability of computing in most A-level providers compared to other, larger subjects;
- Larger providers are offering A-level computing more than A-level ICT;

3.7 Mix of subjects

In 2015 there were 85 subject options at GCSE and 84 at A-level. All these courses cannot reasonably be offered by any one provider and students will be asked to pick from a subset of qualifications. These choices are influenced by the provider: financial viability of courses, availability of teachers, student demand, Attainment/Progress 8 (DfE, 2016c), EBacc (DfE, 2016b), etc; and by external pressures such as the Russell Group's *Informed Choices* document (2015). Computing does not currently appear as one of the Russell Group's 'facilitating' A-level subjects for entry into university; however, out the 61 degrees described in the document computing/computer science appears 22 times as a 'useful' qualification[10]. At GCSE, computing appears as one of the 'single' sciences in the *EBacc* (DfE, 2016b) and can be counted towards the *Attainment/Progress 8* school measurement (DfE, 2016c). This section looks at the subject choices of students sitting computing at GCSE and A-level.

3.7.1 GCSE

In 2015 GCSE students sat on average 6.9 (*SD*=2.4) subjects; the number of subjects taken by computing students was higher at 8.2 (*SD*=1.9). We note that non-Pupil Premium students (see Pupil Premium and IDACI) on average, take more qualifications than those qualifying for Pupil Premium (*M*=7.5 *SD*=2.1 vs *M*=6.1 *SD*=2.3).

The choice of subjects to accompany computing largely reflects the largest subjects available nationally (these subjects are shown as grey bars in the figures below). This might be explained by a lack of subject choice at GCSE. The subjects taken with ICT and physics are very similar to the subjects taken with computing, the only substantial difference being the order of the 'three' single sciences, as physics biology and chemistry are often combined. When combined with physics, biology (94.1%) and chemistry (95.6%) are the main two partner subjects. This is not the case for ICT and computing, with computing students taking core science nearly as much as the single sciences (science core = 25.6%, physics=36.2%, biology=35%, chemistry=35.5%).

The EBacc guidance document states that to pass the science component a student could:

> take 3 single sciences at GCSE and get an A* to C in at least 2 of them (the single sciences are biology, chemistry, computer science and physics) (DfE, 2016b)

The fact that biology, chemistry and physics are not as commonly taken with computing as they are with each other raises questions around how computing is being used as an EBacc subject. Whilst this report does not touch on the prestige value resulting from computing being part of the EBacc, it can look at the situations where computing forms one of the single sciences required to complete the science component of the EBacc. In total there were 1126 students taking exactly 3 single sciences, including computing; this forms 3.4% of total GCSE computing entries. There were 11975 instances where computing was amongst 3 or more sciences taken by a student (36.5% of all computing GCSEs) and 10094 instances where computing formed one of the passes (30.8% of all computing GCSEs). It appears that computing is not considered by the majority of providers and students to be a replacement for the other sciences. This might be expected as providers are only just adapting to the new course and will probably have well established provision for biology, chemistry and physics. However, the proportion taking computing alongside the three other single sciences is high.

Out of the 5035 GCSE providers, 1434 (28.5%) offered computing and 1896 (37.7%) offered ICT; there was an intersection of 655 (13%) providers offering both qualifications. There were 3167 students sitting both qualifications, 9.6% of GCSE computing students.

[10] namely: Aeronautical Engineering, Biochemistry, Biology, Chemical Engineering, Chemistry, Civil Engineering, Computer Science, Economics, Electrical/Electronic Engineering, Engineering (General), Geology/Earth Sciences, Materials Science (including Biomedical Materials Science), Mathematics, Mechanical Engineering, Medicine, Optometry (Opthalmic Optics), Orthoptics, Pharmacy, Physics, Psychology, Sociology, Teacher Training

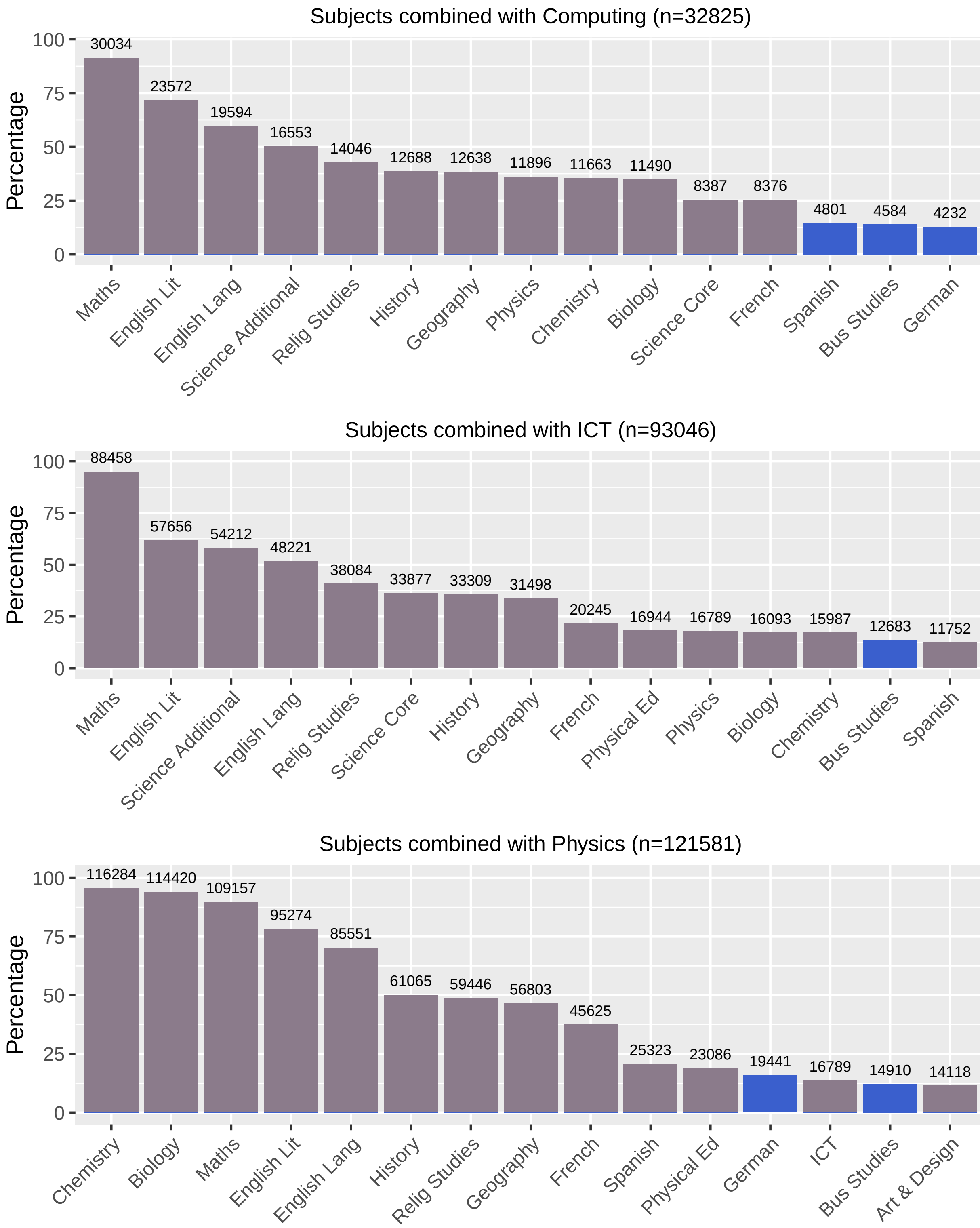


Figure 25: 2015 GCSE Subject combinations. Blue denotes a subject not in the 15 largest subjects at GCSE

3.7.2 A-level

A-level students in 2015 sat on average 2.7 (*SD*=0.9) subjects; the number of subjects taken by computing students was slightly higher at 2.9 (*SD*=0.8).

The choice of subjects to accompany computing are dominated by mathematics (57.3%) and physics (32.9%). Both computing and physics include further mathematics in their top 14 combination subjects. Students who take ICT show a very different set of subject choices.

Out of the 2899 A-level providers, 697 (24%) offered computing and 804 (27.7%) offered ICT; there was an intersection of 240 (8.3%) providers offering both qualifications. 156 (3.2%) of A-level computing students also sat ICT

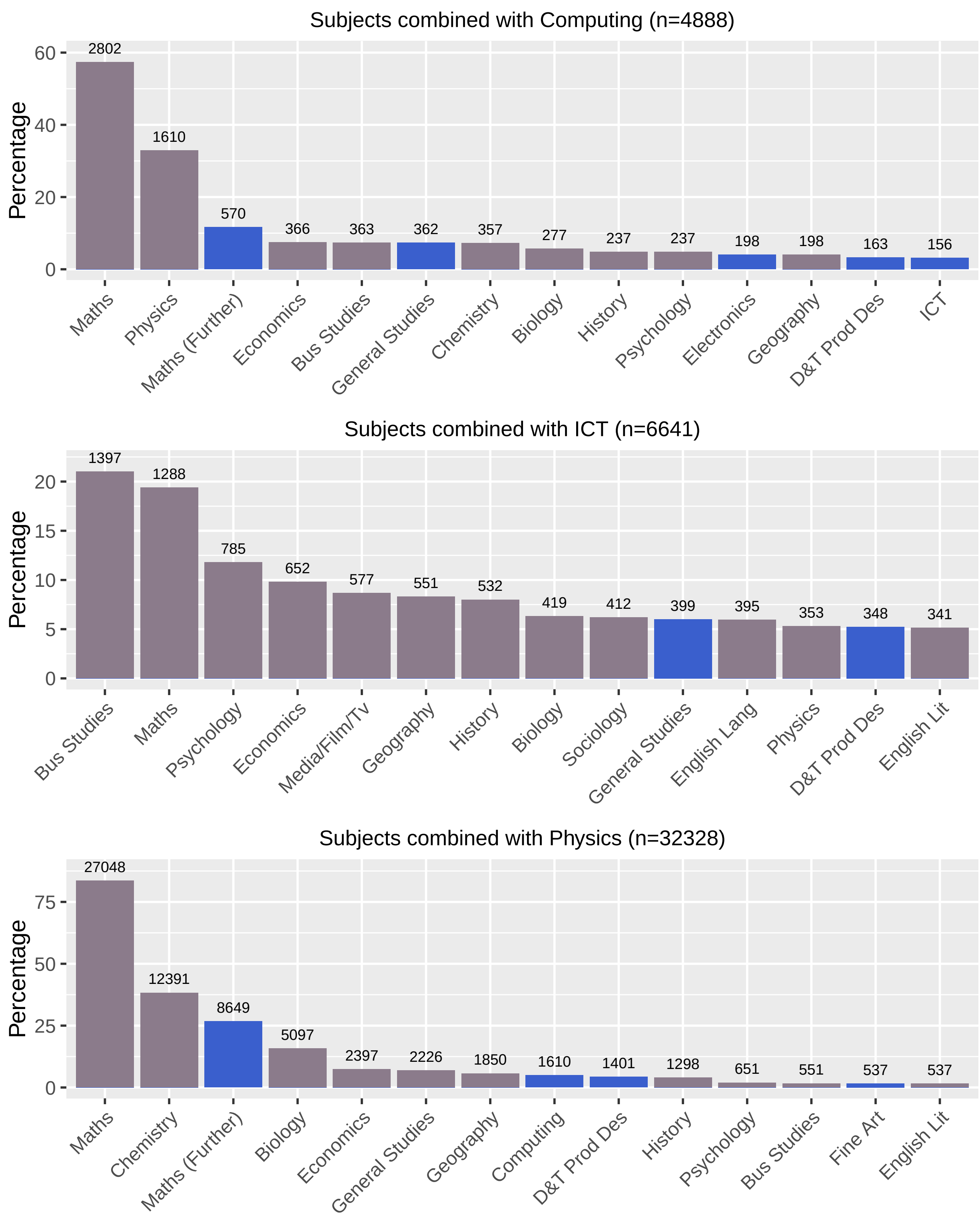


Figure 26: 2015 A-level computing provision by total quals in school

3.7.3 Key points

- 36.5% of GCSE computing students met the single science EBacc requirement and 3.4% of GCSE computing students used computing as one of exactly three single sciences required to access the EBacc qualification;
- 9.6% of GCSE computing students also sat GCSE ICT; at A-level 3.2% of students did this;
- Maths and Physics are the most popular subjects to take with A-level computing. The subject choices at A-level for students sitting physics or computing are more similar than ICT and computing;

3.8 Gender

Statistics on gender relating to GCSE and A-level computing are published yearly (JCQ, 2016a, 2016c), showing that computing has one of the proportionally lowest female intakes of any qualification at GCSE (16.1% female) and A-level (8.6% female). To contrast, females make up 42.4% of GCSE ICT and 35.2% of A-level ICT, as well as 49.2% of GCSE Physics and 21.3% of A-level Physics. Other reports (Bramley, Rodeiro, & Vitello, 2015) cover gender and qualifications in more depth than allowed here. This report gives a brief overview of male and female results in computing compared to other subjects.

3.8.1 GCSE

At GCSE computing, girls outperform boys, achieving proportionally more A* to B grades, and proportionally fewer of all other types of grade.

Table 22: 2015 GCSE computing gender results

GENDER									
	*	A	B	C	D	E	F	G	U
F	454	992	1248	1123	704	386	181	94	97
M	1702	4095	5865	6076	4095	2418	1496	996	803

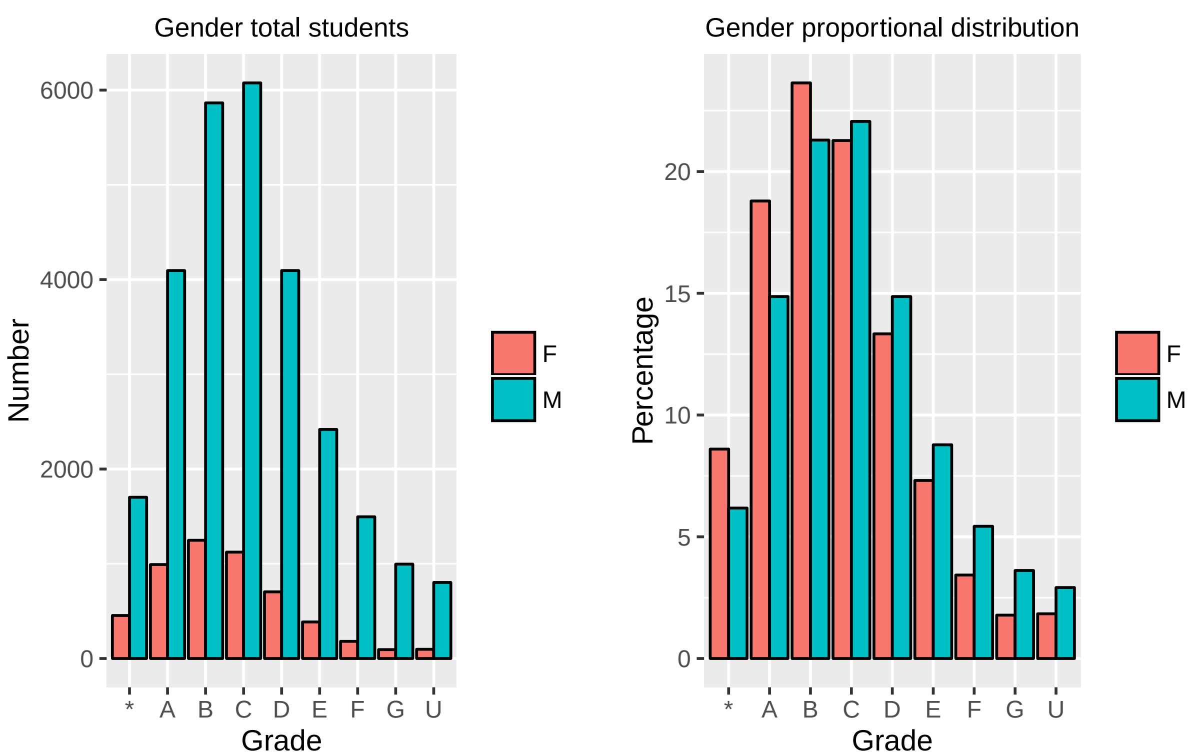


Figure 27: 2015 GCSE computing results by gender

If we look at the percentages of girls passing computing with a C or above we can see that the figure is below the average for all subjects (computing female = 72.3%, all female = 75.6%); boys show a similar pattern (computing male = 64.4%, all male = 66.6%). It is known that girls, on average, outperform boys at GCSE (Bramley et al., 2015) so their stronger results in computing might not be surprising. To better understand the relationship between gender and performance in computing we will need to look at the academic profiles of students taking computing (see Entry profiles) as well as the statistical relationship between gender and computing (report forthcoming).

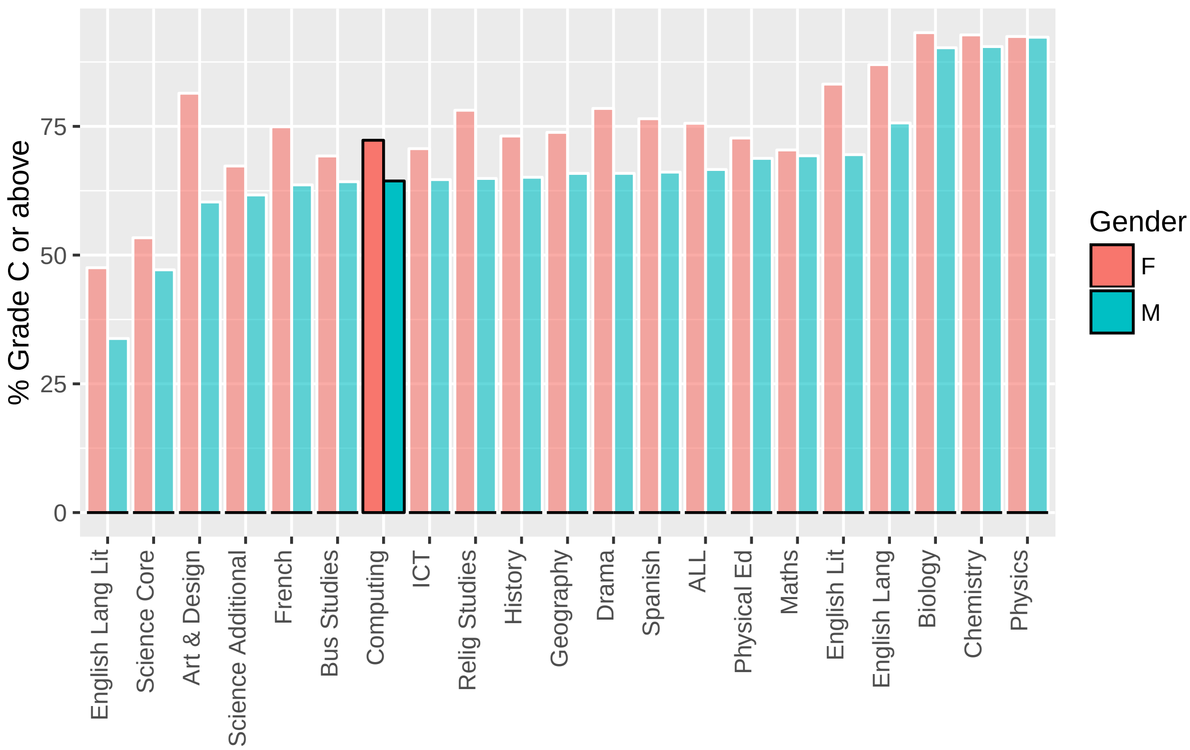


Figure 28: 2015 GCSE results comparison of computing against 20 largest subjects, by male C and above passrate

3.8.2 A-level

A-level shows a similar pattern to GCSE, with girls outperforming boys sitting the same course, achieving proportionally more A* to B grades, and proportionally fewer of all other types of grade. McInerney(2016) notes that males generally outperform females at A* grade and that "female candidates get a higher proportion of As, Bs and Cs". This is not the case with computing; a partial explanation for this might be the 20% coursework component in the final qualification, which is seen by some (Moreton, 2016) to favour females; however, this is a contentious issue with others saying there is no difference (Richardson, 2015). The academic profiles of students taking computing (see Entry profiles) as well as the statistical relationship between gender and computing need to be further explored (report forthcoming).

Table 23: 2015 A-level computing gender results

GENDER	*	A	B	C	D	E	U
F	18	72	93	82	94	49	10
M	133	567	916	1056	973	628	197

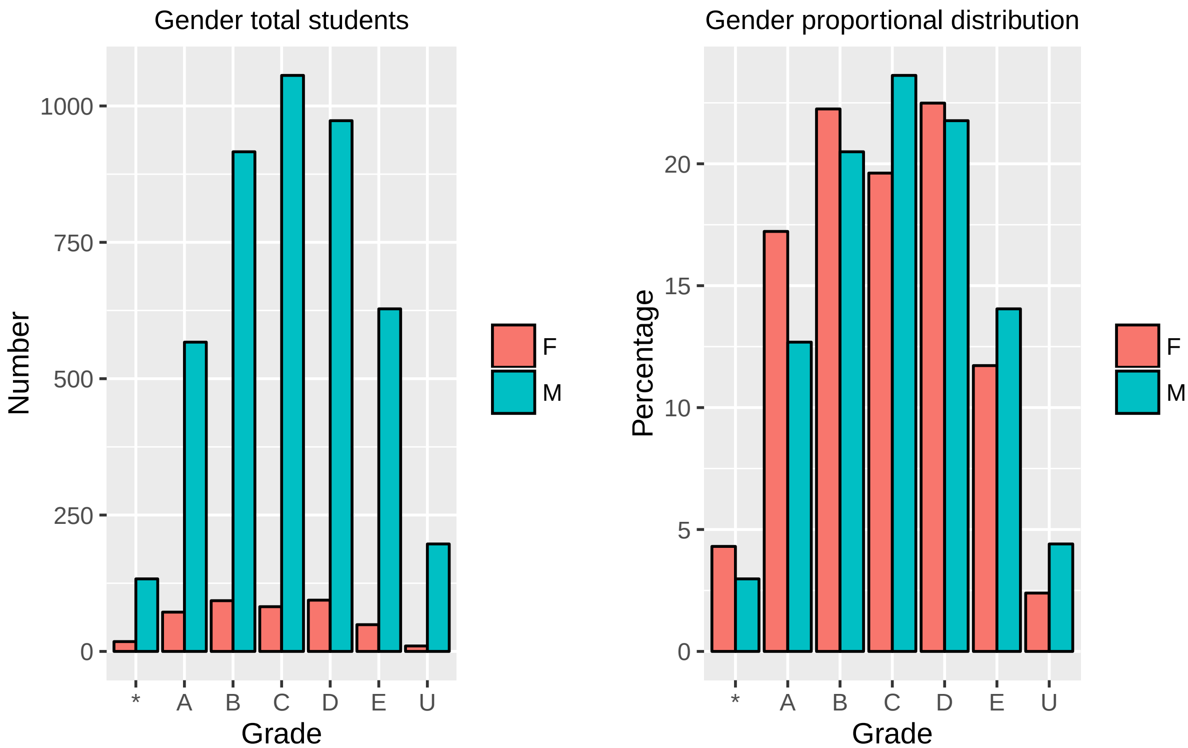


Figure 29: 2015 A-level computing gender results

A*-C grades are less frequently discussed for A-level results. Noting the similarity in female over-representation at grades A*-B in both GCSE and A-level computing, we will use the C grade and above measure for this study. Males and females both perform worse at computing than the population average computing grades are also worse than nearly *all* of the 20 largest subjects (computing female = 63.4%, all female = 79.9%; computing male = 59.8%, all male = 74.7%). Only general studies shows a worse results profile for males; the female performance at computing is worse than in all other given subjects. The poor results profile in general studies might be linked to the Russell Group(2015, p. 30) recommending it as an 'extra' subject rather than a core subject, meaning that there might be less pressure on students to work hard towards achieving highly in this subject. Ofqual(2016) recognise computing as being one of the most difficult A-levels, but not to the extent shown above[11]. Further work is needed here to bring Ofqual's research up to date and the relationship between student profiles and final grades should be fully explored.

[11]Note:Ofquals work includes more than the 20 subjects shown above, but is limited to results up to 2013

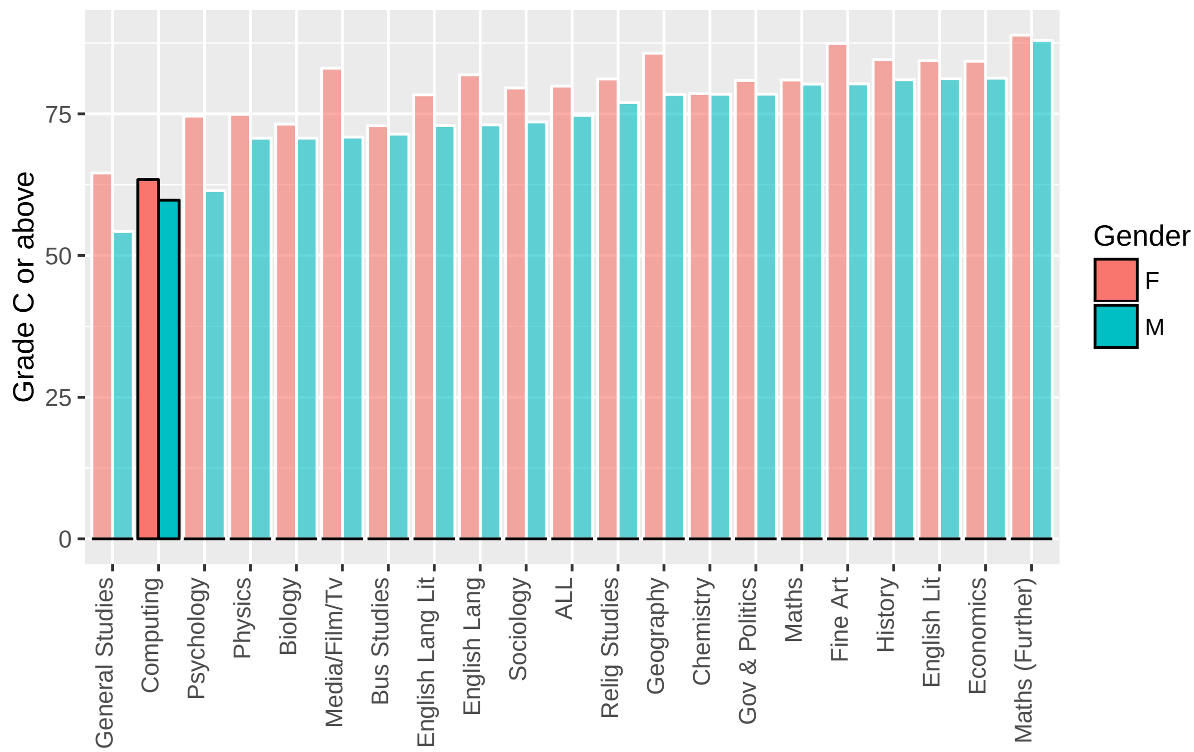


Figure 30: 2015 A-level results comparison of computing against 20 largest subjects, by male C and above passrate

3.8.3 Key points

- In proportional terms, girls do better than boys at GCSE computing for the highest grade bands (A*, A and B). This mirrors the wider patterns at GCSE where girls outperform boys;
- At A-level computing, girls outperform boys at the top grades. This is not the case in other subjects, with boys, on average outperforming girls at A*;
- Both boys and girls perform badly at A-level computing when compared to the top 20 largest subjects;

3.9 Pupil Premium and IDACI

It has been shown that selective schools in 2015 were more likely to offer computing qualifications than non-selective state schools (see Private and state school by gender). Free school meal students are far less likely to be attending selective schools (Skipp et al., 2013) and it remains to be seen what impact this will have on the socio-economic makeup of GCSE and A-level cohorts. This section will use *pupil premium* (PP) and *IDACI* (Income Deprivation Affecting Children Index) scores as indicators of socioeconomic deprivation. Both measures are recorded for individual students, with pupil premium showing whether a student has received free school meals within the last 6 years (DfE, 2016d) and IDACI scores reflecting the deprivation level of the area where a student lives (DCLG, 2015), the higher the value, the more deprived the area[12]. Pupil premium data is missing for 8.2% of GCSE students and 14.9% of A-level students. IDACI data is missing for 8.4% of GCSE students and 22.3% of A-level students. In our analysis below, 1 = for pupil premium, while 0 = does not qualify.

3.9.1 GCSE

In computing pupil premium students are substantially under-represented when compared to other large intake subjects. Of particular note is the difference between the 2015 GCSE computing (19%) and ICT (27.1%) cohorts.

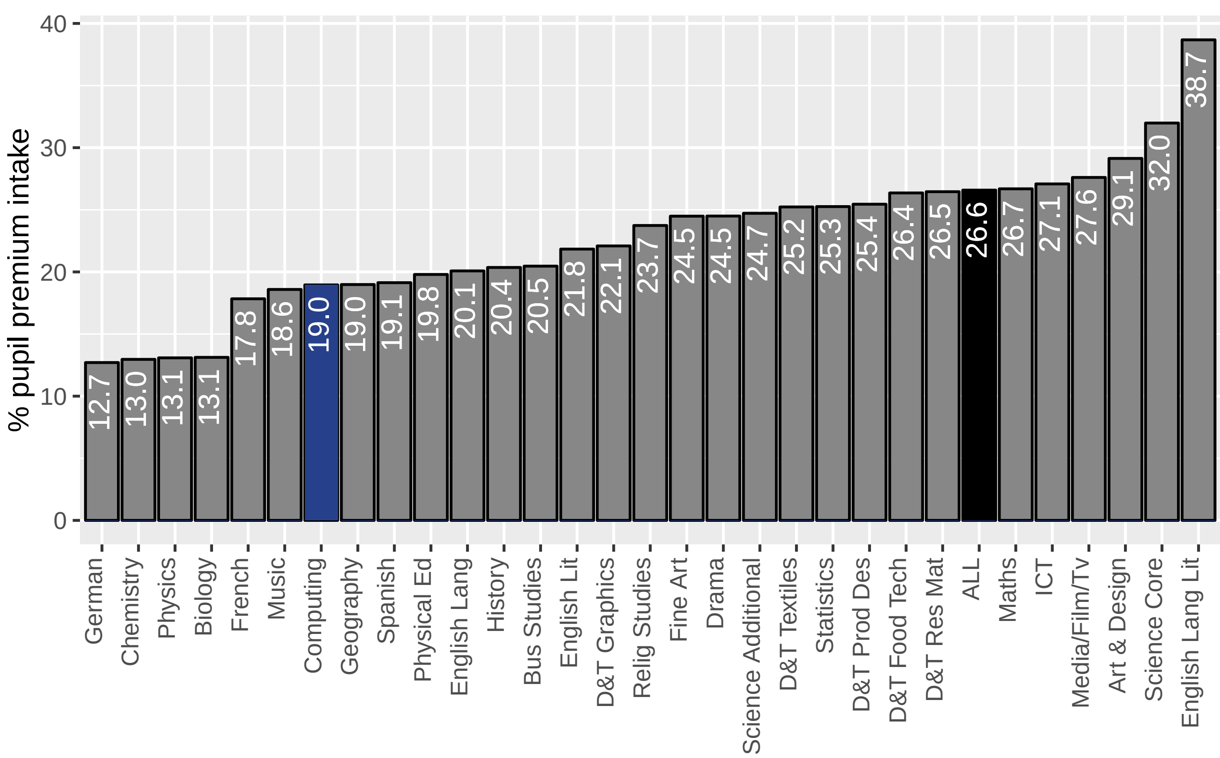


Figure 31: 2015 GCSE computing pupil premium entries compared against 30 largest subjects

Pupil premium students achieve substantially lower grades in GCSE computing, being heavily overrepresented through grade D and below. The C and above pass rate for pupil premium students is 51%, compared

[12] Note: IDACI information is included in the NPD for A-level students, if the DCLG definition is correct this data must be either from a student's secondary school record or recorded for that year in a way the data was not intended. Additionally, we have filled in missing IDACI information from student KS4 records

to non-pupil premium students at 68.3%:

Table 24: 2015 GCSE computing pupil premium results

Pupil premium	*	A	B	C	D	E	F	G	U
0	1790	4238	5806	5646	3596	2044	1194	765	528
1	140	514	1023	1377	1117	696	454	306	361

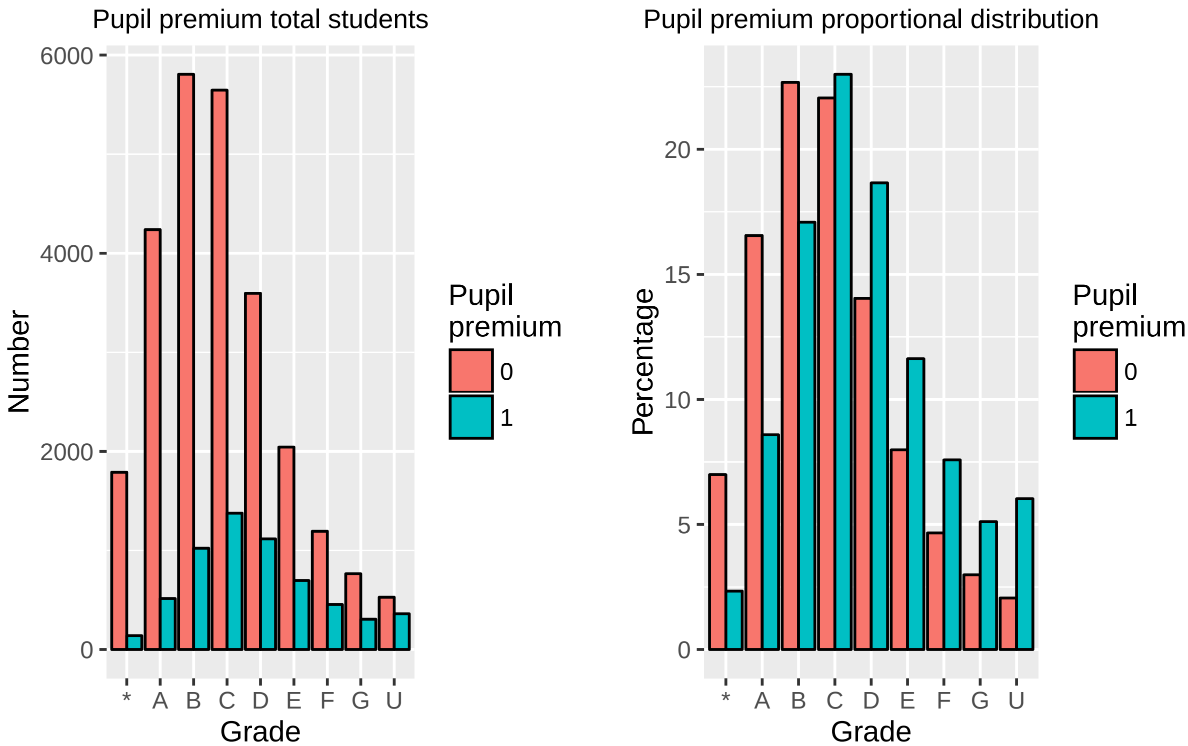


Figure 32: 2015 GCSE computing pupil premium results

Comparing computing against the 30 largest qualifications at GCSE, we can see that the C and above pass rates for both pupil premium and non-pupil premium students are below the average (computing PP = 51%, all PP = 53.6%; computing non-PP = 68.3%, all non-PP = 75.1%). It is also lower than that for students taking ICT (ICT PP = 52.6%, ICT non-PP = 71.8%).

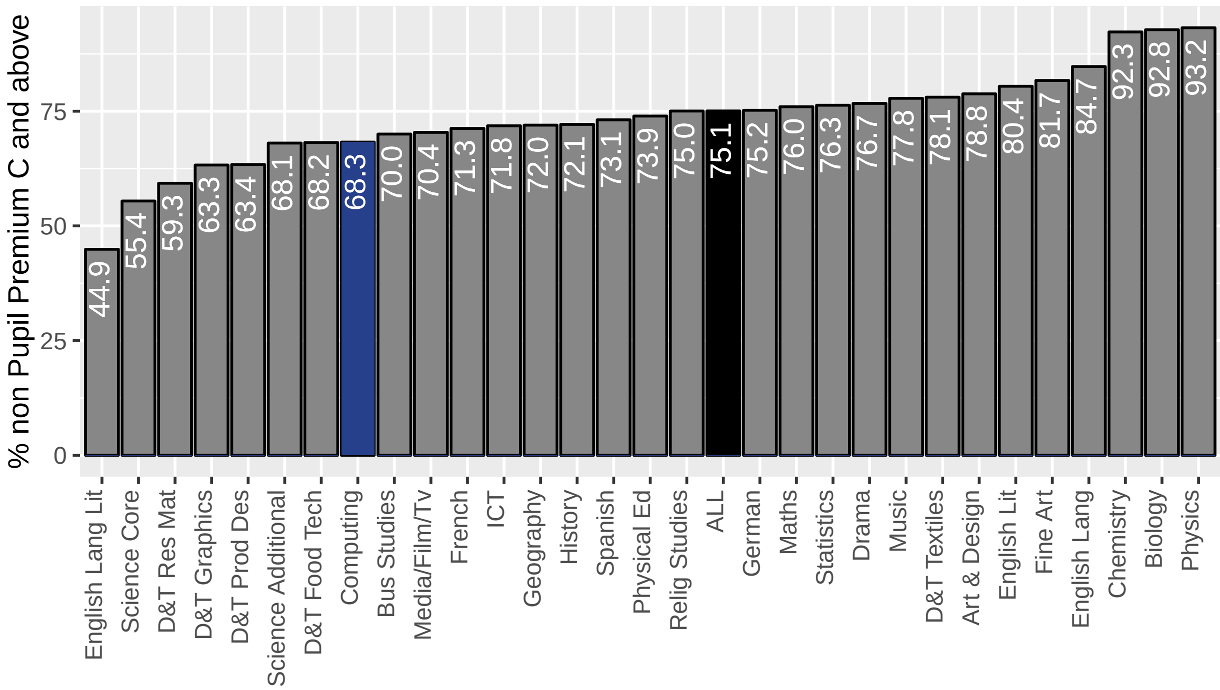


Figure 33: 2015 GCSE computing non pupil premium C and above - 30 largest subjects

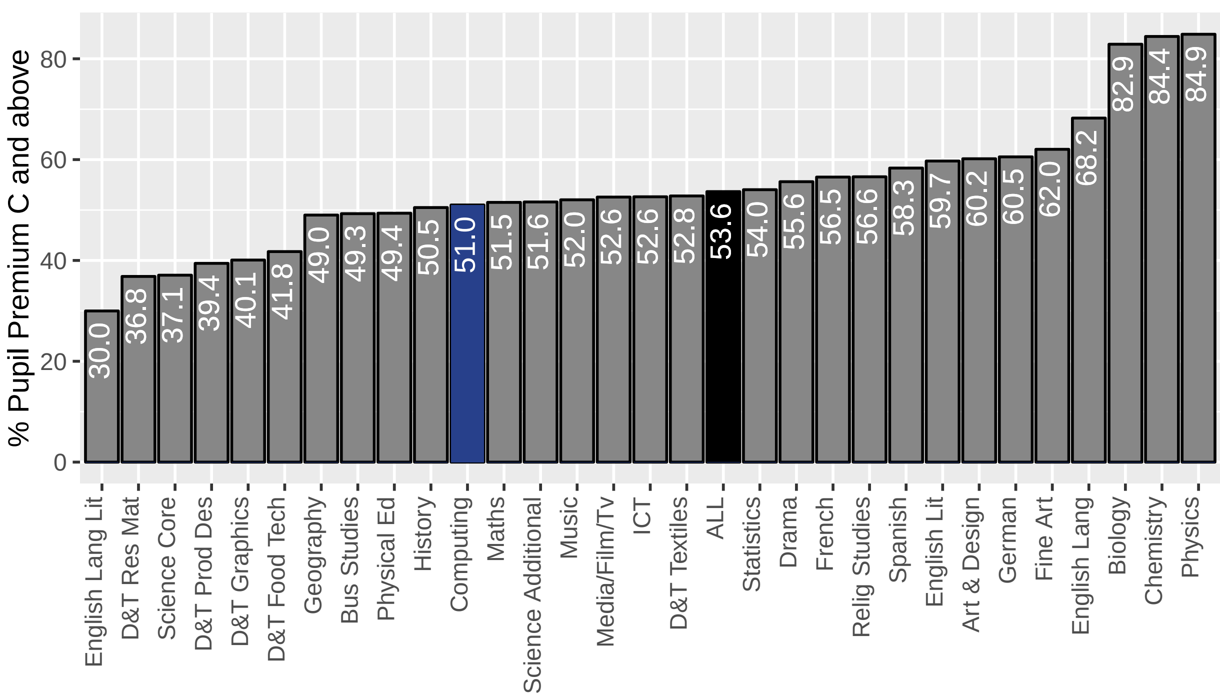


Figure 34: 2015 GCSE computing pupil premium C and above - 30 largest subjects

When we look at the average IDACI score of students entering GCSE computing (M=0.194, SD=0.162), we can see that this is also below the average for all subjects (M=0.218, SD=0.172), and substantially below students sitting ICT (M=0.233, SD=0.177).

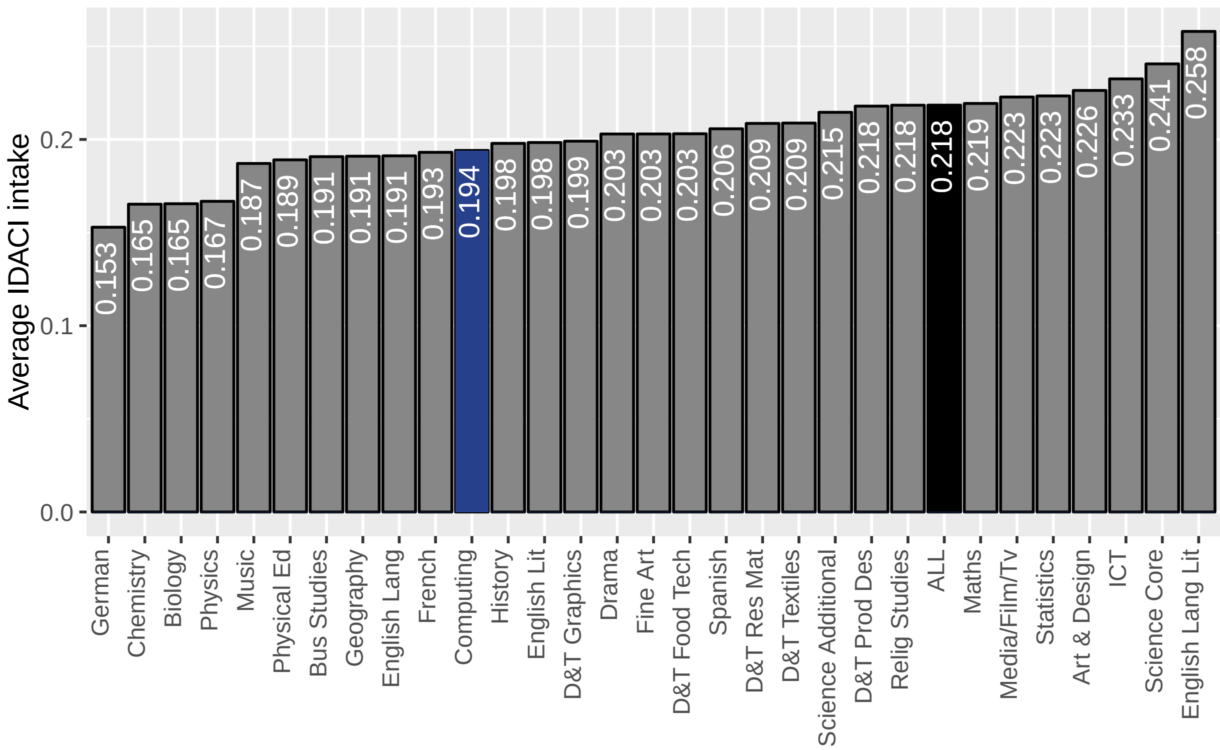


Figure 35: 2015 GCSE Subject IDACI entries - 30 largest subjects

3.9.2 A-level

A-level computing shows a more inclusive intake than GCSE, with the percentage of pupil premium students[13] just below the national average for A-level (computing M=8.9%; All M=9%). However, a comparison with ICT shows a large difference in intake (ICT M=11%).

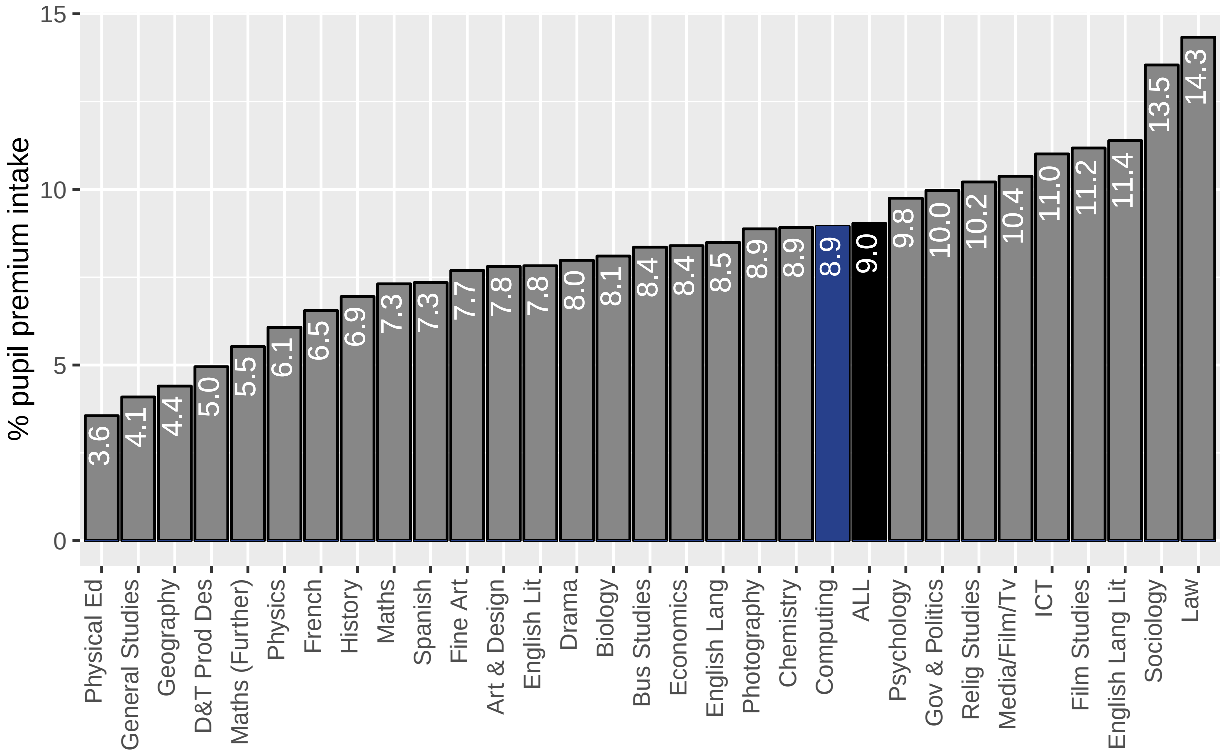


Figure 36: 2015 A-level subject pupil premium entries - 30 largest subjects

Table 25: 2015 A-level computing pupil premium results

Pupil premium	*	A	B	C	D	E	U
0	117	521	853	961	907	560	163
1	6	38	66	98	93	74	26

[13]Note: around 67% of A-level data on free school meal eligibility is missing, due to this, KS4 pupil premium data has been matched where available, bringing the missing data down to 14.9%

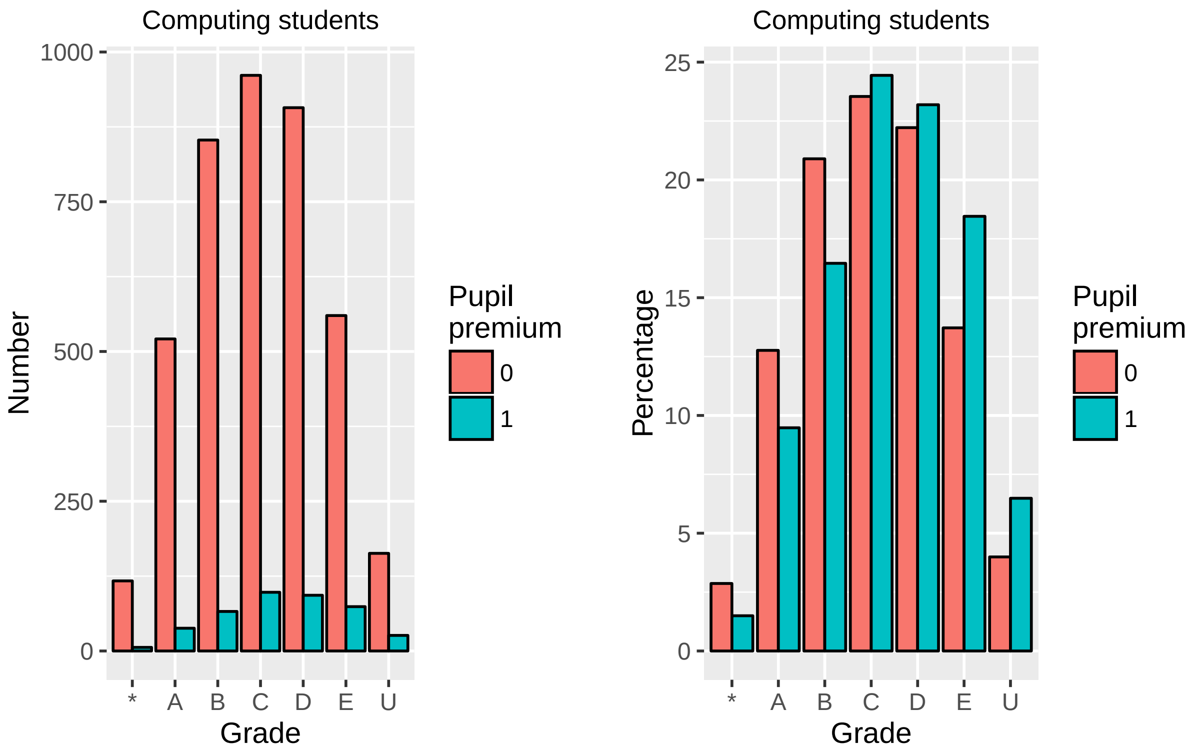
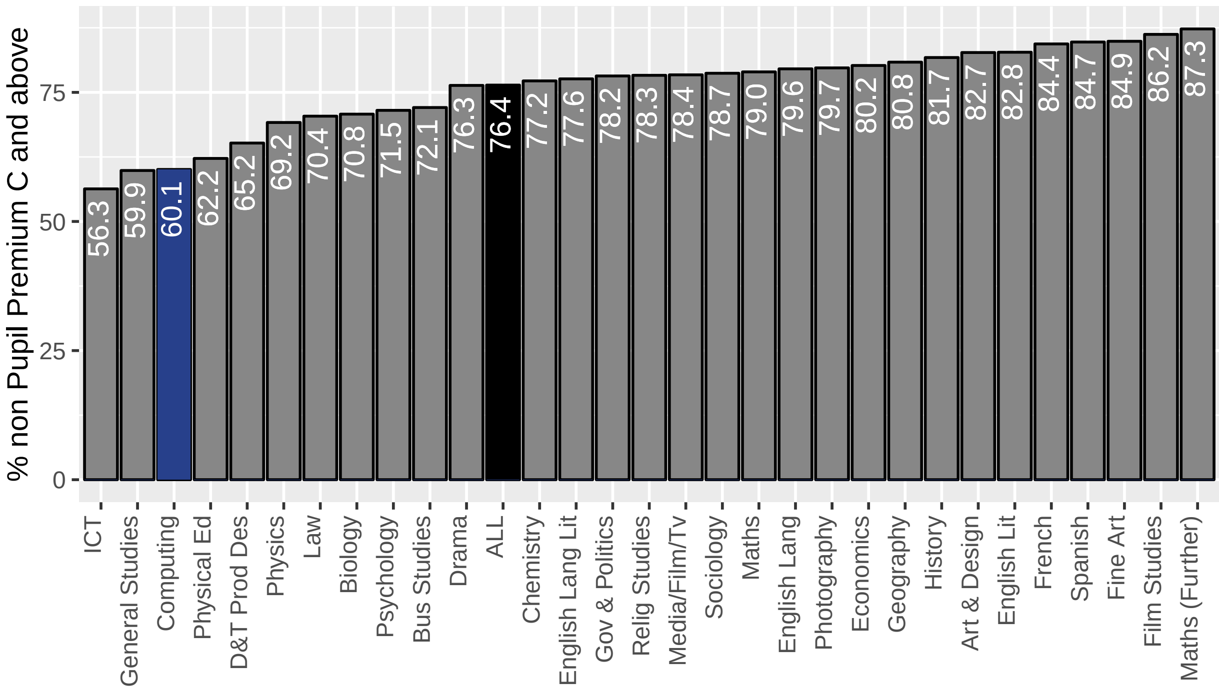
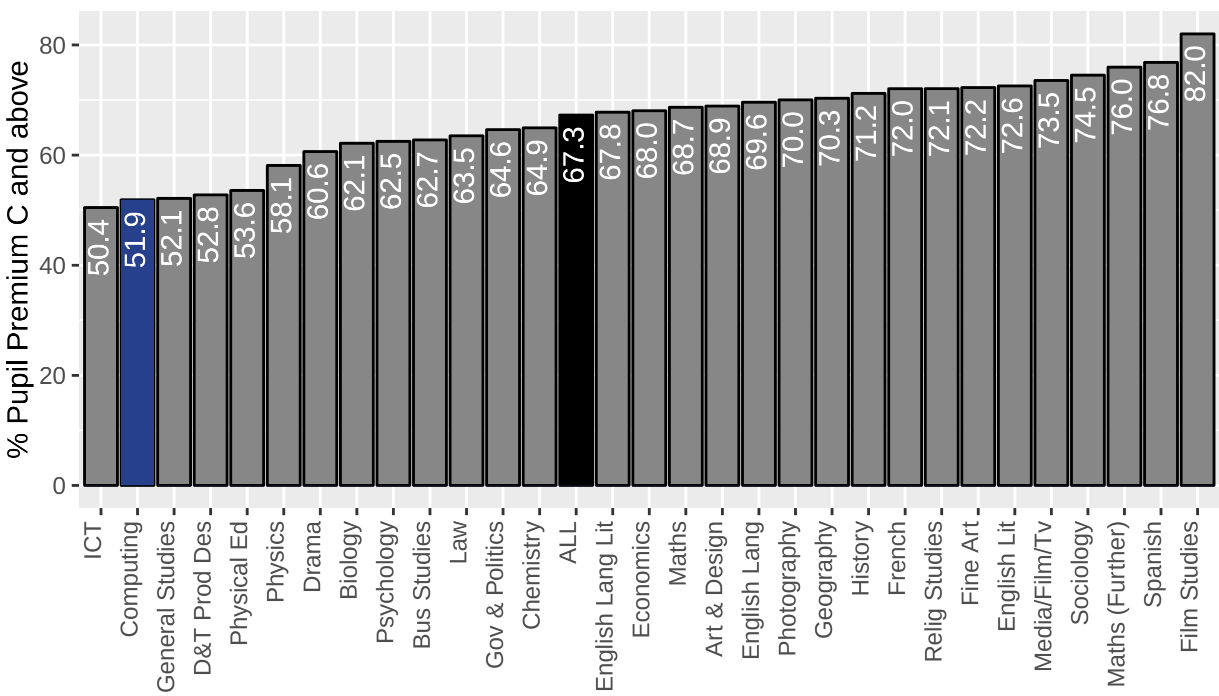


Figure 37: 2015 A-level computing pupil premium results

Comparing computing against the 30 largest qualifications at A-level, we can see that the C and above pass rates for both pupil premium and non-pupil premium students are well below the average (computing PP = 51.9%, all PP = 67.3%; computing non-PP = 60.1%, all non-PP = 76.4%). Only ICT (ICT PP = 50.4%, ICT non-PP = 56.3%) is lower in both instances. Further research is needed here to look at the relationship between profile data of pupil premium students and their grades.





When we look at the average IDACI score[14] of students entering the computing A-level (M=0.161, SD=0.149), we can see that this is substantially below the average for all subjects (M=0.178, SD=0.16), and substantially below ICT (M=0.195, SD=0.166) which has one of the highest IDACI ratings of any subject.

[14]Note:43% of IDACI information is missing from 2015 A-level data. Using GCSE data from previous years, this missing data has been reduced to 22.3%

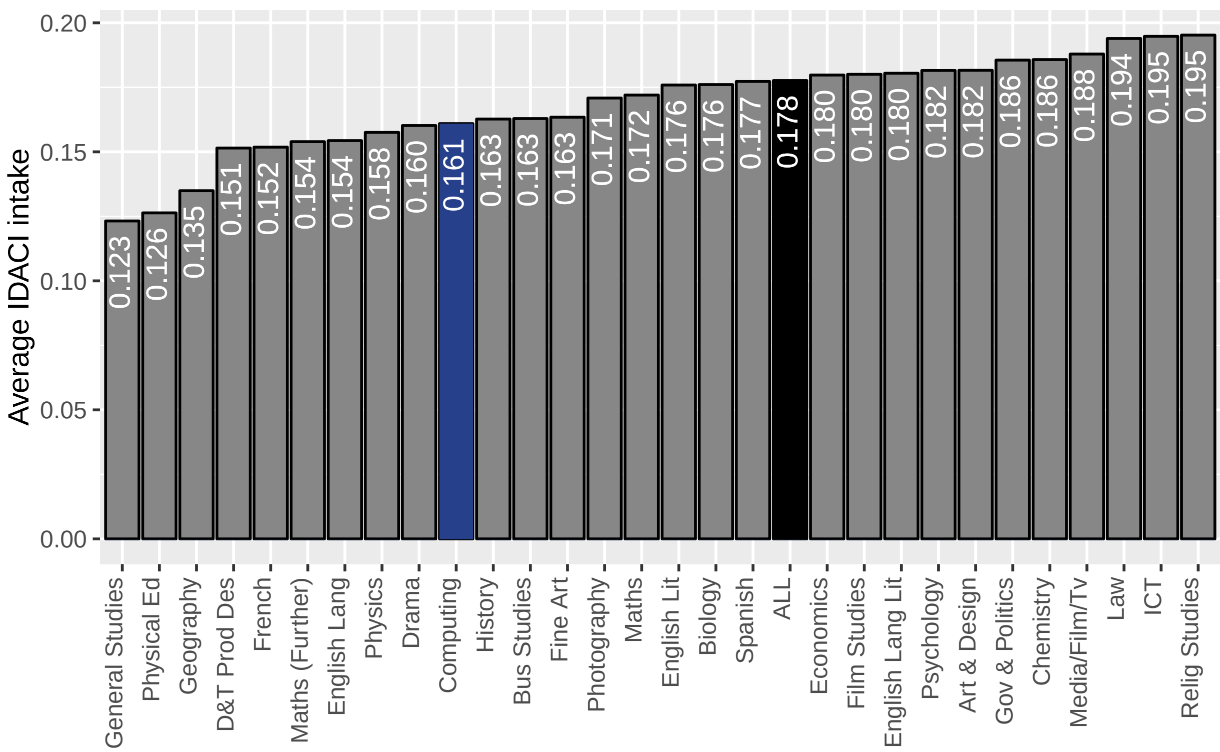


Figure 38: 2015 A-level subject IDACI entries - 30 largest subjects

3.9.3 Key points

- Pupil premium students are substantially under-represented in GCSE computing (19%) compared to ICT (27.1%) and the average of all subjects (26.6%);
- At A-level, the percentage of pupil premium students are in line with national averages (8.9% versus 9%), but below ICT (11%);
- At GCSE, the student average IDACI rating for students sitting computing is below the average for all students (0.194 versus 0.218), and substantially below ICT (0.233);
- At A-level, the student average IDACI rating for students sitting computing is below the average for all students (0.161 versus 0.178), and substantially below ICT (0.195);
- As with other subjects, smaller proportion of pupil premium students achieve a good grade in computing, at both GCSE and A-level, when compared to non-pupil premium students;

3.10 Ethnicity

The NPD records ethnicity data about students using major and minor ethnic groupings. The scope of this report does not allow for a full breakdown of ethnicity using the minor groupings, choosing instead to report on the major categories. These are: Asian, Black, Chinese, Mixed, White, Any Other Ethnic Group, Undeclared and Missing. In addition to these groupings, this section will be looking at White Working Class Males (WWCM), a group whose academic achievement is often lower than other socio-economic groupings (Baars, Mulcahy, & Bernardes, 2016). Definitions of white working class males differ (Baars et al., 2016, pp. 10–11), with limited descriptive data available in the NPD we pragmatically define WWCMs as ethnically: `White British`; gender: `Male`; pupil premium: `True`. Whilst the ethnicity data at GCSE is largely complete, 43% of the A-level data is missing, mainly from independent schools and further education institutions, including sixth form colleges. This missing data has been largely restored through matching students to their KS4 records, where data is better populated. Ethnicity data remains missing for 8% of GCSE students and 14.9% of A-level students.

3.10.1 GCSE

White students make up the majority of the GCSE computing cohort (77.3%). Asian students form a broadly similar proportion of computing (11.8%) and ICT (11.5%) students. Chinese students show substantial over-representation in computing (0.8%) and physics (0.7%). Black students show substantial under-representation in computing (3.6%) and physics (3.7%), but their representation in ICT is close to their population (3.6%). Further research is merited here to understand these trends. Studies from science education have also noted a similar diversity pattern by ethnicity in terms of enrolment (Elias, Jones, & McWhinnie, 2006; Wong, 2016). These studies found identity mismatch, social inequalities and a lack of aspirations to be potential causes for their lack of engagement in science study. Recent studies of computing provision in the USA have also shown a similar under-representation amongst black students (Change the Equation, 2016).

The table below shows the breakdown of ethnicity for computing, physics and ICT at GCSE level. It allows us to look at over and under-representation compared to the population average.

Table 26: 2015 GCSE computing, ICT and physics ethincity breakdown

Ethnicity	Total	Pop %	Computing	ICT	Physics	Computing %	ICT %	Physics %
White	435271	79.3	24437	69583	89897	77.3	77.6	79.2
Asian	48957	8.9	3737	10313	11459	11.8	11.5	10.1
Black	27130	4.9	1152	4179	4164	3.6	4.7	3.7
Mixed	22467	4.1	1253	3090	4686	4.0	3.4	4.1
Other	7679	1.4	471	1233	1527	1.5	1.4	1.3
Undeclared	5674	1.0	292	876	1004	0.9	1.0	0.9
Chinese	2043	0.4	259	347	767	0.8	0.4	0.7

The difference from the average can be easily distorted when dealing with small numbers of students; this might explain why Chinese students appear to be over-represented. Another way to look at this data is to look at the overall representation of each ethnicity across a broader range of subjects; here we are considering the 30 largest subjects at GCSE. This analysis shows that the largest proportional representations for Chinese and Asian students is in computing. Black students are substantially under-represented in GCSE computing.

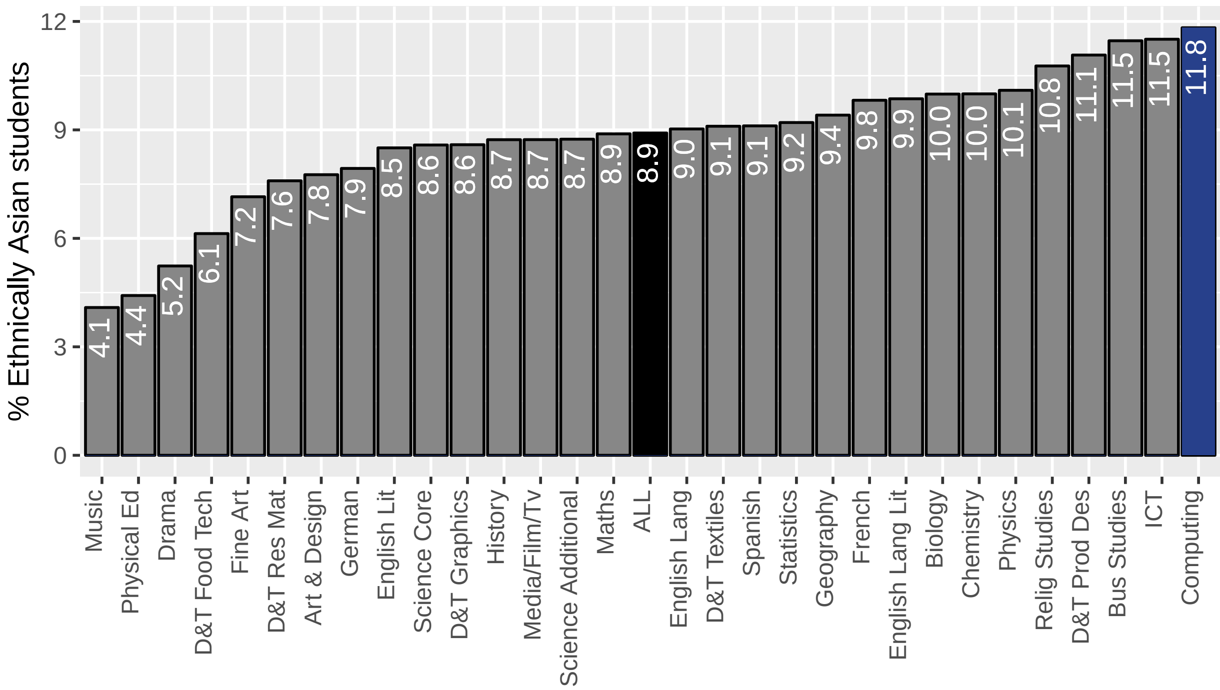


Figure 39: 2015 GCSE Asian student subject representation

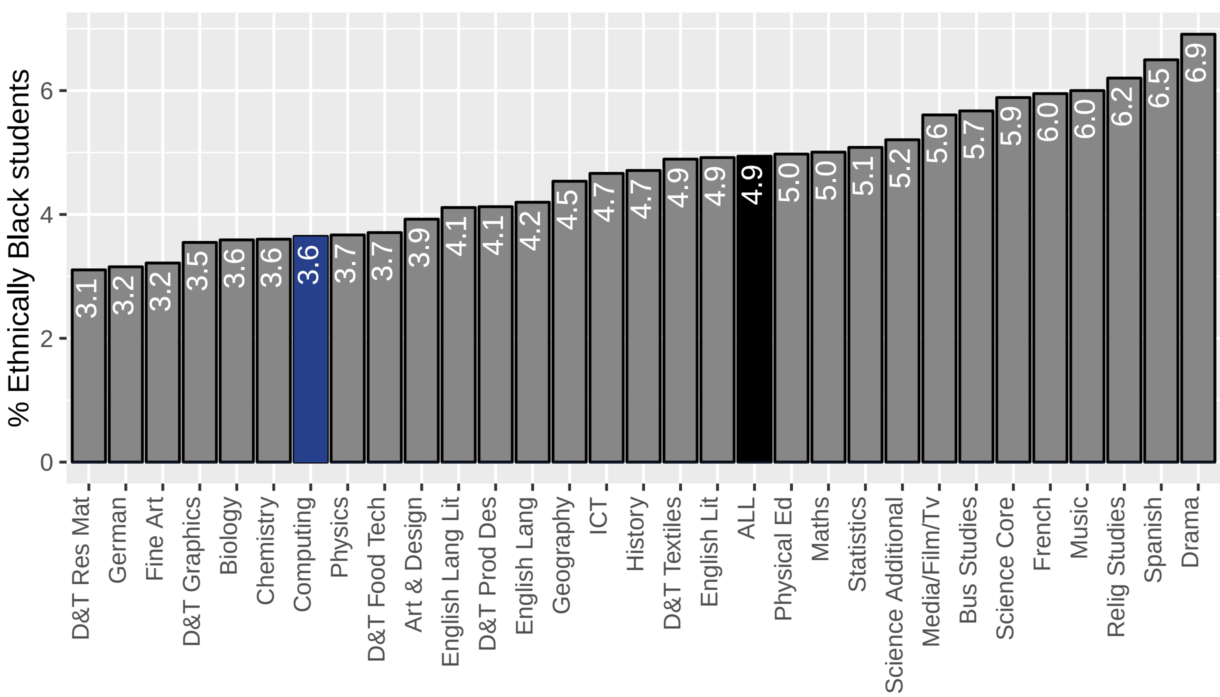


Figure 40: 2015 GCSE Black student subject representation

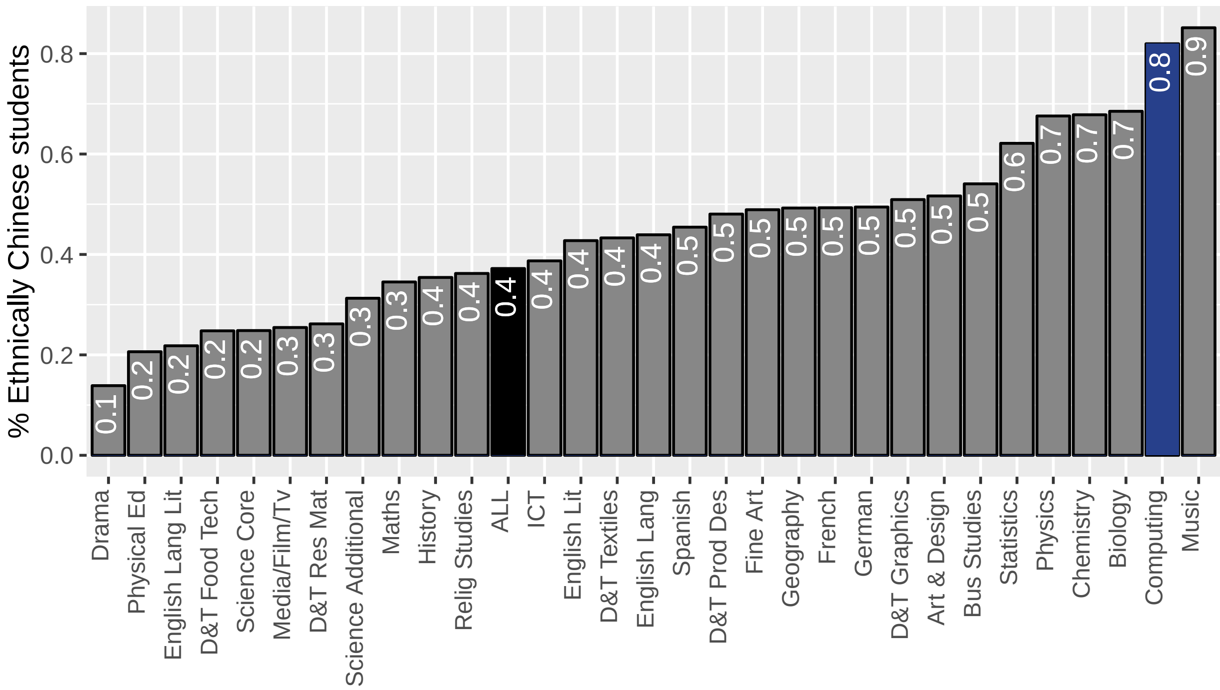


Figure 41: 2015 GCSE Chinese student subject representation

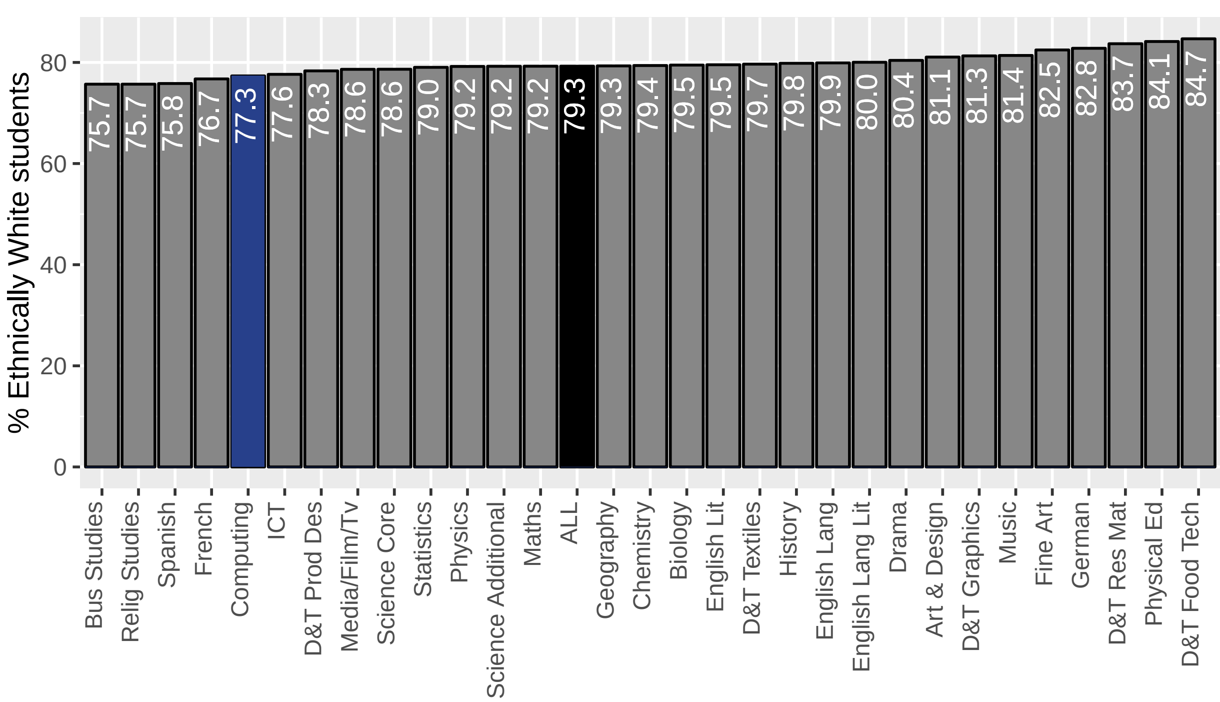


Figure 42: 2015 GCSE White student subject representation

3.10.1.1 Data across ethnicity, gender and Pupil Premium

We acknowledge that enrolment patterns are complicated by the interaction of social demographics. As such, we attempt here to combine some key variables, namely ethnicity, gender and pupil premium, as a way to present a more fine-grained analysis of computing enrolment. We know that pupil premium students make up 19% of the GCSE computing cohort and that for the global GCSE population females and males have almost equal pupil premium representation (26.8% of females, 26.4% of males). It follows that the percentage of GCSE computing pupil premium females should match those of males; this is not quite the case, with pupil premium females being over represented (20.7%) compared to males (18.6%). This raises the question whether GCSE computing is more appealing to pupil premium girls, compared to their richer peers. In our analysis below, 1 = qualifies for pupil premium, while 0 = does not qualify.

Table 27: 2015 GCSE computing pupil premium by gender

Gender	Pupil premium	Computing students	Percentage of gender taking computing
F	0	3971	79.3
F	1	1039	20.7
M	0	21636	81.4
M	1	4949	18.6

Following this, the table below provides a break-down of pupil premium data into gender and ethnicity. This will allow us to study the access to computing for white working class males and other ethnic groupings.

We can see that Chinese students, regardless of gender or pupil premium status, are proportionally over-represented in GCSE computing. A larger proportion of non-pupil premium students (across ethnicity and gender) tend to study GCSE computing. Additionally white working class males don't appear to be under-represented, while white working class females make up the smallest percentage representation of all pupil premium groupings.

Table 28: 2015 GCSE computing pupil premium males by ethnicity

Ethnicity	Total PP males	Computing PP males	% taking computing
White British	47827	3076	6.4
Asian	8480	776	9.2
Black	6785	375	5.5
Mixed	4165	294	7.1
White Other	3244	205	6.3
Other	1847	148	8.0
Undeclared	959	46	4.8
Chinese	146	29	19.9
Total	73453	4949	6.7

Table 29: 2015 GCSE computing pupil premium females by ethnicity

Ethnicity	Total PP females	Computing PP females	% taking computing
White British	47462	529	1.1
Asian	7827	199	2.5
Black	6795	128	1.9
Mixed	4246	78	1.8
White Other	3129	44	1.4

Other	1685	28	1.7
Undeclared	835	23	2.8
Chinese	148	10	6.8
Total	72127	1039	1.4

Table 30: 2015 GCSE computing non-pupil premium males by ethnicity

Ethnicity	Total non-PP males	Computing non-PP males	% taking computing
White British	160424	16755	10.4
Asian	16762	2108	12.6
White Other	9494	996	10.5
Mixed	7013	718	10.2
Black	6662	465	7.0
Other	2208	240	10.9
Undeclared	1966	190	9.7
Chinese	885	164	18.5
Total	205414	21636	10.5

Table 31: 2015 GCSE computing non-pupil premium females by ethnicity

Ethnicity	Total non-PP females	Computing non-PP females	% taking computing
White British	153459	2628	1.7
Asian	15800	653	4.1
White Other	9200	201	2.2
Mixed	6973	162	2.3
Black	6788	183	2.7
Other	1909	55	2.9
Undeclared	1891	33	1.7
Chinese	864	56	6.5
Total	196884	3971	2.0

3.10.2 A-level

White students make up the majority (79.8%) of the A-level computing cohort. Asian students show a substantial over-representation in ICT (19.1%). Much like at GCSE, Chinese students show over-representation in computing (1.6%). Black students show substantial under-representation in computing (2.9%) and physics (3.7%), with their representation in ICT again being closer to the population total. Ethnicity data at A-level is particularly sparse and caution must be taken when making conclusions.

Table 32: 2015 A-level computing, ICT and physics ethincity breakdown

Ethnicity	Total	Pop %	Computing	ICT	Physics	Computing %	ICT %	Physics %
White	185203	75.6	3582	4238	19436	79.8	68.8	76.1
Asian	27622	11.3	431	1179	2897	9.6	19.1	11.3

Black	12617	5.2	131	299	936	2.9	4.9	3.7
Mixed	10410	4.3	154	221	1088	3.4	3.6	4.3
Other	4084	1.7	62	109	422	1.4	1.8	1.7
Undeclared	2920	1.2	57	65	370	1.3	1.1	1.4
Chinese	2022	0.8	70	50	389	1.6	0.8	1.5

The possibility of distortion in the difference from the average noted above for GCSE is even more pronounced at A-level, where only 1.7% of students take computing. At GCSE 5.5% of students take computing

Similarly to what has been presented for GCSE, we compare A-level computing to the 30 largest subjects. This analysis shows that Chinese students are over-represented in computing, even more so than in physics. Black students are again, substantially under-represented.

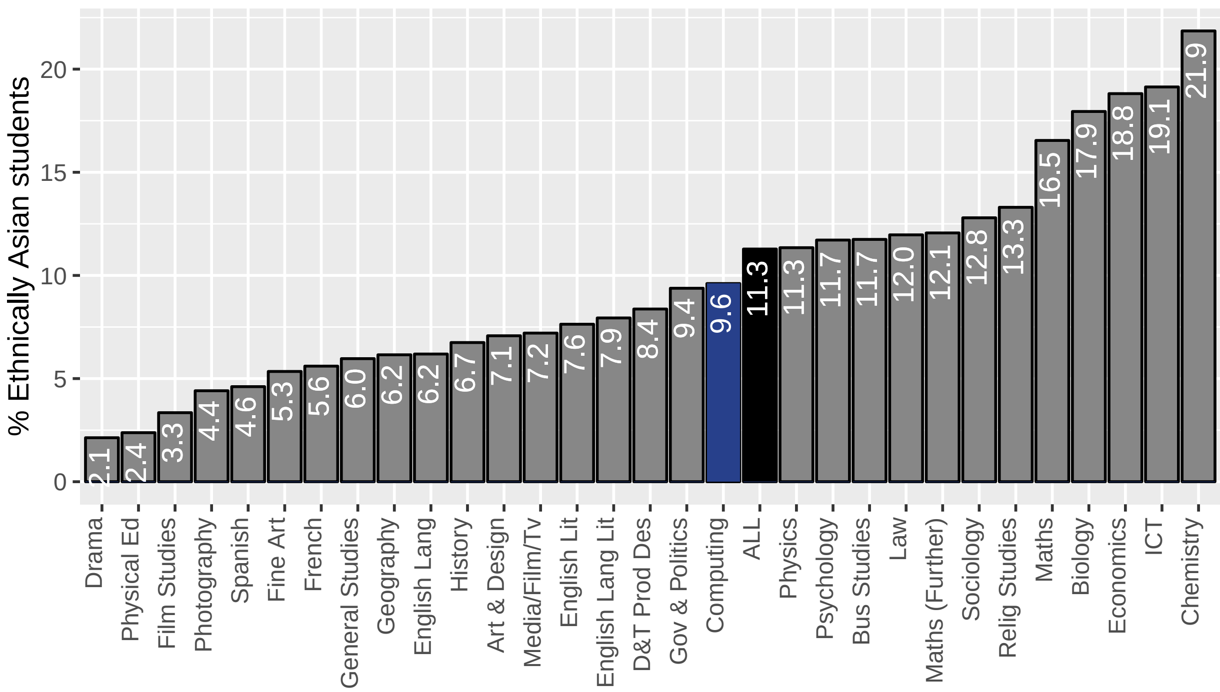


Figure 43: 2015 A-level Asian student subject representation

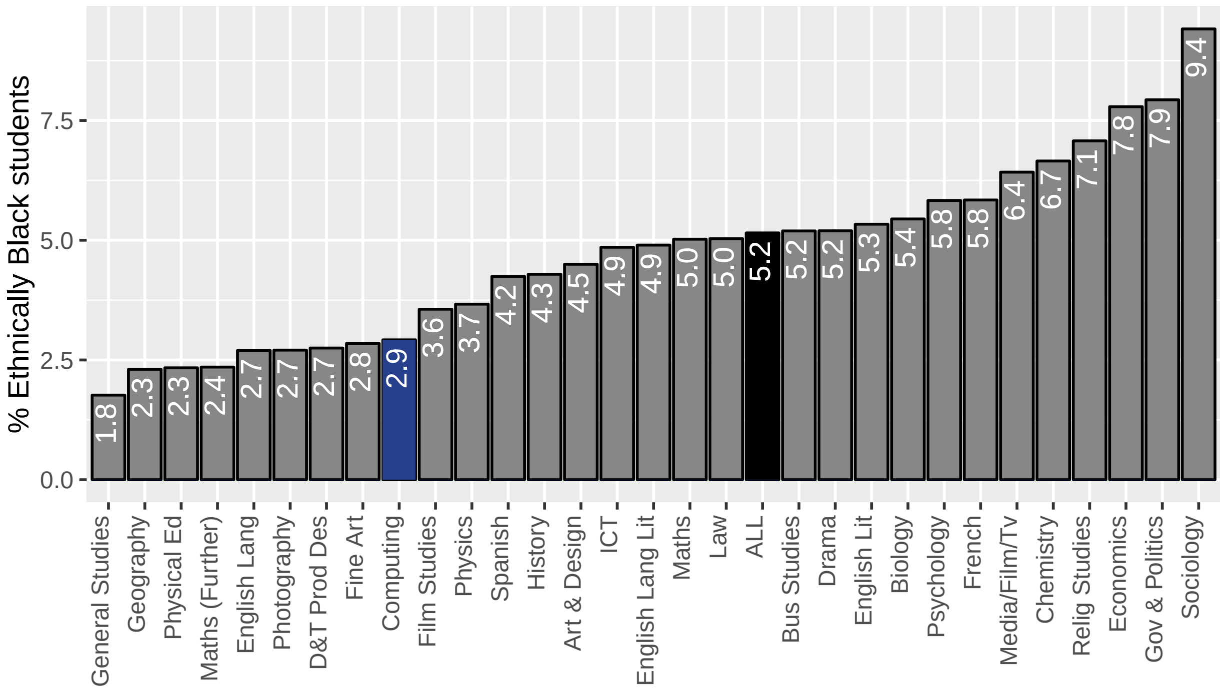


Figure 44: 2015 A-level Black student subject representation

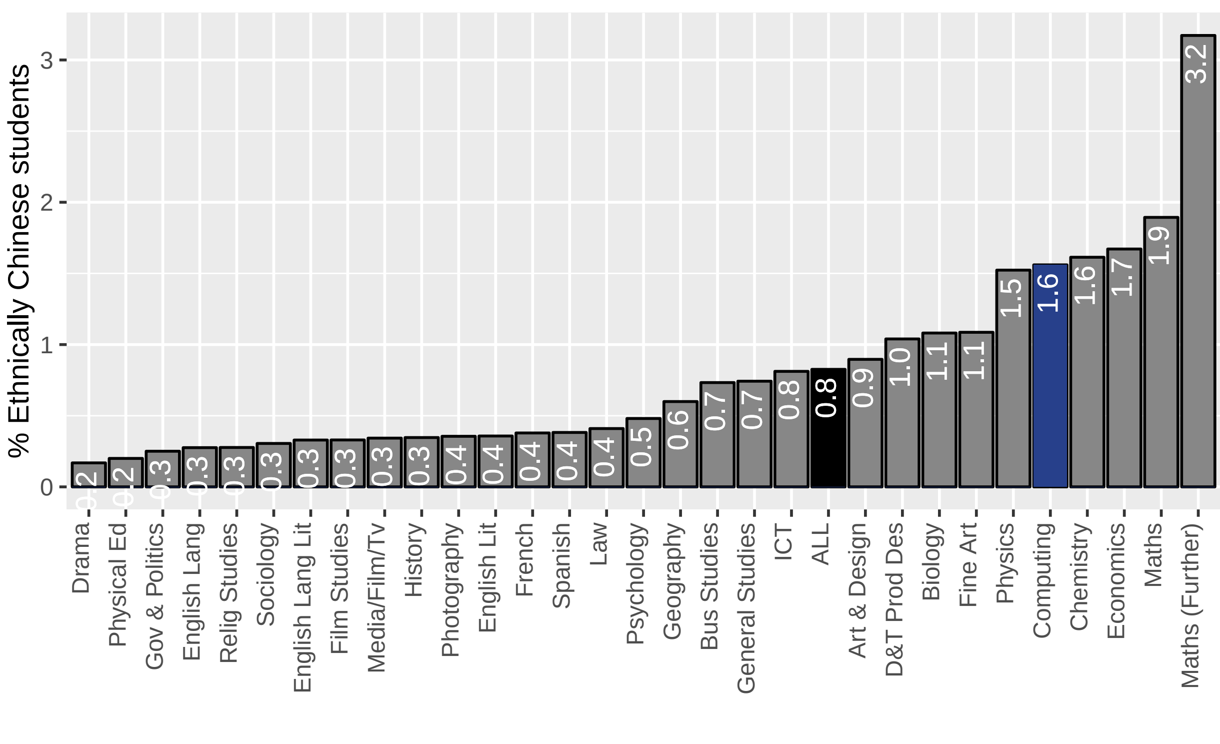


Figure 45: 2015 A-level Chinese student subject representation

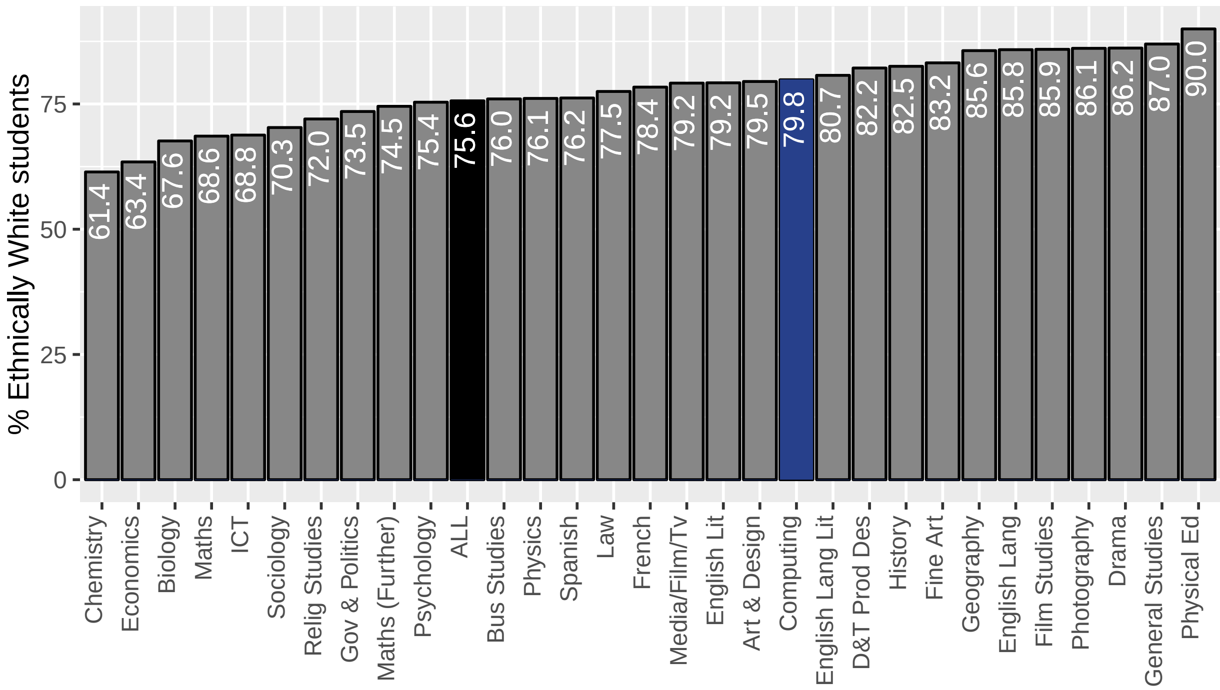


Figure 46: 2015 A-level White student subject representation

3.10.2.1 Data across ethnicity, gender and Pupil Premium

We know that pupil premium students make up 8.9% of the A-level computing cohort and that in the global A-level population females pupil premium have a higher representation than male pupil premium students (9.7% of females, 8.2% of males). It follows that the percentage of A-level computing pupil premium females should be slightly above males; this is the case, even though the proportions are not exactly the same as the global population (females=9.1%; males=8.9%).

Table 33: 2015 A-level computing pupil premium by gender

Gender	Pupil premium	Computing students	Percentage of gender taking computing
F	0	340	90.9
F	1	34	9.1
M	0	3742	91.1
M	1	367	8.9

Only 34 pupil premium females took A-level computing in 2015 meaning that we are unable to give a further breakdown of this figure without risking the identification of individuals. There were 367 pupil premium males taking A-level computing in 2015, with 49 of them being white British working class.

3.10.3 Key Points

- Participation in GCSE and A-level computing varies by ethnicity. Chinese and Asian students are proportionally over-represented, while Black students are proportionally under-represented. This matches

patterns seen in the USA;
- Asian students have similar representation at both GCSE ICT and computing. At A-level they have a much higher representation in ICT than computing;
- A larger proportion of girls taking GCSE computing are on pupil premium when their male counterparts. At A-level the balance is in favour of pupil premium boys;
- The number of white working class males taking GCSE computing is not substantially different from other ethnicities. White British pupil premium females sat computing in proportionally smaller numbers than all other ethnicities;

3.11 Entry profiles

The CAS teacher survey is an online computing education questionnaire, run every year by the Computing at School group. In 2016 262 responses were received from teachers all over England. 42% (n=110) of teachers surveyed came from schools with entry requirements for GCSE computing, with the majority (n=79) of these requirements being around prior or predicted attainment in mathematics[15]. This survey data supports anecdotal evidence that many schools are selecting students based on achievement, in particular their grades in mathematics. It follows that the GCSE computing cohort should show an increased aptitude in mathematics, with KS2 SATS or GCSE mathematics results being above other less selective subjects. Some schools might be targeting high achieveing students as a way to successfully establish computing as a new subject in a provider, and/or they might be linking an aptitude in mathematics to an aptitude in computing; additionally schools might believe that computing is a more academically challenging subject than other subjects such as ICT. In the case of limiting entry by academic performance, it is well established that students from poorer backgrounds are less likely to achieve highly at school (DfE, 2015c), thus the computing cohort might be skewed towards a more affluent group of students. This trend has been noted in the Pupil Premium and IDACI section above. Mathematics being the best predictor for aptitude in computing might also be questioned, unfortunately such a question lies outside the scope of this report. It might also be the case that high achieving mathematics students choose computing over other subjects, testing this also lies outside the scope fo this report.

3.11.1 GCSE

The CAS research is corroborated by the KS2[16] and GCSE maths[17] results of students sitting GCSE computing. Computing students have a stronger mathematics profile than any other of the largest 30 GCSE subjects beside the single sciences. The maths profile for GCSE computing students is much stronger than for ICT, with a smaller standard deviation.

Table 34: KS2 Maths profiles of GCSE subject cohorts

Subject	Mean	SD
English Lang Lit	3.63	0.85
Science Core	3.94	0.76
Art & Design	4.01	0.84
Drama	4.12	0.76
ALL	4.13	0.80
Maths	4.13	0.78
ICT	4.16	0.75
Science Additional	4.17	0.68
Relig Studies	4.23	0.74
English Lit	4.26	0.73
Physical Ed	4.29	0.69
Bus Studies	4.31	0.67
History	4.33	0.68
Geography	4.33	0.69
English Lang	4.33	0.69
French	4.45	0.62
Spanish	4.45	0.63
Computing	4.51	0.62
Biology	4.68	0.51
Chemistry	4.69	0.50

[15]the analysis conducted for the present report is derived from data collected by Sue Sentence, Kings College London, for the CAS 2016 Teacher Survey

[16]Note: NPD data available to the researchers gave students a KS2 level of 0, 1, 2, 3, 4 or 5, with 5 being the highest grade

[17]Note: 58=A*, 52=A, 46=B, 40=C, 34=D, 28=E, 22=F, 16=G, 0=U

Physics	4.69	0.49

Table 35: GCSE Maths profiles of GCSE subject cohorts

Subject	Mean	SD
English Lang Lit	31.31	13.64
Science Core	36.34	11.32
Art & Design	38.30	12.17
Maths	39.38	12.35
ALL	39.38	12.35
Drama	40.13	10.67
ICT	40.24	10.75
Science Additional	40.51	9.03
Physical Ed	41.33	9.85
Relig Studies	41.41	10.59
English Lit	41.77	10.62
Bus Studies	42.31	9.00
English Lang	42.74	9.99
History	42.97	9.45
Geography	43.21	9.51
Spanish	44.86	8.59
French	45.11	8.30
Computing	45.69	8.82
Biology	48.51	7.14
Chemistry	48.72	6.79
Physics	48.74	6.76

3.11.2 A-level

No systematic review of entry requirements for A-level computing currently exists; anecdotal evidence suggests that there is a tendency amongst providers to use GCSE mathematics results as an entry requirement. We also know that mathematics is taken by 57.3% of computing students, making it the most popular choice of qualification to take with computing. Looking at the GCSE maths profiles of A-level computing students, we can see that students average a strong B, well above the B/C for ICT and with a lower standard deviation. Some form of selection on mathematical ability might be in place at A-level, and/or mathematically able students are selecting to study A-level computing.

Table 36: GCSE Maths profiles of A-level subject cohorts

Subject	Mean	SD
Media/Film/Tv	42.75	5.28
Sociology	43.73	5.25
English Lang Lit	44.07	5.45
English Lang	44.43	5.52
Relig Studies	45.47	5.99
Fine Art	45.57	6.33
English Lit	46.13	6.08
Bus Studies	46.24	5.31
Gov & Politics	46.66	6.03
Psychology	46.68	5.44
History	47.04	6.06
ALL	47.39	6.57

Geography	48.35	5.71
General Studies	49.31	6.19
Economics	50.38	5.51
Computing	50.45	5.26
Biology	50.96	5.28
Chemistry	52.80	4.95
Physics	53.74	4.50
Maths	53.94	4.26
Maths (Further)	56.71	2.81

3.11.3 Key points

- 42% of schools in the 2016 CAS teacher survey have entry requirements for GCSE computing, the majority of these entry requirements are around mathematics;
- Students sitting GCSE computing have a stronger mathematics profile than students studying ICT;
- Some form of selection on mathematical ability might be in place at A-level, and/or mathematically able students are selecting to study A-level computing;

4 Notes

- For columns titled `Total Schools` and `Total Students`, figures are taken from all institutions offering GCSEs or A-levels, and all students taking at least one full GCSE or A-level.
- Any instance where `X` appears indicates that data has been redacted that would allow the recognition of 5 or fewer students. In these circumstances other data on the table is rounded to the nearest 5 to prevent the calculation of the value of X. As a result, totals may vary very slightly between tables. This data has been suppressed in line with the DfE National Pupil Database User guide (DfE, 2015d).
- Providers with fewer than 6 students are represented on the maps as having 5 students.
- There is currently a discrepancy in naming conventions for computing qualifications. Historically computer science qualifications have been called "Computing", however, new computer science qualifications are named "Computer Science" with a similar content set. The names "Computing" and "Computer science" are interchangeable in this report.
- Unless otherwise specified, 2015 exam data has used. 2016 data became available in November 2016, a report based on this data will pubished in the new year.
- Comparisons are made throughout the document between computing and ICT (reasoning outlined in About the study) and physics. Physics was chosen so that comparisons can be made between computing and another science. In particular, physics was chosen over the other sciences as it is considered to be highly mathematical, and mathematics is one of the main skill sets used to determine entry onto computing courses (see Entry profiles). In addition, the BCS (2012) used GCSE physics as the benchmark comparison when outlining the need for a computing qualification. It was decided against using mathematics as the main comparison subject, because mathematics GCSE is taken by nearly all students and any comparison would not allow for differentiation from population data.

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