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The Impact of Widening Participation Admissions Policies on Science Foundation Year Students' Experience

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The admissions policy for the Science Foundation Year at the University of Nottingham has recently been broadened through consideration of Widening Participation criteria. Students with A-levels that are accepted for direct entry onto undergraduate science degrees but at lower grades are now considered provided they meet the criteria associated with the University's Flexible Admissions Policy. Analysis of module and overall programme outcomes for the 2019-20 cohort indicates that students with two or more science A-levels outperformed those with one or no science A-levels during closed-book assessments, but this gap narrowed when students completed open-book assessments. Students reported that they enjoyed being in a diverse community and particularly valued the opportunities for peer support that the mixed cohort offered.

Introduction

Access to higher education is dependent on a person's social, economic and cultural background (Attwood, 2010), not least because socioeconomic status is a key determinant of attainment at school (Gorard, 2008). Research conducted for the Social Mobility and Child Poverty Commission found that children from low-income backgrounds who are high achievers at age seven are much more likely to slip back than children from high income backgrounds. Consequently, by the time they take their GCSEs, high achievers from low-income backgrounds often achieve lower grades than low achievers from higher income backgrounds (Crawford *et al*., 2014). Expectations and aspirations of students (Candy, 2013), their teachers (Attwood, 2010) and parents (The Sutton Trust, 2012) can also lead to inequalities in access to university. Many universities attempt to address inequalities in access through contextual admissions policies, which often involve making lower grade offers to students from Widening Participation (WP) backgrounds. The criteria used to identify students with WP status vary: the Higher Education Statistics Agency (HESA) considers whether students have studied at state or private schools and live in neighbourhoods with low rates of participation in university, whereas the Universities and

Colleges Admissions Service (UCAS) considers sex, ethnic group, neighbourhood participation rates, secondary education school sector and income background within their multiple equality measure. To be eligible for the University of Nottingham's Flexible Admissions Policy, students must live in a neighbourhood with low participation rates or have taken part in a recognised Widening Participation programme, such as the Sutton Trust Summer School. Students with refugee status or who have spent at least three months in care are also made contextual offers.

Although eligible applicants for the Science with Foundation Year programme (Science FY) at the University of Nottingham were being made contextual offers, the programme was previously only accessible to students who had not studied the subjects required for direct entry onto an undergraduate science degree. Students with subjects which would allow them direct entry, such as two science A-levels, were only accepted in exceptional circumstances, such as an extended period of poor health. For 2019 entry, the admissions criteria for the Science FY were broadened and students with A-levels accepted for direct entry, but at lower grades, were considered if they met the University's Flexible Admissions Policy criteria. As a result, 60% of the 2019-20 cohort had studied A-Level Biology, 33% had studied A-Level Chemistry and almost 30% had studied both A-Level Biology and Chemistry.

The Science FY is a one-year, intensive programme which requires students to understand a large body of unfamiliar content in a relatively short space of time. Those without any science A-levels are therefore likely to find this programme more challenging than students with science A-levels who already have spent two years becoming familiar with the content. Assessment outcomes for students have been tracked throughout the academic year to compare whether prior study affects outcomes on the Science FY. Alongside this quantitative assessment of inclusive admissions, students completed a survey towards the end of the academic year which asked them to explain why they had chosen to complete the Science FY and what they perceived to be the benefits of doing so. We also asked students to comment on their experiences of being within a mixed cohort to establish whether the change to the admissions policy had created a sense of inclusion or division among students.

Attainment Analysis Comparison

To investigate the impact of taking on a significant proportion of students with two or more of the Science FY module subjects completed at A-level, the students were categorised into groups reflecting their prior knowledge (figure 1) with approximately one third having completed two or more of the module subjects at A-level, one third completing only one of the module subjects at A-level, which is often Biology as is the case here, and one third having not done any science or maths since GCSE (level 2) unless they had completed a science-based level-3 BTEC.

Box plots illustrate the range of marks achieved by each group of students overall on the programme (figure 2) and in each of the four modules that contribute to the Science FY (figure 3), and the descriptive statistics associated with each group are summarised in table 1. Inferential statistical tests were carried out to see if there were any significant statistical differences in achievement between the groups identified in figure 1 for each of the modules and the overall programme outcomes (table 1). Shapiro-Wilks normality tests identified that some of the data sets displayed non-normal distributions and to account for the non-normality of these data sets, in addition to the small sample sizes, non-parametric Kruskal-Wallis tests were used for the comparisons of attainment across the cohorts. The Kruskal-Wallis test resulted in p-values > 0.05 for the Maths and Studying Science modules, suggesting no statistically significant differences at the 0.05 level in outcomes across the group categories and therefore these two modules were not affected by prior exposure to science A-levels. This is not surprising

given that only five students had completed A-level Maths prior to starting the programme (figure 1) and therefore both the Maths and Studying Science (focusing on science research skills) modules provide a relatively level playing field for all students.

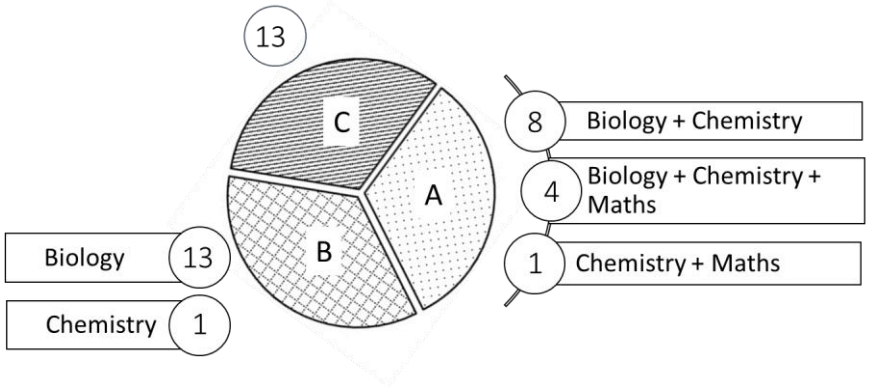

Figure 1: The variation in student experience of science at A-level (level 3). A = students with two or more of the Science FY module subjects at A-level; B = students with one module at A-level; C = students with no science or maths A-levels. Only A-level subjects covered on the Science FY were included as these can be classified as repeats of prior studies.

The overall programme average, the Chemistry module, and the Biological Sciences module, however, resulted in *p*-values < 0.05, suggesting a statistically significant difference at the 0.05 level in the outcomes between the group categories for these. Where a statistically significant difference is identified at the 0.05 level (i.e. $p < 0.05$) between the three groups, further pairwise analysis (with a Bonferroni correction) was carried out and effect size estimates determined between the groups (table 2). The effect size is represented by Cliff's □ which estimates the probability that a randomly selected observation from one group is larger than a randomly selected observation from another group (Cliff, 1993). The 95% confidence intervals (CI) for each effect size are provided (Feng and Cliff, 2004).

The analysis suggests that the differences identified, not surprisingly, are mainly attributable to differences between students with some prior biology and chemistry experience at A-level and those without any prior experience (table 2). For example, in the Biological Sciences module there is not a statistically significant difference ($p = 1.000$) between those students with two or more module subjects at A-level (group A) and those with one module subject at A-level (group B) as the majority of students in both of these categories have studied A-level Biology (figure 1). Indeed, the calculated effect size suggests that there is only a 0.143 probability that a student randomly selected from group A will achieve a higher grade than a student randomly selected from group B. The statistically significant differences in outcomes for this module are between group C, with no science or maths A-levels, and the other two groups where both effect size estimates suggest a > 0.7 probability that a student selected randomly from group A or B will achieve a higher grade than a student randomly selected from group C. Similarly, the outcomes for the Chemistry module show a statistically significant difference between those with A-level Chemistry (the majority of group A, with two or more module subjects at A-level) and those without A-level Chemistry (both category B, which contains students with mainly Biology at A-level, and category C with no A-level science). The largest estimated effect is between groups A and C where there is a 0.846 probability of a student from group A achieving a higher grade than a student from group C. Therefore, it is the Chemistry and Biological Sciences modules that contribute to the differences observed in the overall programme averages. In addition, these modules are more heavily weighted, magnifying the

benefit of prior subject knowledge, as they each contribute 40 credits to the programme compared to 20 credits each for Maths and Studying Science.

Programme / Module	Group Category	Mean	SD	Min	Max	Shapiro-Wilks *p*-value*	Kruskal-Wallis *p*-value[&]
Overall programme	A	71.8	8.0	56.0	85.4	1.000	0.001
	B	68.4	5.7	58.2	77.1	0.904	
	C	57.4	11.5	34.9	75.7	0.057	
Chemistry	A	73.2	7.7	60.3	86.3	0.977	0.001
	B	66.0	8.5	49.6	75.8	0.105	
	C	55.1	13.5	20.4	79.6	0.018	
Biological Sciences	A	72.5	7.9	55.3	83.7	0.329	0.001
	B	71.4	6.9	60.4	85.0	0.555	
	C	56.4	14.0	26.0	76.9	0.504	
Maths	A	73.4	13.0	55.6	96.3	0.797	0.100
	B	65.9	8.3	55.6	82.3	0.084	
	C	59.9	14.5	24.8	71.2	0.001	
Studying Science	A	65.2	10.9	42.7	82.1	0.755	0.099
	B	69.6	7.0	58.2	83.2	0.668	
	C	61.6	9.4	42.3	75.1	0.807	

Table 1: Descriptive statistics and Kruskal-Wallis analysis of the overall foundation programme marks and module marks for the three identified categories of student, where A = students with two or more of the foundation module subjects at A-level (n = 13); B = students with one of the foundation module subjects at A-level (n=14); C = students with no science or maths A-levels (n=13).
*The test rejects the hypothesis of normality when the *p*-value is less than or equal to 0.05. As some of the data reject the hypothesis of normality, and given the small sample sizes, non-parametric tests have been used for comparison purposes. [&]A *p*-value < 0.05 indicates that there is a statistically significant difference between the distribution of marks between the student groups.

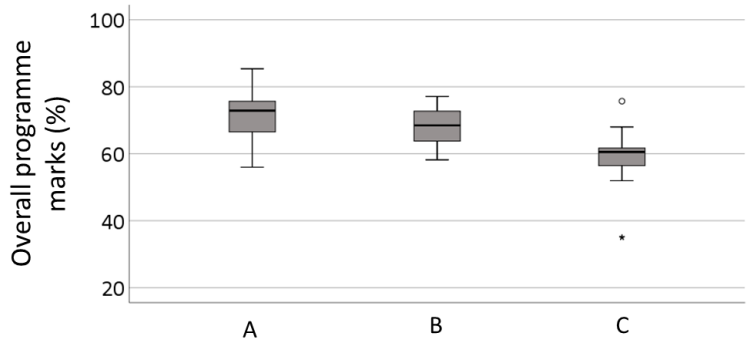

Figure 2: Box plots illustrating the range of overall programme marks for each student category of students with two or more module subjects at A-level (A), one module at A-level (B), and no science A-levels (C).

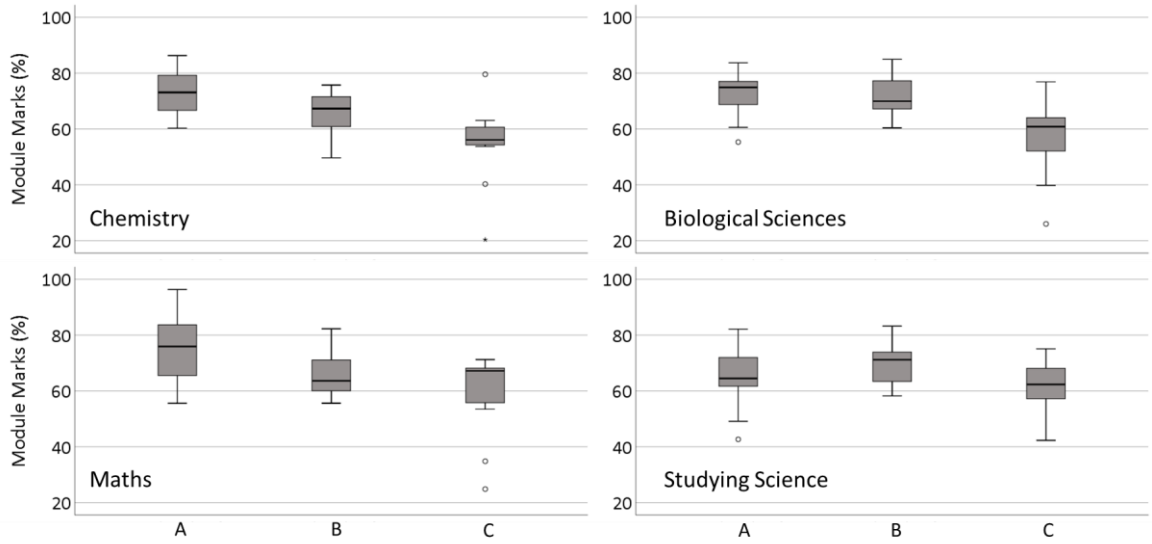

Figure 3: Box plots illustrating the range of modules marks associated with the four foundation modules for each student category of students with two or more module subjects at A-level (A), one module at A-level (B), and no science A-levels (C).

Programme / Module	Pairs	Pairwise *p*-value [&]	Cliff's δ [$]	Cliff's δ 95% CI [*]
Overall programme	A vs B	1.000	0.275	-0.159 – 0.619
	A vs C	0.001	0.728	0.302 – 0.912
	B vs C	0.026	0.659	0.259 – 0.866
Chemistry	A vs B	0.298	0.407	-0.021 – 0.709
	A vs C	< 0.001	0.846	0.446 – 0.964
	B vs C	0.067	0.549	0.069 – 0.823
Biological Sciences	A vs B	1.000	0.143	-0.299 – 0.535
	A vs C	0.003	0.704	0.308 – 0.892
	B vs C	0.009	0.714	0.329 – 0.896

Table 2: Pairwise analysis of the overall programme and the Chemistry and Biological Sciences module outcomes for each student category. [&]*p*-values have been adjusted using the Bonferroni correction; a *p*-value < 0.05 indicates that there is a statistically significant difference in the distribution of marks between the student groups. [$]Cliff's δ provides a measure of effect size: zero means that no effect was found, the observations for the two groups overlap completely; +1 or -1 means the highest effect was found, there is no overlap between the two groups. *95% confidence intervals for the estimate of Cliff's δ effect size.

Assessment Type Analysis

In semester 1, analysis of the first two assessments showed that there was only a small difference in the average marks achieved for each student group but, by contrast, a large difference in the average marks was identified in the outcomes of the semester 1 closed-book exam (figure 4). Due to the Covid-19 pandemic, changes had to be made to the planned

semester 2 closed-book exam in Chemistry and this was replaced with a 5-day open-book assessment (a hybrid between a piece of coursework and a closed-book exam paper). Questions were written in an exam style, but all multiple-choice questions were removed, and the content required students to apply their knowledge to more complex molecules and examples not previously covered in lectures and workshops. When comparing the open-book assessment with the closed-book assessment average marks (figure 4), it was noted that those students with no prior A-level Chemistry experience (all of group C and the majority of group B) improved on average by 15% and, although there is still a difference where those with A-level Chemistry achieved on average higher marks than those without any science A-levels, the gap was reduced.

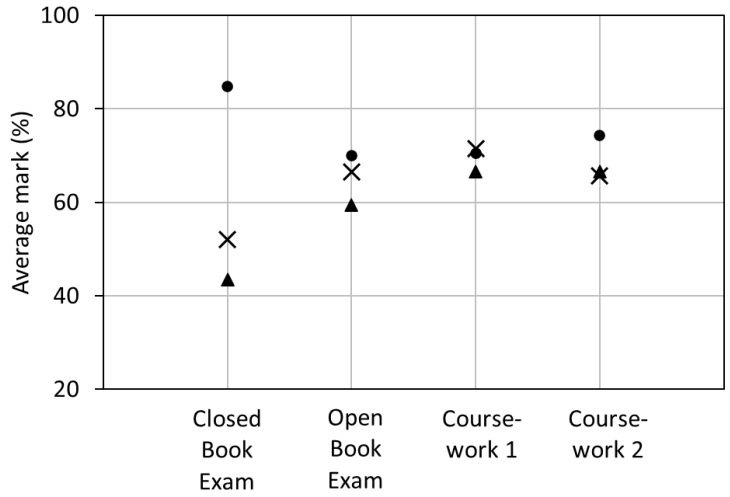

Figure 4: Average assessment outcomes for each student category within the Chemistry module. Students with two or more module subjects at A-level (all with Chemistry A-level) are represented by circles, with one module at A-level (all except one with A-level Biology) by crosses, and with no science A-levels by triangles.

Further statistical analysis on the individual assessment outcomes was carried out for the Chemistry module using the same methodology as described in the *Attainment Analysis Comparison* section above. The Kruskal-Wallis test resulted in *p*-values > 0.05 for both coursework assessments ($p = 0.372$ and 0.392 for coursework 1 and coursework 2, respectively) suggesting no statistically significant differences at the 0.05 level in outcomes across the group categories. Both the closed-book exam and the open-book assessment resulted in *p*-values of < 0.001 and 0.025, respectively. Further pairwise analysis for these assessments shows that the statistically significant differences are between group A (all students with A-level Chemistry) and both groups B and C (i.e. the majority without A-level Chemistry experience) in the closed-book exam, and between group A and group C in the open-book assessment (table 3). Although the analysis suggests that there is still a statistically significant difference between group A and group C for the open-book assessment, the effect size for this difference has decreased from a value of 1.000 (i.e. there is a probability of 1 that a student selected randomly from group A will achieve a higher grade than a student randomly selected from group C) for the closed-book exam, to a value of 0.641 for the open-book assessment. Similarly, the effect size for the difference between group A (A-level chemists) and group B (mainly A-level biologists) is reduced from a value of 0.995 to 0.187.

Programme / Module	Pairs	Pairwise *p*-value [&]	Cliff's δ [$]	Cliff's δ 95% CI [*]
Closed-book exam (January)	A vs B	< 0.001	0.995	0.948 – 0.999
	A vs C	< 0.001	1.000	1.000 – 1.000
	B vs C	0.970	0.351	-0.138 – 0.702
Open-book assessment (May)	A vs B	1.000	0.187	-0.250 – 0.560
	A vs C	0.023	0.641	0.185 – 0.870
	B vs C	0.193	0.411	-0.043 – 0.724

Table 3: Pairwise analysis of the closed- and open-book assessments. [&]*p*-values are only shown where a statistically significant difference was identified in the Kruskal-Wallis tests for each assessment and have been adjusted using the Bonferroni correction; a *p*-value < 0.05 indicates that there is a statistically significant difference between the distribution of marks between the student groups. [$]Cliff's δ provides a measure of effect size: zero means that no effect was found, the observations for the two groups overlap completely; +1 or -1 means the highest effect was found, there is no overlap between the two groups. *95% confidence intervals for the estimate of Cliff's δ effect size.

The Student Experience

Towards the end of the academic year, students completed an online survey which asked them to explain their reasons for choosing the Science FY and comment on their experiences of the programme. Content analysis has been used to compare the responses in the three groups (two or more module subjects at A-level, one module at A-level, no science A-levels).

Students in the three groups differed in their reasons for choosing to complete the Science FY. Seven of those with two or module subjects at A-level (group A) were willing to spend an additional year at university, rather than take up their insurance offer or gain direct entry onto another course through Clearing, because they wanted to secure access to their preferred university and undergraduate course, for example, "I was certain that I wanted to study at the University of Nottingham and this course was a path to get to the course I originally wanted to be on." Six of this group mentioned the league table position or reputation of their undergraduate course: "Nottingham is the top in (the) country for the course I wanted to do." In contrast, students with no science A-levels (group C) rarely mentioned the university or the status of the undergraduate course. Instead, nine of these students commented on how they lacked the right subjects for direct entry and eight indicated that they were using the foundation programme as a route onto their undergraduate degree: "I didn't have the correct subjects to go into my desired course." The responses from students with one module at A-level (group B) were more diverse, reflecting the fact that this group included students who had been made course change or clearing offers as well as those who were direct entrants on the Science FY. All six of the students who had accepted course change offers gave similar reasons to those with two or more module subjects at A-level, such as wanting to study at the University, whereas those who had entered through Clearing (three students) or as direct entrants (four students) all talked of gaining access to their chosen undergraduate degree.

After asking students to explain why they had chosen to complete the Science FY, they were asked if they would still make the same decision. The overwhelming majority of students who answered this question (31 out of 33) indicated that they would make the same choice again. Although there was much diversity within the positive responses, there were no clear differences between the three groups. Indeed, the most common response across all the groups

(18 out of 33 respondents) was that the programme had supported their academic development, for example: “I would definitely choose the Science Foundation Year because it gave me the skills and the knowledge to progress.” The second most common response, which featured in 11 responses, was that completing the Science FY had helped students feel better prepared for their undergraduate course, for instance: “I believe it was deeply beneficial not only in enhancing my knowledge but also my academic experience at a university level.” Other responses included that they had felt well-supported (3 students), enjoyed the programme (3 students), had made friends (2 students), and were thankful of the additional time to choose their undergraduate course (2 students).

Students in the three groups were also asked about how they felt being in a cohort with students who had different academic backgrounds from themselves. Those with one or two (or more) module subjects at A-levels (groups A and B) were asked how they felt being in a group with students with no science A-levels. Students with no science A-levels (group C) were asked how they felt being in a group with students who had previously studied sciences at A-level. Each student was coded according to whether their responses were entirely positive, entirely negative, neutral or ambivalent. In group A, four students were positive, one was negative, four were neutral and four were ambivalent. The four students who gave entirely positive responses reported that they had enjoyed helping others, with two recognising that doing so had helped them to further their own understanding, for example: “It helped me as I could explain some parts of the course to those students who hadn't seen those topics before which, whilst doing so, reinforced my own understanding of that topic.” The comment by the negative student, who said, “I felt as if I was ahead and that I was being set back a year repeating lessons I already knew”, captured one of the concerns raised when the idea of widening access to the Science FY was being considered: were students with two or more module subjects at A-level going to feel that the programme was a waste of time because they had already studied the sciences? Although it was disappointing to find that this student had not enjoyed being in a mixed cohort, it was a relief that only one student had had this experience. The responses for the four students coded as neutral were very short, such as “It didn’t bother me.” In contrast, the four students who were ambivalent gave lengthy responses which often raised important issues. For example, one student explained that those with science A-levels had been worried about whether they were being perceived as having unfair advantage over students with no science A-levels: “In the first few weeks, some of us that had A level sciences … were slightly worried about others feeling that we have an unfair advantage.” Another talked about how although they enjoyed being in a mixed cohort, they did not like comparisons being made about the different outcomes for these groups: “I enjoyed mixing with people with different academic backgrounds and enjoyed being able to offer help to those without the A Levels ... I didn’t really like the comparing of ‘those with’ to ‘those without’ as whilst it was designed to make one group feel reassured it frustrated the other.” This comment caused us to consider whether we inadvertently created division in what had previously been an inclusive group.

Eight of the thirteen students in group B gave neutral responses when asked how they felt about being in groups with students who had not previously studied sciences at A-level, with the majority of these giving very short responses, such as “It was fine!” Two students were positive, with one saying that it encouraged them to approach their studies with an “open mind”. There were no students with entirely negative responses, but three students were ambivalent. One of these students felt that having a mixed cohort had affected the programme content: “I felt at times the teaching was perhaps repetitive of what I had learnt before” and the speed of delivery: “the pace of teaching had to be taken at a slower approach at times”. Interestingly, this student also commented that had if we not brought it to their attention, they would not have been aware of the academic backgrounds of others in the cohort: “it would be hard to tell that many of them hadn't completed them (science A-levels) before”. Another of the

ambivalent students wrote of how having a diverse group exposed them to different ways of thinking: “it was interesting having other students perspective when learning the science ... it opened my mind up to other ways of interpreting science and I really liked that about the course”.

When students in group C were asked how they had felt about being with students who had studied at least one science at A-level, none of the students were entirely positive about their experience and only one was entirely negative. Two students gave neutral responses, with one indicating that they had focused on themselves rather than on others in the group: “Whilst I realised that there were students that were more advanced than me, I was focusing on myself and I received all the support I needed so it didn’t cause me any concern.” The remaining eight respondents were ambivalent. Many of these students commented that although they felt intimidated at first, for instance, “It is very daunting feeling as though you have started on the back foot”, they soon took advantage of the support available from their peers and from the tutors, for example, one student said, “All of the students were really keen to help whenever I asked” and another commented, “But with the help from lecturers I felt more comfortable and I knew what I was doing.” In contrast to the student who objected to be compared to others in the group, one of the ambivalent students noted that they had gained confidence from being compared because it made them realise that their academic background did not necessarily determine their outcome on the Science FY: “after seeing little difference in the marks between those with science A levels and not it gave me confidence that it didn't matter”. Nevertheless, we will exercise caution in how we share student results in future years to avoid creating discord and anxiety.

Conclusions

Students in the three different groups (A, B and C) performed as expected in the modules and on the programme overall with those having prior A-level Chemistry and Biology experience outperforming those with no prior experience. Questions have, however, been raised about the appropriateness of different types of assessment for such a fast-paced programme and which assessment type provides a more inclusive assessment experience for students by offering equal access to the higher grades. It appears that the open-book assessment gave students with no science A-levels a better chance to demonstrate their understanding of the content being assessed as these assessments did not rely on recall style questions which require a greater level of familiarity with the material.

Regardless of whether students had completed science A-levels, many students felt that the Science FY had supported their academic development and they valued the opportunity to work with those from different academic backgrounds. We therefore need to promote the strengths of the students within our diverse community and take care to avoid creating division. We will continue to make offers to students from disadvantaged backgrounds who have previously studied two or more science A-levels. These students are highly likely to achieve excellent outcomes which will allow them access to the undergraduate courses that they are highly motivated to pursue, and they are a fantastic source of peer support for those without science A-levels.

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References

Attwood, R. (2010). Mind the gap. Times Higher Education, 25 February 2010. (http://www.timeshighereducation.co.uk/features/mind-the-gap/410531.article)

Candy, S. (2013). (Un)informed choices? University admissions practices and social mobility. London: Pearson Think Tank. (https://research.pearson.com/content/plc/prkc/uk/open-ideas/en/articles/levelling-the-playingfield/_jcr_content/par/articledownloadcompo/file.res/(UN)INFORMED_CHOICES.pdf)

Cliff, N. (1993). Dominance statistics: Ordinal analyses to answer ordinal questions. Psychological Bulletin. 114 (3): 494–509. (https://doi.org/10.1037/0033-2909.114.3.494)

Crawford, C., Macmillan, L. and Vignoles, A. (2014). Progress made by high-attaining children from disadvantaged backgrounds. London: Social Mobility and Child Poverty Commission. (https://dera.ioe.ac.uk//20433/)

Gorard, S. (2008). Who is missing from higher education? Cambridge Journal of Education, 38, 421-437. (https://www.tandfonline.com/doi/pdf/10.1080/03057640802286863)

Feng, D. and Cliff, N. (2004). Monte Carlo Evaluation of Ordinal d with Improved Confidence Interval, Journal of Modern Applied Statistical Methods, 3(2), 322-332, DOI: 10.22237/jmasm/1099267560. (https://digitalcommons.wayne.edu/jmasm/vol3/iss2/6/)

The Sutton Trust (2012). The Social Mobility Summit. The Royal Society. London: The Sutton Trust. (https://www.suttontrust.com/wp-content/uploads/2020/01/st-social-mobility-report.pdf)

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